IJCSIS Vol. 15 No. 4 Part II, April 2017
ISSN 1947-5500

International Journal of Computer Science & Information Security

Pennsylvania, USA

Indexed and technically co-sponsored by :

IJCSIS

ISSN (online): 1947-5500

Please consider to contribute to and/or forward to the appropriate groups the following opportunity to submit and publish original scientific results.

CALL FOR PAPERS
International Journal of Computer Science and Information Security (IJCSIS)
January-December 2017 Issues

The topics suggested by this issue can be discussed in term of concepts, surveys, state of the art, research, standards, implementations, running experiments, applications, and industrial case studies. Authors are invited to submit complete unpublished papers, which are not under review in any other conference or journal in the following, but not limited to, topic areas.
See authors guide for manuscript preparation and submission guidelines.

Indexed by Google Scholar, DBLP, CiteSeerX, Directory for Open Access Journal (DOAJ), Bielefeld Academic Search Engine (BASE), SCIRUS, Scopus Database, Cornell University Library, ScientificCommons, ProQuest, EBSCO and more.

Deadline: see web site
Notification: see web site
Revision: see web site
Publication: see web site

Context-aware systems
Networking technologies
Security in network, systems, and applications
Evolutionary computation
Industrial systems
Evolutionary computation
Autonomic and autonomous systems
Bio-technologies
Knowledge data systems
Mobile and distance education
Intelligent techniques, logics and systems
Knowledge processing
Information technologies
Internet and web technologies
Digital information processing
Cognitive science and knowledge
Agent-based systems
Mobility and multimedia systems
Systems performance
Networking and telecommunications
Software development and deployment
Knowledge virtualization
Systems and networks on the chip
Knowledge for global defense
Information Systems [IS]
IPv6 Today - Technology and deployment
Modeling
Software Engineering
Optimization
Complexity
Natural Language Processing
Speech Synthesis
Data Mining

For more topics, please see web site https://sites.google.com/site/ijcsis/

For more information, please visit the journal website (https://sites.google.com/site/ijcsis/)

Editorial
Message from Editorial Board

*It is our great pleasure to present the **April 2017 issue** (Volume 15 Number 4) of the **International Journal of Computer Science and Information Security** (IJCSIS). High quality research, survey & review articles are proposed from experts in the field, promoting insight and understanding of the state of the art, and trends in computer science and technology. It especially provides a platform for high-caliber academics, practitioners and PhD/Doctoral graduates to publish completed work and latest research outcomes. According to Google Scholar, up to now papers published in IJCSIS have been cited over 9800 times and this journal is experiencing steady and healthy growth. Google statistics shows that IJCSIS has established the first step to be an international and prestigious journal in the field of Computer Science and Information Security. There have been many improvements to the processing of papers; we have also witnessed a significant growth in interest through a higher number of submissions as well as through the breadth and quality of those submissions. IJCSIS is indexed in major academic/scientific databases and important repositories, such as: Google Scholar, Thomson Reuters, ArXiv, CiteSeerX, Cornell's University Library, Ei Compendex, ISI Scopus, DBLP, DOAJ, ProQuest, ResearchGate, Academia.edu and EBSCO among others.*

A great journal cannot be made great without a dedicated editorial team of editors and reviewers. On behalf of IJCSIS community and the sponsors, we congratulate the authors and thank the reviewers for their outstanding efforts to review and recommend high quality papers for publication. In particular, we would like to thank the international academia and researchers for continued support by citing papers published in IJCSIS. Without their sustained and unselfish commitments, IJCSIS would not have achieved its current premier status, making sure we deliver high-quality content to our readers in a timely fashion.

"We support researchers to succeed by providing high visibility & impact value, prestige and excellence in research publication." We would like to thank you, the authors and readers, the content providers and consumers, who have made this journal the best possible.

*For further questions or other suggestions please do not hesitate to contact us at **ijcsiseditor@gmail.com**.*

A complete list of journals can be found at:
http://sites.google.com/site/ijcsis/

IJCSIS Vol. 15, No. 4, April 2017 Edition

ISSN 1947-5500 © IJCSIS, USA.

Journal Indexed by (among others):

Bibliographic Information
ISSN: 1947-5500
Monthly publication (Regular Special Issues)
Commenced Publication since May 2009

Editorial / Paper Submissions:
IJCSIS Managing Editor
(ijcsiseditor@gmail.com)
Pennsylvania, USA
Tel: +1 412 390 5159

IJCSIS EDITORIAL BOARD

IJCSIS Editorial Board	IJCSIS Guest Editors / Associate Editors
Dr. Shimon K. Modi [Profile] Director of Research BSPA Labs, Purdue University, USA	**Dr Riktesh Srivastava [Profile]** Associate Professor, Information Systems, Skyline University College, Sharjah, PO 1797, UAE
Professor Ying Yang, PhD. [Profile] Computer Science Department, Yale University, USA	**Dr. Jianguo Ding [Profile]** Norwegian University of Science and Technology (NTNU), Norway
Professor Hamid Reza Naji, PhD. [Profile] Department of Computer Enigneering, Shahid Beheshti University, Tehran, Iran	**Dr. Naseer Alquraishi [Profile]** University of Wasit, Iraq
Professor Yong Li, PhD. [Profile] School of Electronic and Information Engineering, Beijing Jiaotong University, P. R. China	**Dr. Kai Cong [Profile]** Intel Corporation, & Computer Science Department, Portland State University, USA
Professor Mokhtar Beldjehem, PhD. [Profile] Sainte-Anne University, Halifax, NS, Canada	**Dr. Omar A. Alzubi [Profile]** Al-Balqa Applied University (BAU), Jordan
Professor Yousef Farhaoui, PhD. Department of Computer Science, Moulay Ismail University, Morocco	**Dr. Jorge A. Ruiz-Vanoye [Profile]** Universidad Autónoma del Estado de Morelos, Mexico
Dr. Alex Pappachen James [Profile] Queensland Micro-nanotechnology center, Griffith University, Australia	**Prof. Ning Xu,** Wuhan University of Technology, China
Professor Sanjay Jasola [Profile] Gautam Buddha University	**Dr . Bilal Alatas [Profile]** Department of Software Engineering, Firat University, Turkey
Dr. Siddhivinayak Kulkarni [Profile] University of Ballarat, Ballarat, Victoria, Australia	**Dr. Ioannis V. Koskosas,** University of Western Macedonia, Greece
Dr. Reza Ebrahimi Atani [Profile] University of Guilan, Iran	**Dr Venu Kuthadi [Profile]** University of Johannesburg, Johannesburg, RSA
Dr. Dong Zhang [Profile] University of Central Florida, USA	**Dr. Zhihan lv [Profile]** Chinese Academy of Science, China
Dr. Vahid Esmaeelzadeh [Profile] Iran University of Science and Technology	**Prof. Ghulam Qasim [Profile]** University of Engineering and Technology, Peshawar, Pakistan
Dr. Jiliang Zhang [Profile] Northeastern University, China	**Prof. Dr. Maqbool Uddin Shaikh [Profile]** Preston University, Islamabad, Pakistan
Dr. Jacek M. Czerniak [Profile] Casimir the Great University in Bydgoszcz, Poland	**Dr. Musa Peker [Profile]** Faculty of Technology, Mugla Sitki Kocman University, Turkey
Dr. Binh P. Nguyen [Profile] National University of Singapore	**Dr. Wencan Luo [Profile]** University of Pittsburgh, US
Professor Seifeidne Kadry [Profile] American University of the Middle East, Kuwait	**Dr. Ijaz Ali Shoukat [Profile]** King Saud University, Saudi Arabia
Dr. Riccardo Colella [Profile] University of Salento, Italy	**Dr. Yilun Shang [Profile]** Tongji University, Shanghai, China
Dr. Sedat Akleylek [Profile] Ondokuz Mayis University, Turkey	**Dr. Sachin Kumar [Profile]** Indian Institute of Technology (IIT) Roorkee

ISSN 1947 5500

TABLE OF CONTENTS

Gladston Raj S., Head, Department of Computer Science, Government College, Nedumangad Thiruvananthapurm, Kerala, India

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

7. PaperID 31031724: An Enhanced SVM for Clustering Imbalanced Time Series Data Using Hybrid Sampling (pp. 51-57)

Kanchana J, Research Scholar, School of Computer Science, Mahatma Gandhi University, Kottayam, Kerala, India
Gladston Raj S, Head, Department of Computer Science, Government College, Nedumangad, Thiruvanathapuram Kerala, India

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

8. PaperID 31031729: Features from Accelerated Segment Test with BoW for Effective Image Retrieval (pp. 58-65)

Khawaja Tehseen Ahmed (1), Imran Tahir (2), Ahmad Naeem (3),
(1) Department of Computer Science, Bahauddin Zakariya University, Multan, Pakistan.
(2,3) National College of Business Administration & Economics Multan, Pakistan.

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

9. PaperID 31031730: Security Assessment Model for a Cloud based e-Governance System based on Fuzzy Comprehensive Evaluation Method (pp. 66-77)

Muzaffar Azim, FTK Centre for Information Technology, Jamia Millia Islamia, New Delhi, 110025 , India

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

10. PaperID 31031732: A Brief Review of Image Segmentation Techniques (pp. 78-82)

Garima, Computer Science Dept., AIET, Lucknow, India
Pervez Rauf, Computer Science Dept., AIET, Lucknow, India

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

11. PaperID 31031737: Global Neighbour Preserving Local Binary XOR Pattern: A new feature descriptor for texture and CT image retrieval (pp. 83-90)

G V Satya Kumar (1), P G Krishna Mohan (2)
(1) Research scholar,Department of Electronics and Communication Engineering, JNT University, Hyderabad, India.
(2) Professor, Department of Electronics and Communication Engineering, IARE, JNT University, Hyderabad, India.

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

12. PaperID 31031738: Android Based Encrypted IP Voice Call Communication through SIP Server On 3G GPRS / Wi-Fi (pp. 91-99)

Ahmed Hassan Zaker, Computer Science Department, Cihan University, Cihan, Duhok
Ramadan Mahmood Ramo, Computer Science Department, Cihan University, Cihan, Duhok

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

13. PaperID 31031740: Implementation of Neural Network through Neural Networks Simulator and Visual Prolog (pp. 100-103)

Elitsa Zdravkova, Department of Computer Systems and Technologies, Shumen University "Konstantin Preslavsky", Shumen, Bulgaria,
Nayden Nenkov, Department of Computer Systems and Technologies, Shumen University "Konstantin Preslavsky", Shumen, Bulgaria

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

14. PaperID 31031743: Improving the Data Center Performance through Data Center Resource Consolidation (pp. 104-109)

Amit Nayak, Ph.D Scholar, Assistant Professor, Information Technology Department, Charotar University of Science & Technology, Gujarat, India
Dr. Amit Ganatra, Dean FTE & HOD Computer Engineering Department, Charotar University of Science & Technology, Gujarat, India

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

15. PaperID 31031746: Linguistic Descriptors for Arabic Sub-Words Conjugation and Recognition (pp. 110-117)

Mohammad Tanvir Parvez, Computer Engineering Department, Qassim University, Qassim 51477, Saudi Arabia
Nasser Al-Horais, Arabic Language Department, Qassim University, Qassim 51477, Saudi Arabia

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

16. PaperID 31031747: A New Research Methodology for Preprocessing of Documents: Information Recovery Systems (pp. 118-125)

Ms Shivani Tyagi, MTech Scholar, GITS, Udaipur
Mr Dinesh Yadav, Supervisor, GITS, Udaipur
Mrs Sarika Khandelwal, Associate Professor, GITS, Udaipur
Dr Sanjay Agal, Professor & HOD , CSE, AITS, Udaipur

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

17. PaperID 31031749: Resolution Enhancement of American Sign Language Image Using DT-CWT and EPS Algorithm (pp. 126-131)

Pradeep Kumar B P, Research Scholar, Jain University, Bangalore, India
Manjunatha M B, principal, AIT, Tumkur, India
Revana Siddesh P N, pg scholar, AIT, Tumkur, India

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

18. PaperID 31031750: Automatic Image Registration of Satellite Images using SIFT (pp. 132-138)

G.B. Hema Malini & R. Radha
Department of Computer Science, SDNB Vaishnav College, Chennai, India

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

19. PaperID 31031754: Do NoSQL Databases Cope with Current Data Challenges (pp. 139-146)

Hina Farooq, Azka Mahmood, Javed Ferzund
Department of Computer Science, COMSATS Institute of Information Technology, Pakistan

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

20. PaperID 31031755: Privacy Preserving System Using Pseudo Zernike Moment with SURF & Affine Transformation on RST Attacks (pp. 147-152)

Sheshang D. Degadwala & Dr. Sanjay Gaur
Madhav University, Rajasthan

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

21. PaperID 31031757: Indoor Localization using Improved Weighted Naïve Bayes (pp. 153-173)

** Muhammad Aziz ul haq, ** Hifsa Irum, * Muhammad Usman Akram,*
Department of Electrical Engineering- College of Electrical and Mechanical Engineering- National University of Science and Technology
*** Department of Electrical Engineering- National University of Computer and Emerging Sciences*

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

22. PaperID 31031758: Modeling Events as Machines (pp. 174-180)

Sabah Al-Fedaghi, Computer Engineering Department, Kuwait University, Kuwait

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

23. PaperID 31031762: Touchless Region based Palmprint Verification System (pp. 181-187)

Satya Bhushan Verma, National Institute of Technology, Durgapur, West Bengal, India.
Dr Saravanan Chandran, National Institute of Technology, Durgapur, West Bengal, India

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

24. PaperID 31031763: Power Factor Improvements and its Effective Strategy to Optimize the kWh (pp. 188-192)

M. Haroon Nadeem (1), Sohaib Tahir (2), Mazhar H. Baloch (3), Ghulam S. Kaloi (1), Waqas A. Wattoo (2), M. Yousif and Mehr Gul (5)*
(1) University College of Engineering and Technology, The Islamia University of Bahawalpur, Pakistan
(2) COMSAT Institute of Information Technology Sahiwal Campus Pakistan
(3) Mehran UET, Khairpur Mir's Campus Pakistan
(4) Shanghai Jiao tong University China
(5) The Baluchistan University of Information Technology, Engineering and Management Sciences, Pakistan

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

25. PaperID 31031764: Handwritten Bangla Numeral Recognition Exerting Neural Network Approach (pp. 193-196)

Tapashi Gosswami, Department of Computer Science and Engineering, Comilla University, Comilla, Bangladesh
Sanjit Kumar Saha, Assistant Professor, Department of Computer Science and Engineering, Jahangirnagar University, Savar, Dhaka, Bangladesh

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

26. PaperID 31031766: Online Real Time Fuzzy Inference System Based Human Health Monitoring and Medical Decision Making (pp. 197-204)

Aqeel Majeed Humadi, Department of Electricity, College of Engineering, Misan University.
Alaa Khalaf Hamoud, Information Technology Department, College of Computer Science and Information Technology, Basra University

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

27. PaperID 31031767: Hybrid Cloud: An Enterprise Solution (pp. 205-212)

Dieudonne Boupo

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

28. PaperID 31031773: Prometheus Methodology: A Special Purpose Agent Oriented Methodology (pp. 213-228)

Nwagu, Chikezie Kenneth (1); Omankwu, Obinnaya Chinecherem (2) & Inyiama, Hycient (3)
(1) Computer Science Department, Nnamdi Azikiwe University, Awka Anambra State, Nigeria,
(2) Computer Science Department, Michael Okpara University of Agriculture, Umudike Umuahia, Abia State, Nigeria
(3) Electronics & Computer Engineering Department, Nnamdi Azikiwe University, Awka Anambra State, Nigeria.

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

29. PaperID 31031774: Comparative Performance Study on Principal Component Analysis Based Mathematical Operations and Distance Measurements (pp. 229-234)

Israa AbdulAmeer AbdulJabbar, Computer Sciences department, University of Technology, Baghdad, Iraq
Zainab Ali Yakoob, Computer Sciences department, University of Technology, Baghdad, Iraq

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

30. PaperID 31031777: Mining of Road Accident Data Using K-Mode Clustering and Improved Apriori (pp. 235-249)

Inderpreet kaur, CTIEMT, Jalandhar
Ashish Kumar Luhach, Associate Professor, CTIEMT, Jalandhar
Pooja, Assistant Professor, CTIEMT, Jalandhar

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

31. PaperID 31031778: Private Recommendation: Extending Capabilities of Privacy-Protection Recommender Systems (pp. 250-258)

Rubya Shaharin, Dept. of Computer Science and Engineering, Jatiya Kabi Kazi Nazrul Islam University, Mymensingh, Bangladesh
Uzzal Kumar Prodhan, Dept. of Computer Science and Engineering, Jatiya Kabi Kazi Nazrul Islam University Mymensingh, Bangladesh

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

32. PaperID 31031786: Hiding an Image using Mandelbrot Fractal (pp. 259-263)

Mustafa M. Auda, Dept. of Computer Science, Deanship of Academic Services, Taibah University, P.O Box 344, Madinah, Saudi Arabia

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

33. PaperID 31031788: Minimize Delay based Routing Protocol (MDRP) for V2V Communication in VANETs (pp. 264-269)

Babu Ram & Dr. Neelendra Badal, Department of Computer Science & Engineering, KNIT, Sultanpur, India

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

34. PaperID 31031790: Interactive Science Learning using Handheld – AR (pp. 270-275)

Nivedha S., Assistant Professor, Department of Computer Science and Engineering, Karpagam College of Engineering, Coimbatore- 641 032
Hemalatha S., Assistant Professor, Department of Computer Science and Engineering, Sri Shakthi Institute of Engineering and Technology, Coimbatore-641 062

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

35. PaperID 31031792: Operating System Embedded Mobile Agent (EMA) and JADE: A Comparative Analysis (pp. 276-286)

Oguntunde, B.O; Department of Computer Science, Redeemer's University, Ede, Osun State, Nigeria
Osofisan A.O; Department of Computer Science, University of Ibadan, Ibadan, Oyo State, Nigeria.

Aderounmu, G.A; Department of Computer Science and Engineering, Obafemi Awolowo university, Ile-ife, Osun State, Nigeria

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

36. PaperID 31031793: Performance Analysis of Fingerprint Reference Point Detection Techniques based on Regularized Orientation Model (pp. 287-294)

Shoba Dyre, C. P. Sumathi,
Department of Computer Science, SDNB Vaishnav College for Women, Chennai, India

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

37. PaperID 31031796: Enabling Software Factory with Job Workflow Automation (pp. 295-303)

Dzulkafli Jalil, School of Computing, Universiti Utara Malaysia, 06010 UUM Sintok, Kedah, Malaysia
Muhamad Shahbani Abu Bakar, School of Computing, Universiti Utara Malaysia, 06010 UUM Sintok, Kedah, Malaysia

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

38. PaperID 31031798: Analysis of Boneh Shaw Finger Printing Codes under Randomized Bits Collusion Attacks (pp. 304-311)

Alok Tripathi, IT Division, NIELIT, Patna, India
Rajiv Pandey, IT Department, Amity University, Lucknow, India

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

39. PaperID 310317104: Overview of Broadband Connectivity for Rural Areas-Tanzania as a Case Study (pp. 312-320)

Mastidia Byanyuma & Zaipuna O. Yonah, Nelson Mandela African Institution of Science and Technology (NM-AIST) Arusha, Tanzania
Fatuma Simba, University of Dar es Salaam, Tanzania.
Lena Trojer, Blekinge Institute of Technology, Sweden

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

40. PaperID 310317105: QSearch: A Question Bank Decision Support System Using Query Expansion Algorithm (pp. 321-328)

Anna Liza A. Ramos, Saint Michael's College of Laguna, Old National Road, City of Biñan, Laguna 4024, Philippines
Jennica C. Corpuz, Saint Michael's College of Laguna, Old National Road, City of Biñan, Laguna 4024, Philippines
Baby Joy B. Lacampuenga, Saint Michael's College of Laguna, Old National Road, City of Biñan, Laguna 4024, Philippines
John Mark D. Lozanta, Saint Michael's College of Laguna, Old National Road, City of Biñan, Laguna 4024, Philippines
Manilyn A. Sausal, Saint Michael's College of Laguna, Old National Road, City of Biñan, Laguna 4024, Philippines

Adrian D. Evanculla, Saint Michael's College of Laguna, Old National Road, City of Biñan, Laguna 4024, Philippines
Cathy P. Alzona, Saint Michael's College of Laguna, Old National Road, City of Biñan, Laguna 4024, Philippines

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

41. PaperID 310317101: Access Model with Rights Evolution "AMWRE" (pp. 329-333)

Samir TAHIRI, Hassan II University, ESTC, RITM Lab, Casablanca Morocco
Reda FILALI HILALI, Hassan II University, ESTC, RITM Lab, Casablanca Morocco
Nadia AFIFI, Hassan II University, ESTC, RITM Lab, Casablanca Morocco

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

42. PaperID 310317106: A Novel Technique for Paper Currency Recognition System (pp. 334-338)

Dr. O Rama Devi, Y. Padma, J. Sirisha, D. Kavitha, K. Sindhura
Dept. of IT, PVP Siddhartha Institute of Technology, Kanuru, Vijayawada

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

43. PaperID 310317108: A Proposed Design of a Smart Bracelet for Facilitating the Rituals of Hajj and Umra (pp. 339-343)

Gamal H. El-Adl, Information Systems Department, Faculty of Computer and Information Sciences, Mansoura, University, Mansoura, 35516, Egypt

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

44. PaperID 310317109: Hybrid Privacy-Preserving Authentication Protocol for Secure Communication under Malicious Attacks in MIPMANET (pp. 344-348)

Abdurahem El Atman Igrair, Department of Computer Science & information Technology, Sam Higginbottom University of Agriculture, Technology & Sciences Allahabad India.
Raghav Yadav, Department of Computer Sciences & Information Technology, Sam Higginbottom University of Agriculture, Technology & Sciences Allahabad India

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

45. PaperID 310317118: Analysis of Classification Methods for Diagnosis of Pulmonary Nodules in CT Images (pp. 349-354)

Capt. Dr. S.SANTHOSH BABOO, Associate Professor, P.G & Research Department of Computer Science Dwaraka Doss Goverdhan Doss Vaishnav College, Arumbakkam-106
E.IYYAPPARAJ, Research Scholar, P.G & Research Department of Computer Science, Dwaraka Doss Goverdhan Doss Vaishnav College, Arumbakkam-106

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

46. PaperID 310317120: Information Extraction with Speech Recognition (pp. 355-371)

Amit Verma, Professor and Head Chandigarh Engineering College, Landran (Mohali)
Iqbaldeep Kaur, Associate Professor, Chandigarh Engineering College, Landran (Mohali)
Amit Kumar, Research Scholar, Chandigarh Engineering College, Landran (Mohali)

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

47. PaperID 310317122: Load Balance for Multicast Traffic in SDN using OnTime traffic Monitoring (pp. 372-377)

Alaa M. Allakany, Graduate school of Information Science and Electrical Engineering, Kyushu University, 744 Motooka, Nishiku, Fukuoka City, 819-0395, Japan
Faculty of Science, Kafrelsheikh University, Kafrelsheikh, Egypt
Koji Okamura, Research Institute for Information Technology, Kyushu University, 744 Motooka, Nishiku, Fukuoka City, 819-0395, Japan

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

48. PaperID 310317125: DOG Oriented Structure Tensor based Active Contours (pp. 378-380)

Brijesh N Shah, Department of Electronics and Communication, Engineering, C S Patel Institute of Technology, Charotar University of Science and Technology, Changa, 388421, Gujarat, India
Jaymin K Bhalani, Department of Electronics and Communication Engineering, Babaria Institute of Technology, Varnama, Vadodara, Gujarat, India

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

49. PaperID 28021719: Mining Details from Single Opinion (pp. 381-390)

Alaa Omran Almagrabi, Faculty of Computing and Information Technology at Rabigh, King Abdul Aziz University (KAU), Jeddah, Kingdom of Saudi Arabia

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

50. PaperID 28021732: Taking Frames Out of (News) Videos (pp. 391-395)

Pooja & Renu Dhir,
B R Ambedkar National Institute of Technology, Jalandhar, Punjab, India

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

51. PaperID 31011749: Digital Watermarking Scheme for Ensuring Information Security and Authentication (pp. 396-402)

Dr. T. Hemalatha, Dr. Fahad Khan Azeez, Wajiha Rehman, Sumaira Idrees
Department of Health Information Management and Technology, Faculty of Public Health and Tropical Medicine, Jazan University, Jazan, Kingdom of Saudi Arabia

Full Text: PDF [Academia.edu | Scopus | Scribd | Archive | ProQuest]

Hybrid Cloud: An Enterprise Solution

***Abstract*—- Cloud computing has brought a new way of interaction with data in the field of Information Technology as it enhances collaboration, scaling and availability while effectively reducing the cost and maintenance. Most companies are now shifting to cloud-based service like private and public cloud computing to have a better grip on their data. and among these services, hybrid cloud is emerging as the solution that addresses the broader customer challenges. While hybrid cloud is now being deployed in most companies, many of them are focusing on how to tackle security challenges that can emerge while at the same time looking into ways to protect and backup their data using cloud bursting. This paper focuses on security issues related to hybrid cloud deployment, its benefits and challenges in an enterprise environment and explore how an enterprise can use cloud bursting to backup and move their data onto the cloud.**

***Index Terms*— Hybrid cloud, cloud computing, security, cloud security, Cloud bursting, Enterprise security.**

I. INTRODUCTION

Cloud computing allows users access computing resources resources on demand. It enables enterprises to cost reduction, elasticity and efficiency. Depending on the implemented cloud model, enterprises find it benefic to move to the cloud.

The US National Institutes of Standards & Technology (NIST) defines cloud computing Service Models as follow, in which the consumer refers to an enterprise seeking to deploy its cloud.

- *Cloud infrastructure as a Service (IaaS). The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, deployed applications, and possibly limited control of select networking components.*

- *Cloud Platform as a Service (PaaS). The capability provided to the consumer is to deploy onto the cloud infrastructure consumer created or acquire applications created using programming language and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but does control the deployed applications and possibly application hosting environment configurations.*

- *Cloud Software as a Service (SaaS). The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through a thin client interface such as a web browser. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.*

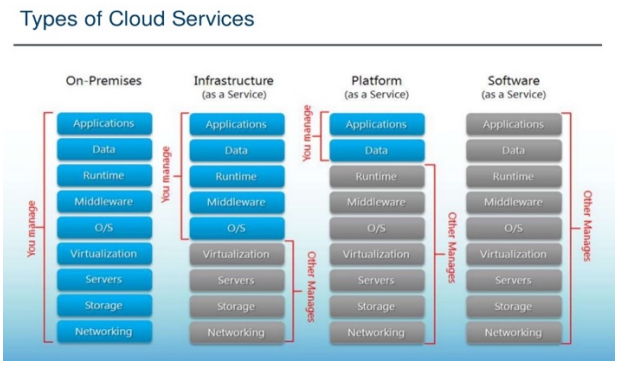


Figure 1. Cloud Services

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Cloud computing can be deployed as follow:

- Private cloud. The cloud infrastructure is solely for an organization. It may be managed by the organization or a third party and may exist on premise or off premise.

- Community cloud. The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns. It may be managed by the organization or a third party and may exist on premise or off premise.

- Public cloud. The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.

- Hybrid cloud. The cloud infrastructure is a composition or two or more clouds that remain unique entities but are bound together.

Cloud computing adoption in the information technology industry has increased over the past years. Hybrid cloud deployment is the most attractive between public and private cloud deployment; because it offers to cloud service customers a wide range of capabilities from public cloud service providers, depending on their business needs.

Hybrid cloud deployment has become the common used among companies because of the flexibility it offers to combine public and private cloud deployment, depending on theirs needs of data security and accessibility, data location storage and many others.

As hybrid cloud might sound the best choice for some organizations, its deployment is not without challenges and security concerns. Such complex deployment model brought us to focus on some of the benefits and challenges regarding its security implications and deployment in an enterprise environment.

II. Hybrid Cloud as an Enterprise Model

Hybrid cloud is a composition of two or more distinct cloud infrastructures (private, community or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (cloud bursting for load balancing between clouds) [1]. It could be a combination of private clouds in an enterprise.

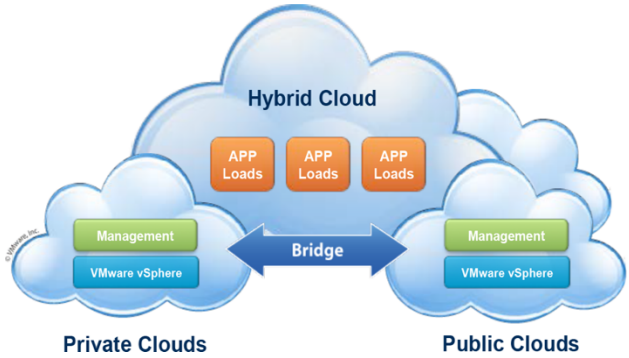


Figure 2: Hybrid cloud representation [2].

The success that hybrid cloud has shown with workloads in test and development environment makes it the common choice amount cloud models for enterprises.

Hybrid cloud offers companies a simple approach where public cloud and private cloud are combined as one platform bringing maximum value and effectiveness of each component of a workload. In the hybrid paradigm, system live where they make the most sense; on premise or hosted, virtualized or cloud. Enterprises have different set of requirements for different type of applications, and hybrid cloud solutions offer the flexibility to meet these needs.

The mixing and matching of infrastructure component allows enterprises to create a cloud strategy around their unique needs instead of building around the components of a single provider or platform.

III. Benefits and Challenges of Hybrid Cloud in an Enterprise

Hybrid cloud enables businesses to get the right combination of cloud and existing resources to work together which is in fact creating the right infrastructure to best suite their needs thus bringing benefits to the enterprise by improving enterprises

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

information technology strategy. Here are some of the benefits that hybrid cloud offers to enterprises:

A. *Cloud efficiency*

By connecting dedicated or on premise resources to cloud component, companies can establish cloud efficiencies into existing investments in information technology that aren't ready for cloud to boost performance, maintain security and enhance reliability while reducing the total cost of ownership.

B. *Gradual cloud adoption*

Making the most of public cloud often requires understanding new paradigms and new terminology, re-architecting applications, writing codes to allow applications to control resources via application programming interfaces (APIs) to provide scalability and resiliency. Hybrid cloud on the other side, allows customers to start by taking advantage of dedicated servers and virtualization using existing applications and paradigms and eventually evolve the application by moving the right element to a public cloud over time as needed. The flexibility of moving certain workloads or components of an application between platforms gives companies the ability to transition to cloud at their own pace and only with the components that they need.

C. *Enhance innovation*

Hybrid cloud brings all the benefits of the public cloud; access to massive public resources to test out new capabilities and try out new technologies without investments. Developers can focus instead of provisioning. With available compute power at enterprises fingertips and fully integrated into their existing infrastructure, new system enhancements or application updates get through the software lifecycle faster.

D. *Security and Compliance*

Combining dedicated and cloud resources, enterprises can more easily address many of the security and compliance concerns of a fully cloud-based solution. But compliance does not guaranty security, most of the security issues declared over the past year (yahoo, SONY) have proven that even though these companies had met compliance mandate, their security were still breached.
While it is obvious that hybrid cloud has shown the best of what private and public models have to offer. Besides the benefits that hybrid cloud models have to offer, there are challenges, which we can easily be identified.

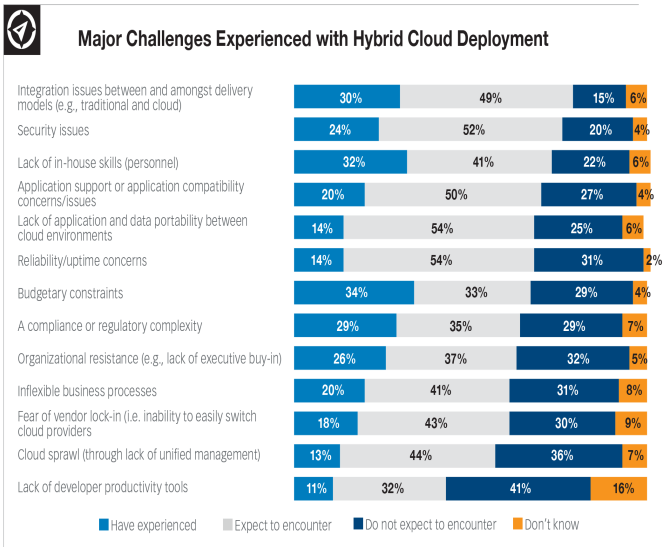


Figure 3. Challenges on hybrid cloud deployment [3]

As cloud computing adoption continues to rise, the emergence of hybrid environment (cloud, on premise and in-between) is further driving the need for integration as companies must connect newer cloud technologies to existing, legacy on premise solutions to get a better view on their business [4]. We've identified the following challenges:

1) *Integration of data and application*

The first step in building any information infrastructure requires identifying, combining and managing relevant data to derive insights that can impact the enterprise. This step requires an integration strategy that supports the agility needs on of the business and can evolve with the company [5].

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

In a hybrid cloud deployed environment. It has remained a challenge for companies since they've migrated to cloud models. Proper implementation of integrations is a key in enterprise businesses. Lack of integration data and application can result of major issues in businesses where contact information in the billing system of a company does not match the contact information listed in the customer relationship management of that company. While most professional believe data integration is growing in strategic importance, they are still primarily focused on implementing the basic foundation. Data integration initiatives include migrating from one system to an another (42%), back office to front office (37%), integration data for business intelligence (37%), and integration on premise applications (35%). Which illustrate that 20 to 30% of enterprises that have customer relationship management (CRM) system do not have that CRM system connected to other core business systems such as enterprise resource planning (ERP), data warehouses, and customer service systems [6].

Figure 3. Data and application integration [3,7]

2) Migration complexity

While it is important the understand which application should be distributed across cloud models it does matter to have tested it in both environments models before migrating.

3) Scale issues

When it comes to managing hybrid cloud the complexity falls under change and scale. In hybrid cloud, virtualized and containerized environments, event volumes grow exponentially, configuration management database will be inaccurate, and it becomes difficult to determine root cause when an error happens.

4) Networking

Hybrid cloud integration requires a well network design implementation.
The latency between the public cloud location and the private one has to be considered. Same network security appliances in the private and public cloud have to be considered.

5) Managing and monitoring infrastructures and systems across multiple provider.

IV. Security Concerns on a Hybrid Cloud Model

There are numerous aspects of security threatening hybrid cloud. Dan Sullivan [4] is listing five of which IT administrators are taking into consideration while being concerned about turning over all their production applications to a third party or losing their substantial investment in on-premises infrastructures. In such cases, a hybrid cloud environment can capitalize on the benefits of both public and private cloud. But hybrid isn't perfect, it is still including few security obstacles.

A. Hybrid cloud security issue1: lack of data redundancy

Hybrid cloud is a complex system that enterprises admins have limited experience in managing. While risks of running applications in a single datacenter without failover, cloud architects need redundancy across data centers to mitigate the impact of an outage in a single data center in this extend, a lack of redundancy can become a serious security risk in a hybrid cloud deployed environment. Specifically, if redundant copies of data are not distributed across data centers. Cloud architects can implement redundancy using multiple data centers from a single provider, multiple public cloud providers or a hybrid cloud.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

B. Hybrid cloud security issue 2: Compliance

maintaining and demonstrating compliance can be more difficult with a hybrid cloud. Not only enterprises have to ensure that their public cloud provider and private cloud are in compliance, but they should also demonstrate that the means of coordination between the two clouds is compliant.
Companies need to ensure that data are not transferred from a compliant database on a private cloud to a less secure storage system in a public cloud.

C. Hybrid cloud security issue 3: Poorly constructed Service-Level Agreement

Enterprise must be confident that their public cloud provider can consistently meet expectations detailed in the Service-Level Agreement (SLA). If the enterprise private cloud does live up the same SLA, then they may need to create Service-Level Agreement based on expectations of the lesser of the two clouds.
Enterprises should collect data on their private cloud availability and performance under realistic workloads. They should look for potential problems with integrating public and private clouds that could disrupt service. For instance, if a key business driver for the private cloud is keeping sensitive and confidential data on premises, then the enterprise SLA should reflect the limits to which they can use public cloud for some services.

D. Hybrid cloud security issue 4: Risk management

From business perspective, formation security is about managing risk. Hybrid cloud uses new application programming interfaces (APIs), requires complex network configurations and pushes the limits of traditional system administrator's knowledge and abilities.
These factors introduce new types of threats. Cloud computing is not more or less secure than internal infrastructures, but hybrid cloud is a complex system that enterprise admins have limited experience in managing and that creates a risk.

E. Hybrid cloud security issue 5: Security management

Existing security controls such as authentication, authorization and identity management will need to work in both the private and public cloud. To integrate hybrid cloud security protocols, there are two options:

Either replicate controls in both clouds and keep security data synchronized, or use an identity management service that provides a single service to systems running in either cloud. Companies should allocate sufficient time during their planning and implementation phases to address what could be fairly complex integration issues.
Implementing a hybrid cloud introduces more than just technical challenges; IT administrators in these companies need to address security issues; by understanding and mastering these five hurdles, hybrid cloud could offer more reward than risks.

F. Hybrid cloud security issue 5: Disaster recovery

With companies adopting hybrid cloud as their enterprise solution, disaster recovery plays a key role on keeping data safe in case something goes wrong. More companies are now putting into place disaster recovery solutions, which are done via the cloud; the on-premise solution has been put away. Let's understand how we can implement it.

V. CLOUD BURSTING & HYBRID CLOUD

Most organizations are putting their focus on achieving smooth transfer of large data over the cloud as the workload is increasing; the need of high performance and scalability is required. With most businesses using applications, workloads level is on the rise. It would be costly for enterprises to keep these loads down with an on premise solution. Let us consider the fact that, hybrid cloud and cloud bursting are two different solutions that can be integrated. As we do understand, following the different survey on cloud computing, that hybrid cloud is the solution, most enterprises are adopting as their I.T infrastructure. As hybrid cloud allows applications to run in different cloud environments

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

depending on the companies needs, cloud bursting is that application, bursting data back and forth between cloud environments. Hybrid cloud is the right environment with the ability to deliver cloud bursting.

Cloud bursting is the process of taking the workload of running application running from private cloud and burst it into public cloud environment once a threshold of increased demand is reached.

Cloud bursting within a hybrid cloud denotes a responsive approach to disaster recovery as well. Just like an increased workload triggers cloud bursting, the system can be configured to recognize a reduction in workload, which in turn could trigger cloud bursting as well (If a reduced work load capacity is reached, due to a major disaster incident which causes enterprise resources to fail). [6668]

- Cloud bursting concerns

- Security, compliance and privacy issues when moving data between environments or other constraints or requirements involved when migrating data and or services to a public cloud.
- The public cloud needs to be able to satisfy the over capacity needed by the private cloud and should be able to effectively load balance its workload so as not to cause deterioration in other existing services
- Latency challenges (ensure latency between environments does not have a negative effect on the application or user experience)

- Cloud bursting benefits

- Increased performance with spikes in workloads
- Bursting new instances of applications to another cloud
- Ability to burst scalable application tiers to improve performance at peak periods
- Reduced capital expense
- Fail over or disaster recovery
- Increased availability

Organizations should be aware of the challenges when leveraging this architecture

VI. Hybrid Cloud and Disaster Recovery

Hybrid cloud offers advantages when it comes to disaster recovery. Due to the architecture disaster recovery can be more cost effective and flexibility and agility of disaster recovery is significantly improved.

The hybrid cloud is an ideal operating architecture for disaster recovery. As hybrid cloud becomes more widely used and better understood it will lead the way to a transformed disaster recovery approach with capability of being a more effective and efficient route to protect critical applications.

Hybrid cloud is facilitating the move away from the common disaster recovery approaches including on-premises replicated data centers and collocation. On premise replicated data centers work well for many businesses however this approach is highly resource dependent requiring power, cooling and proper network infrastructure for effective disaster recovery support. With the addition of manpower to keep the site maintained this approach is extremely costly.

Collocation, whereby a third party collocation site is rented for disaster recovery, is a second commonly used approach. This method for disaster recovery is widely available and easily employed and capital expenditure is less compared to the first approach. However to ensure the colo is not also affected by the disaster the business experiences it should be located in a different geographic location to the business and distance relates to increased cost.

Hybrid cloud is the opportunity for a third disaster recovery approach, through Disaster-recovery-as-a service (DRaaS). The public cloud can now be utilized as the offsite location to store a secondary copy of data. The hybrid cloud offers the array of benefits companies look for in disaster recovery approaches including geographic diversity, fixed

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

pricing and managed services (to look after hardware and infrastructure).

The hybrid cloud simplifies how we approach disaster recovery without abating the benefits, probably achieving more than is possible from other strategies.
Further benefits achieved through disaster recovery in hybrid cloud and DRaaS:

- *Live replication of data*
  Unlike other backup solutions DRaaS enables live replication of data in real time so that the data is always up to date and protected.
- *Virtualization*
  Virtualization can offer many benefits (reduced costs, automation and less complex infrastructure). With DRaaS your disaster recovery can be managed remotely ensuring a consistent approach to disaster recovery.

Most companies today work with security providers; however, IT team in the enterprise must make sure physical security measures are implemented in on premise facilities where the servers or network equipment are located with video surveillance, alarms, keycards or biometric to allow access to the accredited IT team.
While making the choice of a cloud provider, the IT team of the company must ensure that security on the cloud provider facilities are as good that the one on premise.

- Policies

Enterprise should define a clear policy on premise and with the cloud providers. Incident response established in case something goes wrong.

- Coding

If hosting applications on premise, or in a hybrid cloud environment, enterprise must make sure that sources codes or application program interface (APIs) are written using standard methodology and that the level of security in each platform is the same (private, public cloud or conventional servers). Many companies are opting for custom applications development with the idea of retaining control, lack of awareness of new technology approaches. Companies today, choose to develop their own applications in order to keep track on their coding practices as coding to an API represent an integration method.

As Distributed Denial of Service is a common threat, security in Layer 3, 4 and 7 must be established against attack mitigation, maintaining an IP reputation database with real time feedback, putting in place a Web Application firewall that will counter other malicious forms of attacks.

- Data Leakage

For many year, data leakage has become one of the greatest organizational risk in enterprises. When this kind of threat comes from the cloud provider (public) or the enterprise premises itself both the cloud provider or the enterprise itself must be able to map their policies to their security protocols.

VII. Conclusion

In this paper, we have provided a basic definition of hybrid cloud computing and discussed the benefits and challenges as well as the security issues related to its deployment in an enterprise environment. Hybrid cloud offers many benefits to enterprises that satisfies businesses needs. As we acknowledge that threats are always present in many forms, companies are looking to better secure their data no matter the deployment model. Putting all resources in research and to counter major security risks.

Cloud bursting may be practical in some situations but the reality is that a hybrid cloud or having your apps or services or data permanently in the cloud is by far more beneficial and even more cost effective than bursting into the public cloud at times of increased capacity. With hybrid cloud deployment on the rise even more so.
Security will always be a concern. But comparing security issues between cloud busting and hybrid

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

cloud, cloud bursting does not always allow for better security. Bursting from a secure private data center into a public cloud also requires the same compliance and security in the public environment equivalent to that of your data center for you to claim compliance; you cannot claim to be compliant except in peak intervals. Likewise when utilising hybrid cloud you need to ensure that both your private and public environments within a hybrid cloud share equal security and compliance criteria.

REFERENCES

[1] Practical Guide to hybrid Cloud Computing, Issued February 2016 http://www.cloud-council.org/deliverables/CSCC-Practical-Guide-to-Hybrid-Cloud-Computing.pdf

[2] Unlocking the promise of Cloud –based Agility with integration. *https://www.martechadvisor.com/articles/cloud-integrationesbs/unlocking-the-promise-of-cloudbased-agility-with-integration/*

[3] Security in the Hybrid cloud: Putting rumors to rest https://ww2.frost.com/files/1614/2113/3098/Whitepaper-VMware_Bluelock_Security_In_The_Hybrid_Cloud.pdf

[4] Realizing the full potential of hybrid Cloud computing,

https://www.emc.com/collateral/white-paper/cio-wp-realizing-the-full-potential-of-hybrid-cloud-computing.pdf

[5] Five Hybrid Cloud Security by Dan Sullivan http://searchcloudcomputing.techtarget.com/tip/Hybrid-cloud-Its-not-as-secure-as-you-think

[6] http://www.cloud-council.org/deliverables/CSCC-Practical-Guide-to-Hybrid-Cloud-Computing.pdf

[7] National Institute of Standards and Technology. « The nist definition of cloud computing ». 2011.

[8] A Berkeley View of Cloud Computing. Technical Report UCB/EECS-2009-28, University of California at Berkeley, eecs.berkeley.edu/Pubs/TechRpts/2009/EECS-2009-28.html

[9] Salesforce (2011) Security Implementation Guide. login.salesforce.com/help/doc/en/salesforce security impl guide.pdf

[10] An Overview and Study of Security Issues & Challenges in cloud computing by Rajesh Piplode, Umesh Kumar Singh 2012

[11] http://searchcloudcomputing.techtarget.com/tip/Hybrid-cloud-Its-not-as-secure-as-you-think

[12] Cloud Computing: Security Issues and Research Challenges ,2011 by Rabi Prasad Padhy, Manas Ranjan Patra, Suresh Chandra Satapathy

[13] R. Gellman, "Privacy in the clouds: Risks to privacy and confidentiality from cloud computing," The World Privacy Forum,2009.http://www.worldprivacyforum.org/pdf/WPF_Cloud_ Privacy_Report.pdf.

[14] Survey: Cloud Computing 'No Hype', But Fear of Security and Control Slowing Adoption. Tech- nical report. http://www.circleid.com/ posts/20090226_cloud_computing_hype_ security/.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

PROMETHEUS METHODOLOGY: A SPECIAL PURPOSE AGENT ORIENTED METHODOLOGY

Nwagu, Chikezie Kenneth, Omankwu, Obinnaya Chinecherem and Inyiama, Hycient

[1] Computer Science Department,
Nnamdi Azikiwe University,Awka
Anambra State, Nigeria,
Nwaguchikeziekenneth@hotmail.com

[2] Computer Science Department, Michael Okpara University of Agriculture, Umudike
Umuahia, Abia State, Nigeria
saintbeloved@yahoo.com

[3] Electronics & Computer Engineering Department, Nnamdi Azikiwe University, Awka
Anambra State, Nigeria.

Abstract
In this publication we present the Prometheus methodology for building agent-based software systems. Our goal in developing Prometheus was to have a process with associated deliverables which could be used by industry practitioners and undergraduate students without a previous background in agents. As a result, the Prometheus methodology aims to be detailed and complete, as well as being general-purpose and having tool support. Prometheus comprises three phases: system specification, architectural design, and detailed design. The Prometheus methodology has been developed over a number of years as a response to both educational and industrial needs. The methodology has been used by industrial practitioners, taught at workshops at a number of conferences, and has been taught to undergraduate and postgraduate students, as well as having been used in student projects. These experiences have been positive and we have noticed an enormous difference in the ability of our students to develop agent systems. Using Prometheus third year undergraduates are able to build reasonable agent systems in a one semester course, something that previously was challenging for graduate students.

Keywords: Agents, Software Engineering, Methodologies.

Introduction

Prometheus[1] is a methodology for developing agent-oriented software systems. Our goal in developing Prometheus was to have a process with associated deliverables which could be used by industry practitioners and undergraduate students to develop intelligent agents systems, without a previous background in agents. To this end Prometheus aims to be *detailed* and *complete* in the sense of covering all the stages of software development as applied to agent systems.

The Prometheus methodology includes three phases:

- The *system specification phase* focuses on *(i)* identifying the system's *interface*, that, since we are dealing with situated agents, consists of

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

percepts (information from the environment), and *actions*; and *(ii)* deter-mining the system's goals, functionalities, and use case scenarios, along with any important shared data. The outputs from this phase are a set of functionality descriptions, percept and action descriptions, system goals, and use case scenarios.

- The *architectural design phase* uses the outputs from the previous phase to determine which agents the system will contain, how they will inter-act, and what significant events occur in the environment. The outputs of this phase are a system overview diagram, agent descriptions, agent interaction protocols and a list of significant events and messages between agents.

- The *detailed design phase* looks at the internals of each agent and how it will accomplish its tasks within the overall system. The outcomes of this phase are detailed diagrams showing the internal functionality of each agent and its capabilities, process diagrams that show the internal processing of the agent, as well as descriptions of data structures used by the agent, plans and subtasks and the details of plan triggers.

Figure 1.1 indicates the main design artifacts that arise from each of these phases as well as some of the intermediary items and relationships between items. The figure shows the models and dependencies, but does not show the process (although it does imply it).

The development (and revision) of the various models depicted in Figure 1.1 is intended to proceed in an iterative fashion (similar to the Rational Unified Process) where in each iteration the focus of the work gradually shifts further down towards implementation, but where it is expected that most iterations will not be exclusively concerned with a single phase and that many iterations will involve revision of previously developed models Figure 1.1 is divided horizontally and vertically. The three horizontal regions form the three *phases* of the methodology discussed above. The left-most region (consisting of scenarios, interaction diagrams, interaction protocols and process diagrams) deals with descriptions of the *dynamic* behaviour of the system. The middle vertical region (data coupling, acquaintance, system overview, agent overview and capability overview) deal with *overviews* of the system while the remaining models (the right region) give detailed descriptions for each entity in the system. Both the middle and right region deal with the static structure of the system.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

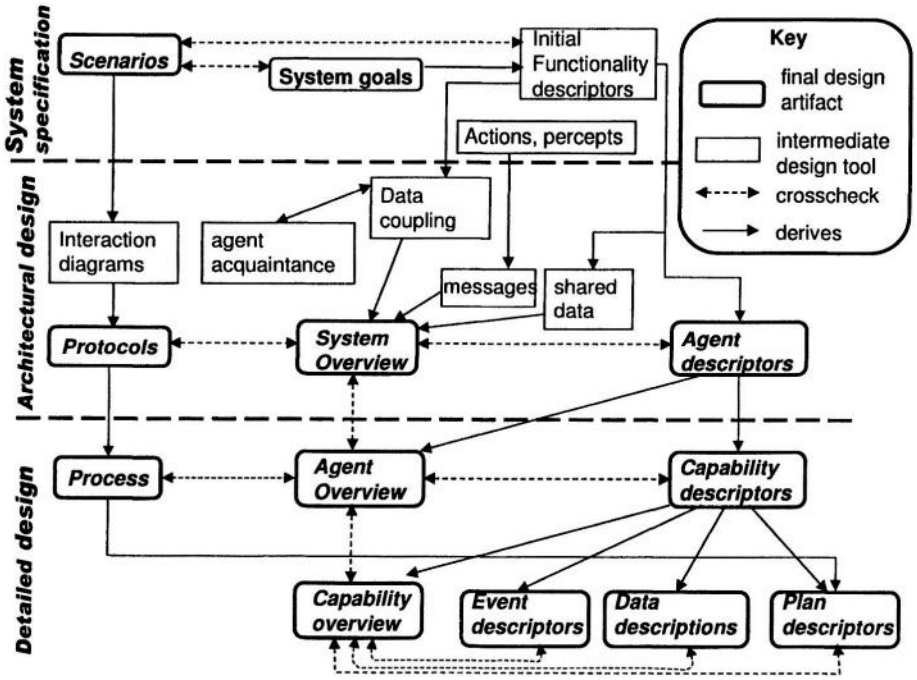


Figure 1.1. Overview of the Prometheus Methodology

Prometheus, like any other methodology, defines a number of system models and notations that are used to describe these models. We describe structural overviews at various levels (system, agent, capability) with a single diagram type. In addition, diagrams are used for showing data coupling and agent acquaintance relationships. Dynamic behaviour is currently described with existing models from UML (Unified Modeling Language) and AUML (Agent UML) (see chapter 12).

In addition to graphical notations, we use structured textual descriptors (i.e., forms) for describing individual system entities (e.g., agents, functionalities, plans, etc.). We also maintain a data dictionary which is important in ensuring consistent use of names.

It is important to note that Prometheus is a general purpose methodology. In particular, most of the methodology (specification and architectural design) does *not* assume a particular agent architecture. Although the detailed design phase does target a particular family of agent architectures (namely those that achieve goals using a library of plans), this does not make Prometheus special-

purpose. Any methodology that addresses implementation needs to have a target platform. For example, Tropos (Bresciani et al., 2002) also targets

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

BDI-like systems, whereas Gaia (see chapter 4) avoids the issue by not addressing implementation.

In the following sections we briefly describe the processes and models associated with each of the three phases. Due to space limitations and the desire to describe all of the methodology this chapter cannot do justice to Prometheus. In particular, we cannot describe a running example in detail, and the detailed techniques, that is *how* particular steps in the process are performed, are not described. The description in this chapter is current as of October 2003. For further or up-to-date information see `http://www.cs.rmit.edu.au/agents/SAC`.

System Specification

System specification consists of three main activities: determining the sys-tem's interface to the environment, determining the system's goals and func-tionalities, and determining scenarios which capture the usage of the system.

Since agents are situated, one of the key things to be captured in the devel-opment process is how the agents interact with their environment. Following standard terminology (Russell and Norvig, 1995) we call incoming informa-tion from the environment *percepts* and agents' means of affecting the envi-ronment *actions.* As discussed in (Winikoff et al., 2001) the raw data from percepts may need to be processed in order to obtain things that are a signifi-cant event for the agent system. Prometheus prompts the developer to consider such issues. For example a video frame from a camera on a soccer playing robot, may need processing to extract the symbolic objects, such as ball, goal and players, as well as further processing to determine whether anything sig-nificant has actually happened – such as a ball having moved since a previous frame, or a ball not appearing where one was expected.

Determining the system's goals and functionalities is done by iterating over the following steps:

- Identify and refine system goals – main and subsidiary;
- Group goals into functionalities;
- Prepare functionality descriptors;
- Define use case scenarios (and variations); and
- Check that all goals are covered by scenarios.

An initial set of goals is identified from the initial requirements. These are refined and elaborated into a hierarchy of goals by asking *how* goals will be

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

achieved, and *why*[2] goals are being achieved (van Lamsweerde, 2001). For example, if we are designing an online book store we might have a high-level goal *fully online system.* This goal might have associated with it the subgoals *find books online, pay online* and *order online.*

Functionalities are limited "chunks" of system behaviour that describe in a broad sense what the system needs to be able to do. We derive functionalities by grouping related goals. For example, given the goals above, we might also have another high-level goal of *purchase books* with subgoals *find books, place order, make payment,* and *arrange delivery. Pay online* and *make payment* are clearly closely related if not identical goals, and are therefore grouped together in a single functionality.

Functionality descriptors capture the name and description of each function-ality as well as what events activate it, what goals it achieves, what actions it performs, what percepts it receives, what messages it sends/receives, and what data it uses and produces.

Use case scenarios are complementary to goals in that they show how processes are composed within the system. In developing goals, we typically already are building up scenarios of how these goals will be part of various processes within the system. Scenarios enable us to specify some of this struc-ture, which in turn may help to identify missing goals.

Use case scenarios are based on ideas from object oriented design but are more structured. This structure allows for automated cross checking, and automatic production of partial information for later design artifacts (e.g., proto-cols).

The core of the use case scenario is the sequence of steps describing a particular example of the system in operation. Each step can optionally have data read and data written noted as well as the functionality that performs that step. Each step can be a GOAL, ACTION, PERCEPT or SCENARIO, as well as OTHER allowing for additional step types, although these cannot be used in automated processing. The following example illustrates the steps of a use case scenario in Prometheus.

Query Late Books Scenario

Trigger: User enquiry
GOAL: Determine delivery status
GOAL: Log delivery problem
ACTION: Request delivery tracking
GOAL: Inform customer
OTHER: Delay

PERCEPT: Tracking information received
GOAL: Arrange delivery
GOAL: Log books outgoing
GOAL: Inform customer

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

10. GOAL: Update delivery problem

Functionality descriptors, goals, and use cases give different views of a common underlying system. As a result they should be checked for mutual consistency. For example an interaction between functionalities in a use case scenario should also be evident in the interactions field of a functionality descriptor. Also, each system goal should be represented in at least one scenario; all functionalities should be covered; and use case scenarios should cover the important normal uses of the system as well as some error/unusual situations, in order to give an idea of how these will be handled.

Architectural Design

The three aspects that are developed during architectural design are:

1 Deciding on the *agent types* used in the application. Agent types are formed by grouping a number of functionalities together. Diagrams which we use to assist in the analysis are *data coupling diagrams* and *agent acquaintance diagrams.*

Designing the overall system structure (with a *system overview diagram* along with descriptors).

Describing the interactions between agents using *interaction diagrams* (developed from scenarios) and *interaction protocols* (developed from interaction diagrams).

Deciding on the Agent Types

One technique that we use to systematically examine the properties which lead to coupling and cohesion is the *Data Coupling Diagram.* Potential groupings are then evaluated and possibly refined using an *Agent Acquaintance Diagram.*

A data coupling diagram (see Figure 1.2) consists of the functionalities and all identified data (not only persistent data, but also data the functionalities require to fulfill their job). Directed links are then inserted between functionalities and data, where an arrow pointing towards the data indicates the data is *produced or written by* that functionality, whereas an arrow pointing towards the functionality indicates the data is *used by* the functionality. A double-headed arrow indicates that the functionality both uses and produces the data. Edges

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

between data and data or between functionality and functionality are incorrect syntax (and cannot be drawn in the tool).

The data coupling diagram is used to identify groupings which are linked by their data use. When assessing the diagram visually we are looking for clusters of functionalities around data. This is one important aspect in the analysis of potential groupings of functionalities. It is also used to guide refinements and changes to achieve a cleaner delineation between agents.

Some reasons for grouping functionalities into a single agent are if the functionalities seem to be related or if they share a lot of information. Some reasons for *not* grouping functionalities are if the functionalities are clearly unrelated, or if they exist on different hardware platforms.

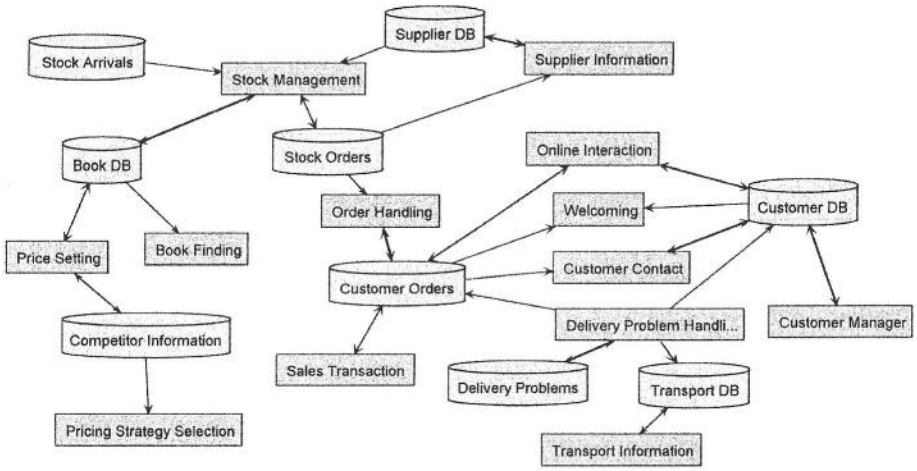


Figure 1.2. Data Coupling Diagram

In order to evaluate a potential grouping of functionalities into agents with respect to agent coupling we use an *agent acquaintance diagram* (see Figure 11.3). This diagram represents each of the agent types in the system. Information about agent interaction is extracted from the functionality descriptors and each agent type is linked with the other agent types it interacts with. Links can be decorated with the cardinality of the relationship if desired (e.g., one warehouse agent interacts with many sales agents).

We then analyse the resulting diagram in two ways. One is simply an analysis of the density of the links within the diagram. It is a measure of the ratio of the actual coupling to the maximal possible coupling. If the system has four agents, then each agent could potentially be linked to a maximum of three other agents, giving a total number of 3 + 2 + 1 possible links. To get the link

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

density we simply count the links and divide by this number. This measure is only one aspect of the analysis. We also consider bottlenecks and other issues.

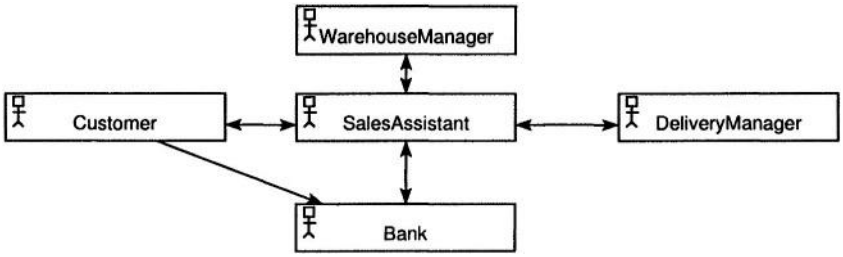


Figure 1.3. Agent Acquaintance Diagram

Designing the Overall System Structure

The system overview diagram is arguably the single most important artifact of the entire design process, although of course it cannot really be understood fully in isolation. The various descriptors provide the more detailed information that may be required.

The notation used in the system overview diagram (and in agent and capability overview diagrams) is a directed graph where nodes represent design entities and directed arcs represent relationships. Figure 11.4 depicts the nodes that are currently used, these correspond directly to the concepts used in the Prometheus methodology.

A syntactically valid overview diagram consists of a set of nodes (excluding goals and functionalities), each labelled with a name, with links between them. We distinguish between “active” nodes (entities that do things – agents, capabilities, and plans) and “passive” nodes (anything else – percepts, actions, messages, protocols, data). A link is valid from an active node to a passive node or from a passive node to an active node. A link is *not* valid from an active to an active node or from a passive to a passive node. An additional

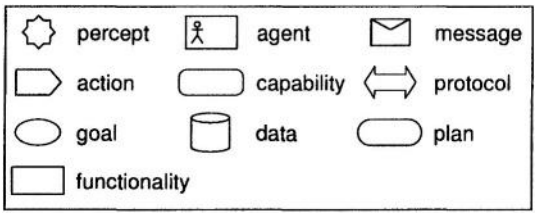


Figure 1.4. Notation used in Overview Diagrams

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

constraints is that there cannot be links *to* a percept and there cannot be links *from* an action.

The meaning of links is as follows:

- A link *to* a message indicates that the agent type (or capability or plan) sends that message.
- A link *to* a protocol indicates that the entity communicates using the protocol in question.
- A link *to* an action indicates that the entity performs the action.
- A link *to* a data node indicates that the entity writes to it.
- A link *from* a message indicates that the agent type (or capability or plan) receives that message.
- A link *from* a percept indicates that the entity receives the percept.
- A link *from* a data node indicates that the entity reads the data.

When drawing the system overview diagram (see Figure 11.5) we start by creating a named agent symbol for each agent type. We also add the percepts and actions at this point.

A data store icon is placed for each persistent data store, with an incoming link from each agent that writes to the data store and an outgoing link from the data store to each agent that directly accesses the data. Double headed links (arrows at both ends) indicate both read and write.

Once interaction protocols have been defined they are added into the diagram and we indicate which agents participate in these protocols.

Describing the Interactions between Agents

This sub-phase focuses on the system's *dynamic* behaviour by fully specifying the interaction between agents. *Interaction diagrams* borrowed from UML sequence diagrams, are used as an initial representation of agent interaction. Fully specified *interaction protocols* (borrowed from the revised version of AUML currently under development) are the final design artifact.

Interaction diagrams are the same as sequence diagrams of UML except that they show interaction between agents rather than objects. One of the main processes for developing interaction diagrams is to take the use case scenarios developed in the specification phase and to build corresponding interaction diagrams, showing the interaction between agents in a scenario.

As with scenarios, we would expect only to have a representative set of interaction diagrams, not a complete set. In order to have complete and precisely

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

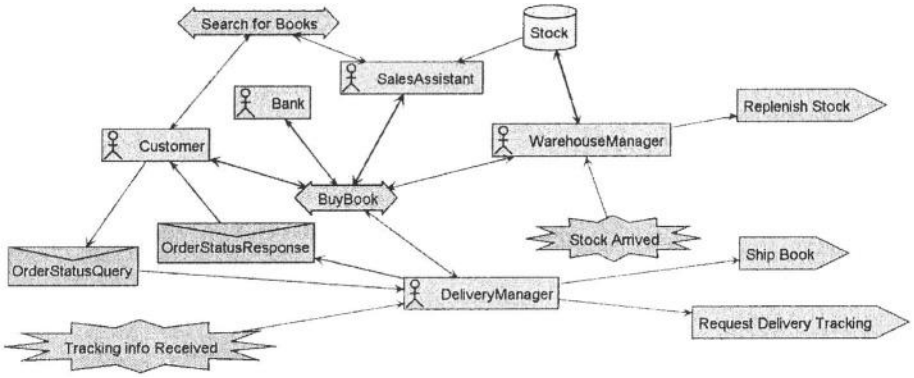


Figure 1.5. System Overview Diagram (excerpt)

defined interactions we progress from interaction diagrams to protocols which define exactly which interaction sequences are valid within the system.

Developing protocols is done by considering alternatives. For each message (or percept) that an agent receives we ask *"what are the possible messages that the agent could send as a response?"* We then repeat the process for these messages. Because protocols must show all variations they are often larger than the corresponding interaction diagram and may need to be split into smaller chunks.

An example interaction diagram can be found in Figure 11.6 and an example interaction protocol (using the new AUML notation) can be found in Figure 1.7.

Detailed Design

This phase deals with the internals of each agent, rather than the system as a whole. We use a hierarchical model so that each agent is broken up into capabilities. Capabilities may be included in more than one agent.

The steps within detailed design are:

1 Develop agent overviews (showing interactions between capabilities) and capability descriptors.

Develop the internal process of an agent from the interaction protocols, described using a variant of UML activity diagrams[3].

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

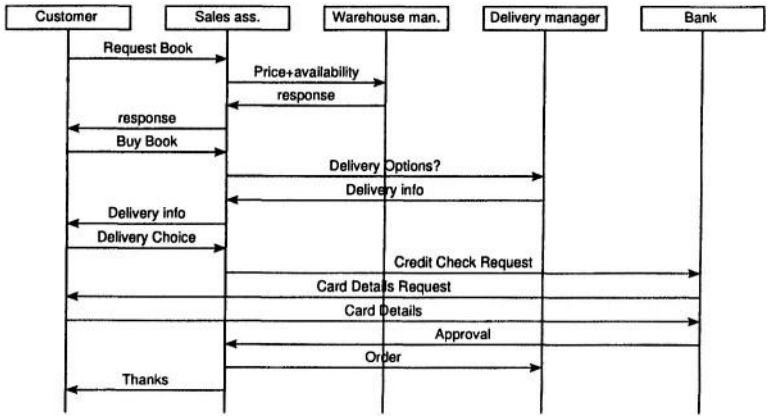


Figure 1.6. Interaction Diagram

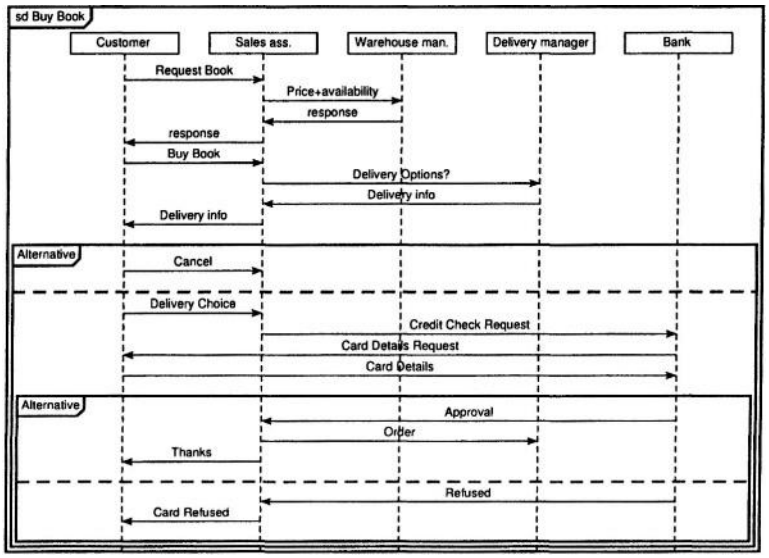


Figure 1.7. Interaction Protocol

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Develop the internal design of each capability in terms of plans, events, beliefs, and (possibly) sub-capabilities.

The process followed is essentially iterative refinement. We begin by considering for each agent what the agent needs to be able to do. Often, the functionalities that were grouped to form the agent type will be a good starting point for defining the capabilities of that agent type.

We then "connect" up the capabilities. As depicted in the system overview diagram, each agent has incoming and outgoing messages, percepts that it received, actions that it performs, and data that is read and/or written. Each of these connections to an agent is mirrored in the *agent overview diagram* for that agent type. The agent overview diagram for a given agent type is quite similar to the system overview diagram, but shows interactions between capabilities *within* an agent, rather than between agents within a system. Any messages or percepts that are incoming to an agent in the system overview, must be incoming to some capability (or plan) within that agent in the capability overview diagram. Similarly any actions or messages that are outgoing from an agent in the system overview, must be outgoing from some capability (or plan) within that agent in the capability overview diagram.

Once capabilities (and plans) within an agent have been defined we consider each capability and refine its internals. This process continues until the inter-nal operation of each agent and each capability is defined in terms of plans, messages, data, and other capabilities.

Tool Support

Designs for large systems are almost always developed incrementally with many revisions. When revising any artifact, be it documentation, code, or de-sign, it is easy to introduce inconsistencies and minor errors. We have found tool support to be extremely useful for checking and maintaining design con-sistency across varying levels of detail.

The *Prometheus Design Tool* (PDT) allows a user to enter and edit a de-sign, in terms of Prometheus concepts; check the design for a range of possible inconsistencies; and automatically generate a design report that includes de-scriptors for each design entity, a design dictionary, and the various diagrams. It also provides descriptor forms which prompt for the various aspects which should be considered. When any aspect of the design is modified, the change is propagated to all levels, although in some cases user input is still required for finalisation.

PDT supports the Prometheus methodology in a number of ways. It sup-ports the process of deriving agent types from functionalities by deriving part of each agent's interface, by cross checking the declared interface of an agent against the functionalities that make up the agent type, and by generating cou-

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

pling and acquaintance diagrams. It supports the process of developing the internals of agents in the detailed design phase by cross checking an agent's internals against the agent's declared interface, checking the consistency of a plan with its context, and by supporting views of design diagrams at different levels (system overview, agent overview, and capability overview). For more details on tool support for the Prometheus methodology see (Padgham and Winikoff, 2002) (this paper discusses an early prototype tool which was also, somewhat confusingly, called PDT).

The Prometheus Design Tool is currently available[4] and further functionality is under development.

Debugging with Design Artifacts

The Prometheus methodology aims to support the full life cycle, including testing and debugging. David Poutakidis, a research student of the authors, has been working on debugging MAS, using design artifacts such as those produced by the Prometheus methodology. The central claim in his work is that:

> *"... design documents and systems model developed when following an agent-oriented software engineering methodology* [such as Prometheus] *can be incorporated in an agent and used at run-time to provide for run-time error detection and debugging."* (Poutakidis et al., 2002)

Specifically, the work described in (Poutakidis et al., 2002; Poutakidis et al., 2003) uses *interaction protocols* expressed in AUML (Odell et al., 2000). These are translated into Petri nets and a debugging agent uses these to monitor agent interactions and alert the programmer when a protocol is not followed correctly.

Code Generation

The latest version of the JACK[5] Development Environment (JDE) includes a design tool that allows Prometheus overview diagrams (based on a slightly older version of the methodology) to be drawn. The JDE also includes a graphical user interface that allows the structure of an agent system to be built by drag-and-drop and by filling in forms.

The JDE supports the Prometheus methodology in that the concepts provided by JACK correspond to the artifacts developed in Prometheus' detailed design phase. It is important to realise that the agent structure described in the JDE generates JACK code that can be compiled and run. This automatic

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

generation of skeleton code from design artifacts is extremely useful, and has encouraged students to do design prior to coding.

Experiences with Using Prometheus

The Prometheus methodology has been developed over a number of years, as a response to both educational and industrial needs. During its development it has been used by industrial practitioners, taught at workshops at a number of conferences, and has been taught to undergraduate and postgraduate students, as well as having been used in student projects.

We have worked with development of agent software for eight years and have during this time had a wealth of experience in trying to teach students to build such systems. The *Prometheus* methodology has partially grown out of this experience and we have noticed an enormous difference in the last few years, in the ability of our students to develop agent systems. Previously, with-out a methodology, graduate student would flounder and end up building a system which made little real use of agents. Using Prometheus, third year undergraduates are now able to build reasonable agent systems in a one semester course.

We have worked with companies that sell agent development platforms (for BDI agents) and they have experienced similar difficulties with teaching their customers how to develop agent based systems, as we have experienced with students. We have worked with Agent Oriented Software[6] (AOS) both in developing the methodology and also in producing materials for training professional software developers in development of agent systems. The methodology has formed the basis for a course on agent-oriented design that is offered by AOS to industry software developers who are starting to use the JACK intelligent agents development environment (Busetta et al., 1998), and has been successful in introducing them to methods to assist them in design of agent applications. For example, a prototype weather alerting system (Mathieson et al., 2004) developed for the Australian Bureau of Meteorology by AOS used Prometheus overview diagrams (produced using the JDE) to capture the de-sign. The Prometheus overview diagram notation (as implemented in the JDE) is also used within AOS on a range of projects.

The methodology has also been taught to undergraduate students as a class. The class spends roughly half of the semester covering the methodology and the other half introducing the JACK agent programming language and plat-form. The students were able to design and implement reasonable agent systems in a single semester. Finally, we have on two occasions given undergraduate students materials on Prometheus (tutorial notes and papers) and, with intentionally limited guidance, had them design (and in one case also implement) an agent system. During the Christmas 2002/2003 vacation a second year student was given a description of the methodology and a description of an agent application (in the area of tourism)

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

and asked to design and build a system. Although there was not enough time to build the system (a considerable amount of time was spent in developing requirements based on an available database of tourist in-formation), the student did produce a detailed design in 8 weeks. During the Christmas 2001/2002 vacation a (different) second year student was given a description of the methodology and a description of an agent application (in the area of Holonic Manufacturing) and asked to build a system. With only (intentionally) limited support, the student was able to design and implement an agent system to perform a Holonic Manufacturing simulation in a period of 8 weeks. This was in marked contrast to projects in the late 1990s where students struggled and required large amounts of help, usually ending up with poorly designed agent systems. The feedback from these undergraduate students was valuable in improving the methodology. The two primary issues identified by the students were the need for tool support and the need to simplify the concepts (Prometheus previously had percepts, events, incidents, messages and triggers). Both issues have since been addressed.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

References

[G. Booch, J. Rumbaugh, and I. Jacobson. '*The Unified Modelling Language User Guide.*' Addison Wesley, 1998.

[Jeffrey M. Bradshaw. '*An Introduction to software agents.*' In Jeffrey M. Bradshaw, editor, Software Agents, pages 3–46. AAAI Press / The MIT Press, 1997.

P. R. Cohen and H. J. Levesque. '*Teamwork.*'Nous, 25(4):487–512, 1991.

Jacques Ferber. '*Multi-agent Systems: An Introduction to Distributed Artificial Intelligence.*' Addison-Wesley, 1999.

Leonard N. Foner. '*What's an agent anyway? -a sociological case study.*' FTP Report - MIT Media Lab, May 1993.

S. Franklin and A. Graesser. '*Is it an Agent, or just a Program? A Taxonomy for Autonomous*

Agents.' In Intelligent Agents III. Agent Theories, Architectures and Languages (ATAL'96), volume 1193, Berlin, Germany, 1996. Springer-Verlag.

N. R. Jennings and Michael Wooldridge. '*Agent-Oriented Software Engineering.*' In Francisco

J. Garijo and Magnus Boman, editors, Proceedings of the 9th European Workshop on Modeling Autonomous Agents in a Multi-Agent World: Multi-Agent System Engineering (MAAMAW-99), volume 1647, pages 1–7. Springer-Verlag: Heidelberg, Germany, 30– 2 1999.

T. Juan, A. Pearce, and L. Sterling. '*Roadmap: Extending the GAIA methodology for complex open systems.*' In Proceedings of the First International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS 2002), Bologna, Italy, July 2002.

Michael Luck, Peter McBurney, and Chris Preist. '*Agent technology: Enabling next generation computing: A roadmap for agent-based computing.*' Agent Link report, available from www.agentlink.org/roadmap., 2003.

H. S. Nwana. '*Software agents: An overview.*'Knowledge Engineering Review, ` 11(2):205– 244, 1995.

James Odell. '*Objects and agents compared.*' Journal of Object Technology, 1(1):41–53, 2002.

M. Wooldridge and N. R. Jennings. '*Intelligent agents: Theory and practice.*' The Knowledge Engineering Review, 10(2):115–152, 1995.

Wooldridge, M; N.R. Jennings, and D. Kinny. '*A methodology for agent-oriented analysis and design.*' In Proceedings of the third international conference on Autonomous Agents (Agents-99), 1999.

Wooldridge, M; Jennings, and D. Kinny. '*The GAIA methodology for agent-oriented analysis and design.*' Autonomous Agents and Multi-Agent Systems, 3(3), 2000.

Wooldridge, M; '*An Introduction to Multi-Agent Systems.*' John Wiley & Sons, 2002.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Comparative Performance Study on Principal Component Analysis Based Mathematical Operations and Distance Measurements

Israa AbdulAmeer AbdulJabbar
Computer Sciences department
University of Technology
Baghdad, Iraq
Israameer3012@gmail.com;
110033@ uotechnology.edu.iq

Zainab Ali Yakoob
Computer Sciences department
University of Technology
Baghdad, Iraq
70200@uotechnology.edu.iq

Abstract— This paper discuss one of the most popular face recognition statistical method, *Principal Component Analysis (PCA)*, and attempts to display an exhaustive study for all its mathematical operations in detail and highlighted point of view on using matrix multiplication and dot product in mathematical equations of principle component and testing two types of computing distance (Euclidean distance and Manhattan distance) when different threshold values are used and different number of the best eigenvectors are selected, ORL face database is used in our experiment to compute the recognition rate for all training images, the result shows that the dot product with Manhattan distance gives the best ratio and there is a direct proportion between the number of taken eigenfaces and the threshold value.

Keywords- Face recognition, Principal Component Analysis (PCA), matrix multiplication, dot product, Euclidean distance and Manhattan distance .

I. INTRODUCTION

In the past people was using password, tokens, plastic cards, keys and so forth. all these can easy forgotten or stolen so the scientist developed many technique depending on human behavior such as signature and key stork, or on using biometric technologies for identification depending on physiological characteristics such as face form that era the development of face recognition in security area and surveillance purposes using the features of the faces for a live human [1]. Security system which applied face recognition only allowed for the authorized user to enter to such system impossible to be entered by anonyms [2][3].

Two principle tasks accomplishing a purpose in face recognition which is verification and identification. Verification which is one to one matching applied in systems which need to make matching between the human face tries to enter the system with only one image which is stored in a file with only one copy. Identification is one to many matching utilized in systems that make matching between a human face with a database of faces and presented a ranked number of most similar faces [4].

Essentially face recognition has three approaches, Firstly feature based approach it's used to segment the local features for the image like noise, mouth and eyes to use it in face recognition and then developed to face model depending on size and position of these characteristic and because of that known as geometric approach, best use for this method in image restoration. Secondly holistic approach based on extract the whole face model as single unite and make comparison between them ,it also called photometric or template approach and uses it in face recognition best example of these methods are Eigenfaces [5][6] [7]. Lastly, hybrid approach it's merged between feature based and holistic methods and get input to face detection system best example of this method is 3D images [8][9] [10].

The main limitation (drawback or problem) in the previous work that the researches didn't discuss some of PCA mathematical operations in detail especially the threshold value and the way to select the best eigen value so the aim of this paper is to produce exhaustive study to these operations and which will be used to give the highest recognition rate.

Section 2 will view some of previous researcher works as a literature review; section 3 describes PCA mathematical equations as algorithm in detail, section 4 shows the experimental result and discussion and finally the conclusions are described in section 5.

II. LITERATURE REVIEW

In 2011, Hussein Rady published a paper titled "face recognition using principle component analysis with different distance classifiers" introduced the difference between given recognition rate use Euclidean distance with identified 80 images and get 95.2% and with city-block distance identified 78 images and get 94.3% and declared that PCA with square Euclidean distance and Euclidean distance given better ratio than city-block distance but less efficient in processing in CPU [11].

In 2012, S. P. Bahurupi and D. S. Chaudha produced principle Component Analysis for Face Recognition. They proved that the noise in images led to decrease in the recognition rate and when the number of images is big then the size of covariance matrix will be very large because of the rising in the number of sampled images led to increase the variance and as a result the recognition rate will increased [12].

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

In 2012, Suhas Satonkar, A. Kurhe and P.B. Khanale produced face recognition using different distance measures techniques which discussed different measurement methods: Euclidean and Manhattan and gave detection results for male, female and male stuff images in database with 100% ratio and conclude that Euclidean is slower than Manhattan in average time and the average increase with the increasing in the number of identified images [13].

In 2013, face recognition using PCA, LDA and various distance classifiers work was produced by Kuldeep Singh Sodhi, Madan Lal. They declared that PCA is unsupervised technique so it was the best algorithm used in databases with images has different classes and use different distance measurement such as Euclidean, square Eclidean, Mahalobies and city-block and made combination between them in simple way by add them and found individual distance but it has time consuming[14].

In 2014, adaptive principle component analysis based wavelet transform and image de-noising was proposed by Israa A., Tan J. and Hou Z., they aimed to increase the accuracy rate and decrease both time and computational complexity by producing Adaptive PCA with accuracy rate equal to 85.5% with faster time execution than the original PCA [15].

In 2015 a Performance Comparison of Face Recognition Algorithm Based on Accuracy Rate was produced by Rashmi Ravat and Namrata Dhanda, they applied PCA on ORL face database and found the accuracy rate equal to 93.7% but without mentioned to the threshold value or the number of eigenvectors, also they found PCA has the slowest performance in computing the accuracy rate when compared to LDA, ICA and SVM algorithms [16].

III. PRINCIPLE COMPONENT ANALYSIS (PCA)

It is a useful statistical technique and one of popular holistic approach which applied in face recognition and compression because it is use dimensionality reduction [17]. PCA gives good results in changing poses but it consumes time in its execution [18].

PCA steps are defined in the following [13, 14, 16, 17, 19, 20, 21]:

- PCA converts the training set images into vectors, each image of two dimensions (x,y) be in vector of one dimension with size (x*y) so matrix (A) be with size (x*y,M) where M= number of images.

$$(A) = (\overrightarrow{a_1}, \overrightarrow{a_2}, \ldots\ldots \overrightarrow{a_M}) \quad (1)$$

- Find the average face (mean) of all 400 images of ORL database like the one in fig. (1).

$$(\bar{A}) = \frac{1}{M-1} \sum_{i=0}^{M-1} A_i \quad (2)$$

Figure 1. Average image

Some research apply PCA with computing average mean faces for full number of images, row mean, column mean or row with column mean in ORL database and found detection rate with compute full average mean images is the highest rate. [19]

- Subtract the average face vector from each image vector

$$\Phi = A - \bar{A} \quad (3)$$

- PCA looking for a useful data in images so must remove the noise which is on top of data and can do that by using the idea of redundancy by getting the covariance matrix among all pairs of data vector. The variance can get between data in each single vector let's say vector $\overrightarrow{(a_1)}$ with itself $\overrightarrow{(a_1)}$ and if there statistically independent or related in some way depending in data distribution. Covariance depending on find the variance between the data vectors and tells how many that vectors are in the same direction, let's say that vector ($\overrightarrow{a_1}$) and vector ($\overrightarrow{a_2}$) in the same direction and how they correlated to each other so the maximum score can get is equal to one. However if there is in different directions so the data in $\overrightarrow{(a_1)}$ is orthogonal in data in $\overrightarrow{(a_2)}$.

$$\mathbf{C} = \frac{1}{M-1} \sum_{i=0}^{M-1} \boldsymbol{A}\, \boldsymbol{A}^T \quad \textbf{(4)}$$

Where $\mathbf{A} = [\Phi_1, \Phi_2, \ldots, \Phi_M]$

But this matrix will be in high dimensionality so replaced the matrices for dimensionality reduction and the size will be (M, M)

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

$$C = \frac{1}{M-1}\sum_{i=0}^{M-1} A^T A \quad (5)$$

- Compute the eigen value (α) and eigenvectors (V) by using eigenvalue decomposition or by using singular value decomposition in this paper we use SVD:

$$SVD(C) = VSV^* \quad (6)$$

Where V is matrix of eigenvectors but in small eigen space and S is matrix of eigenvalue associated with its corresponding eigenvectors.

- Sort the eigenvectors depending on its eigenvalue in descending way

- Compute the eigenfaces U matrix to convert the V from small Eigen space to large space which its size (x*y, K), where x=height and y = width, eigenfaces are shown in fig.(2).

$$U = AV \quad (7)$$

Figure 2. Eigenfaces

K is chosen as the highest number of eigenvalues and takes its corresponding eigenvectors; K can be all of eigenvectors or half of them or can use energy equation to get it.

$$G_m = \sum_{i=0}^{M-1} \alpha_i \quad (8)$$

Chose appropriate value for L to satisfy the following equation:

$$\frac{\sum_{i=0}^{L} G_i}{G_m} \geq 0.9 \quad \text{where } 1 \leq L \leq M \quad (9)$$

- Compute the weight matrix which each vector of it represent how much percentage this eigenface contain from the original image in another word the weight of original image in that eigenvector.

$$\Omega_{(K,K)} = U^T \phi \quad (10)$$

- Compute the distance between weighted vector

$$\mathcal{E}_K = \|\Omega_i - \Omega_K\| \quad \text{where i,k = 1,2,,…,K} \quad (11)$$

and found the maximum distance between any two vectors to use it as threshold value multiplied by (t) which is any percentage value like (0.3,0.5,0.8), using Euclidean or Manhattan measurement distance

$$\text{Threshold} = t * \max\|\Omega_i - \Omega_K\| \quad (12)$$

The previews steps are applied on all training images in the database and the following steps applied on testing input image to decide if it is an image or not.

- Convert the input image into vector X_P where p is the size of test image.

- Compute the average of test image

$$\bar{X} = \sum_{i=0}^{P-1} x_i \quad (13)$$

Some resource use the same average of whole database in eq. (2)

- Subtract the X vector from the average face vector

$$\phi_p = X_p - \bar{X}_p \quad (14)$$

- Compute the weight of unknown image in each eigenface

$$\Omega_K = U^T \phi \quad (15)$$

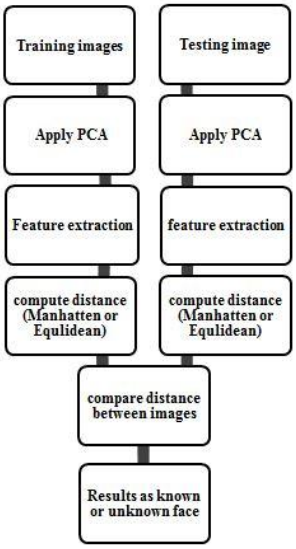
- Compute the minimum distance between the weight of the test image and the weight of each training image in the database

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

$$£ = \min \|\Omega - \Omega_K\| \quad (16)$$

Where Ω is unknown image weight and Ω_k the weight of all database images

- If min ≤ threshold then the unknown image is a face Else it is not a face.



Block diagram 1. Face recognition using PCA

In PCA we use two different mathematical operation, first Dot product which be between vectors regardless these vectors are taken as rows or columns because there is no condition to be the columns number equal to row number for the matrices so take each image in the training set as vector rather than matrix and product it with another eigenface vector then get the weight value of each image vector in that eigenface vector.

$$\vec{p} = (a_1 + a_2 + a_3 + \cdots + a_n) \quad ,$$
$$\vec{q} = (b_1 + b_2 + b_3 + \cdots + a_n)$$
$$C_{ij} = row_i(\vec{p}) \cdot col_j(\vec{q})$$

Second mathematical operation is matrix multiplication which uses multiply a matrices rather than vectors by use all 400 images in 2D matrix of height equal to the size of training image and width equal to the number of all training images, matrices must satisfy the condition of matrix multiplication which is both of matrices must be compatible in sizes, and then get the eigenvectors in matrix 2D after that obtain the weighted matrix by doing matrix multiplication between them.

In PCA method attempt to produce different recognition ratio by getting in the beginning the eigenfaces for all 400 images in ORL database and then to recognize unknown input image we need to get the minimum distance between the unknown image and each training images then compare this distance with threshold distance. The threshold distance is chosen by get the maximum distance between all vectors of database images and then multiply it by any value chosen by the user to get a satisfy result for recognition rate. Another thing can effect on recognition ratio is the chosen number for K value which is the best eigenfaces from the 400 image which contain the most valuable features of all database images which can be chosen by the user or can calculated it by eq. (8). The recognition ratio depending on how many faces are true recognized from the 400 images and dividing this number over 400. The input images which uses as unknown image are the four hundred images, so PCA process repeated 400 times because of that the execution time is computed and notice its increase in some seconds when the K and threshold values are decrease but recognition rate increase.

IV. Experimental Results and Discussion

In PCA equations many previews researches using in mathematical operations Dot product rather than matrix multiplication so the question was why do not try to use matrix multiplication to get the results, so both of them are applied and get the results and compared between them, the results of matrix multiplication were good results in face recognition but in dot product the results higher in recognition ratio than matrix multiplication and that was predictable because Dot product between vectors gives correlation between data and how much there are in the same direction, if there are in the same direction means it is a face if it is in opposite direction then it means that is not a face.

For the distance measurements two methods are used for computing it and compare between both of their results. Firstly the Euclidean distance which obtain the distance between the test image and every image in the training set by getting the root square of the difference between each Corresponding points in the two images or we can get the same results if obtain the difference between the two Corresponding vectors, the weight vector of test image and each training image vector.

$$\text{Euclidean Distance}(x,y) = \sqrt{\sum_{i=0}^{k} (x_i - y_i)^2} \quad (17)$$

Secondly the Manhattan distance or called city-block which obtains the absolute difference between the weighted vectors of the training images or the points of the vectors and the same result will obtain.

$$\text{Manhattan Distance } (x,y) = \sum_{i=0}^{k} | x_i - y_i | \quad (18)$$

Where k= best higher values of eigenvalues

The previews two distance measurement are used in both dot product and matrix multiplication each one on different side and registered all the result got from the execution and paid attention that the recognition ratio increase with the increasing

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

of K value and the increasing of threshold value that is mean there are direct proportion between K and threshold value.
Other observation that using Dot product is better than matrix multiplication because it gives better recognition rate with different type of distance measurement with best execution time and the main reason of being Dot product better is the vectors of images represent as an arrow getting out from the original point (0,0) going to specific direction and all the operations of principle component method essentially deals with the fact of eigenvector direction ,eigenvector length and how much each vector far away from the others represent the distance between vectors. The using of Manhattan distance measurement is preferred to use instead of Euclidean distance because it gives better ration in recognition with less time as explained in table [1] and table [2].

Table (1): Results of PCA recognition rate using Matrix multiplication

	Threshold	***K(best number of taken eigenvectors)***	***Recognition Rate***	***Time execution In seconds***
Euclidean distance	0.5*max	100	72.75	49.459788
	0.7*max	100	93.75	42.037712
	0.8*max	100	96.5	44.973895
	0.5*max	200	38.75	80.980601
	0.7*max	200	82.5	79.224018
	0.8*max	200	92	92.660521
	0.5*max	Energy (k= 342)	35.75	154.609843
	0.7*max	342	74.25	156.604586
	0.8*max	342	89	158.881088
Manhattan distance	0.003*max	100	49	48.282085
	0.005*max	100	67	50.934090
	0.007*max	100	77	54.319296
	0.008*max	100	80	57.376901
	0.003*max	200	65	89.091757
	0.005*max	200	79.25	76.763391
	0.007*max	200	86.25	75.223332
	0.008*max	200	90.5	78.897513
	0.003*max	Energy (k= 342)	82.75	112.617441
	0.005*max	342	93.75	115.376204
	0.008*max	342	97.25	116.804624

Table (2): Results of PCA recognition rate using Dot product

	Threshold	***K (best number of taken eigenvectors)***	***Recognition Rate***	***Execution time In seconds***
Euclidean distance	0.3*max	100	61.5	50.105866
	0.5*max	100	80	49.057806
	0.7*max	100	92.5	48.775790
	0.8*max	100	93	48.686785
	0.3*max	200	61.5	86.889970
	0.5*max	200	80	88.861540
	0.7*max	200	92.5	90.742190
	0.8*max	200	93	91.837253
	0.3*max	Energy (k= 342)	65.25	135.817768
	0.5*max	342	83.75	138.889944
	0.8*max	342	93	141.714106
Manhattan distance	0.3*max	100	96.5	50.605338
	0.5*max	100	99.75	47.480996
	0.7*max	100	100	51.688727
	0.8*max	100	100	52.594938
	0.3*max	200	96.5	70.206857
	0.5*max	200	99.75	69.953542
	0.7*max	200	100	71.719915
	0.8*max	200	100	74.760243
	0.3*max	Energy (k= 342)	99.5	105.143451
	0.5*max	342	100	106.041205
	0.8*max	342	100	107.935921

V. CONCLUSIONS

In this paper the realized fact is that the best ratio is getting by increasing the threshold value and take more number form eigenvectors to recognize the known and unknown faces and the using of dot product with Manhattan distance given highest ratio because they are both together given accuracy rate reaches to 100% with best execution time than Euclidean distance. In general matrix multiplication not convenient to be used in PCA at all because it is not efficient in dealing with vectors and it gives less accuracy rate with high time execution and dot product is used basically to deal with vectors.

REFERENCES

[1] Urvashi Bakshi1, Rohit Sing , "A survey on face detection methods and feature extraction technique of face recognition", International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Vol. 3, No. 3, 2014.

[2] Srinivasulu Asadi and Dr.Ch.D.V.Subba Rao and V.Saikrishna, "A Comparative study of Face Recognition with Principal Component Analysis and Cross-Correlation Technique", International Journal of Computer Applications, Volume 10– No.8 ,2010. India.

[3] Venkata Naresh Mandhala, Debnath Bhattacharyya and Tai-hoon Kim , "Hybrid Face Recognition using Image Feature Extractions: A Review", International Journal of Bio-Science and Bio-Technology, Vol.6, No.4 ,2014.

[4] PHD. A. S. Deshpande and Asavari G. Joshi," Review of Face Recognition Techniques", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 5, Issue 1,2015,India.

[5] Heena Gulati, Deepak Aggarwal, Amit Verma, Dr. Parvinder S. Sandhu, "Face Recognition using Hybrid Histogram & Eigen value Approach", International Journal of Research in Engineering and Technology (IJRET), Vol. 1 No. 1,2012,India.

[6] Rohan K. Naik, Kalpesh B. Lad, "A Review on Side-View Face Recognition Methods", International Journal of Innovative Research in Computer and Communication Engineering, Vol. 4, Issue 3,2016,India.

[7] Omaima N. A. AL-Allaf, "Review Of Face Detection Systems Based Artificial Neural Networks Algorithms", IJMA, Vol.6, No.1,2014,Jordan

[8] Riddhi Patel and Shruti B. Yagnik "A Literature Survey on Face Recognition Techniques", International Journal of Computer Trends and Technology (IJCTT),volume 5 number 4,2013,india.

[9] Ghanshyam Sahu, Asstt. Prof. Bhanupratap Singh, Asstt. Prof. Pradeep Tripathi, "A Comprehensive Review on Face Recognition Techniques", International Journal of Emerging Technology and Advanced Engineering, Volume 4, Issue 6,2014,India.

[10] Divyarajsinh N. Parmar and Brijesh B. Mehta, "Face Recognition Methods & Applications", Divyarajsinh N Parmar et al ,Int.J.Computer Technology & Applications, Vol 4 (1),84-86 ,2013,India.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

[11] Hussein Rady, "Face Recognition using Principle Component Analysis with Different Distance Classifiers", IJCSNS International Journal of Computer Science and Network Security, VOL.11 No.10,2011,Egept.

[12] S. P. Bahurupi and D. S. Chaudha,"principle Component Analysis for Face Recognition", International Jouranal of engineering and Advanced Technology, vol. 1,no. 5 ,2012,India.

[13] Suhas Satonkar, A. Kurhe and P.B. Khanale, "face recognition using different distance measures techniques", IJIPA,3(1),2012,India.

[14] Kuldeep Singh Sodhi, Madan Lal, "FACE RECOGNITION USING PCA, LDA AND VARIOUS DISTANCE CLASSIFIERS", Journal of Global Research in Computer Science, Volume 4, No. 3,2013,India.

[15] Issra'a abdul-ameer abdul-Jabbar ,Jieqing Tan and Zhengfeng Hou,"adaptive principle component analysis based wavelet transform and image de-noising for face recognition application", IJSIP, vol 7.no 3,2014.

[16] Rashmi Ravat, Namrata Dhanda, **"**Performance Comparison of Face Recognition Algorithm Based on Accuracy Rate", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 4, Issue 5,2015,india.

[17] Satonkar Suhas S. , Kurhe Ajay B. , Dr.Prakash Khanale B.,"Face Recognition Using Principal Component Analysis and Linear Discriminant Analysis on Holistic Approach in Facial Images Database", IOSR Journal of Engineering , Vol. 2, Issue 12,2012,india.

[18] Sasan Karamizadeh, Shahidan M. Abdullah, Mazdak Zamani and Atabak Kherikhah, "PATTERN RECOGNITION TECHNIQUES: STUDIES ON APPROPRIATE CLASSIFICATIONS", ARPN Journal of Engineering and Applied Sciences, VOL. 9, NO. 8, 2014,Kuala Lumpur, Malaysia.

[19] Dr.H.B.Kekre, Sudeep D. Thepade, Akshay Maloo,"Eigenvectors of Covariance Matrix using Row Mean and Column Mean Sequences for Face Recognition", International Journal of Biometrics and Bioinformatics (IJBB), Volume (4): Issue (2),2010,India.

[20] Kamini Solanki and Prashant Pittalia," Review of Face Recognition Techniques" , International Journal of Computer Applications, Volume 133 – No.12,2016,India.

[21] M. Turk and A. Pentland,"Eigenfaces for Recognition", Journal of Cognitive Neuroscience , vol. 3, no. 1 ,1991,USA.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Mining Of Road Accident Data Using K-Mode Clustering And Improved Apriori

Inderpreet kaur
CTIEMT, Jalandhar
Kaur.inderpreet5500@gmail.com

Ashish Kumar Luhach
Associate Professor, CTIEMT,Jalandhar

Pooja
Assistant Professor, CTIEMT, Jalandhar
Poojachoudhary80@gmail.com

Abstract- There are several major data mining techniques which have been developed and used in various data mining projects. In the proposed work, k –means performance will be enhanced by using hybrid approach for better result. To show the effect of noise on the performance of various clustering techniques. Clustering may be applied on database using various approaches, based upon distance, density hierarchy and partition. Clustering is being widely used in many application including medical, finance etc. our purpose is to study how a particular clustering technique is responsive to the noise in the term of time.Apriori algorithm minimum support is needed to generate the large item set from candidate set in which not so required candidate item sets are pruned by utilizing user defined minimum support threshold.

Keywords: Data Mining,Association Rule Mining,Road Accident Data.

1. Introduction

The amount of data stored in computer files and databases is growing at a phenomenal rate. At the same time user of these data are expecting more sophisticated information from them. Data mining is the analysis step of the “knowledge Discovery in databases” process. It is the computational process of discovering patterns in large data sets involving methods at the intersection of artificial intelligence, machine learning, statistics, and database systems. The overall goal of the data mining process is to extract information from a data set and transform it into an understandable structure for further use [17].Data mining is the analysis step of the "knowledge discovery in databases" process, or KDD [18].

There are two kind of data mining: predictive and descriptive. These two types have sub types, firstly, predictive such as classification, regression, time series and prediction. Descriptive like as Clustering, summarization, association rules and sequence discovery.The term is a misnomer, because the goal is the extraction of patterns and knowledge from large amounts of data, not the extraction of data itself [19]

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

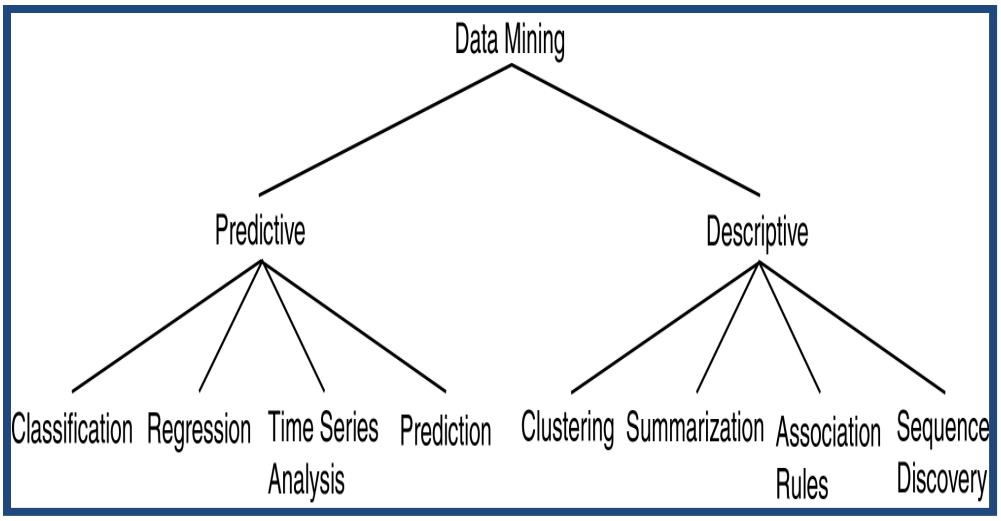


Fig.1. Technique of Data Minning[1]

In data mining communities, there are 3 kinds of mining: data mining, text mining and web mining.[3]Data mining mainly deals with structured data organized in a database, while text mining mainly handles unstructured data or text. Web mining lies in between semi structured and unstructured data. The mining data may vary from structured and unstructured.The basic task of KDD is to extract knowledge (or information) from lower level data (databases).[20]. There are several formal definitions of KDD, all agree that the intent is to harvest information by recognizing patterns in raw data. Let us examine definition proposed by Fayyad, Piatetsky-Shapiro and Smyth, "Knowledge Discovery in Databases is the non-trivial process of identifying valid, novel, potentially useful, and ultimately understandable patterns in data.[21].During the preprocessing stage the data is cleaned. This involves the removal of "outliers" if appropriate; deciding strategies for handling missing data fields; accounting for time sequence information, and applicable normalization of data.[22].The data mining component of KDD often involves repeated iterative application of particular data mining methods. "For example, to develop an accurate, symbolic classification model that predicts whether magazine subscribers will renew their subscriptions, a circulation manager might need to first use clustering to segment the subscriber database, then apply rule induction to automatically create a classification for each desired cluster."[23].

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

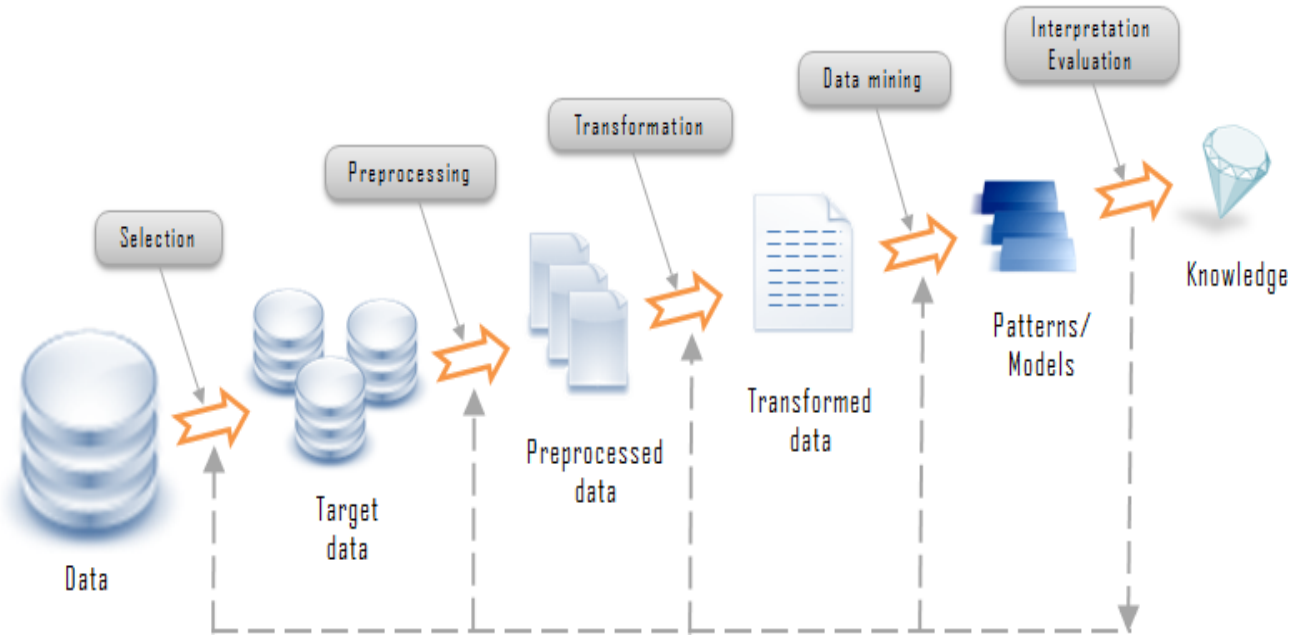


Fig.2. Knowledge Discovery Process[2]

1.2 Road accidents in data mining

Road and accidents are uncertain and unsure incidents. In today's world, traffic is increasing at a huge rate which leads to a large numbers of road accidents. The highway safety is being compromised and there are not enough safety factors by which we can analyze the traffic collisions before it happens. A method is proposed by which we can preprocess the accidental factors. Young drivers tend to be more daring and are unable to avoid a crush when they face one. They tend to be more daring after drinking alcohol at night and this causes them to lose control of the car. Drunk driving will not only risk a person's own life but may also cause an incident life to be lost. Number of factors contributes to the risk of collision, including vehicle design, speed of operation, road design, road environment, and driver skill, impairment due to alcohol or drugs, and behavior, notably speeding and street racing. Worldwide, motor vehicle collisions lead to death and disability as well as financial costs to both society and the individuals involved. Road injuries occurred in about 54 million people in 2013[14]. This resulted in 1.4 million deaths in 2013, up from 1.1 million deaths in 1990[15]. About 68,000 of these occurred in children less than five years old. [15] .Almost all high-income countries have decreasing death rates, while the majority of low-income countries have increasing death rates due to traffic collisions.[14] Middle-income countries have the highest rate with 20 deaths per 100,000 inhabitants, 80% of all road fatalities by only 52% of all vehicles.[14] While the death rate in Africa is the highest (24.1 per 100,000 inhabitants), the lowest rate is to be found in Europe. [16]Road and traffic accidents defined by a set of variable .the major issue are analysis of accidents data is its varied nature. The diverse must be considered analysis of the data. So those researchers are used clustering analysis. The clustering analysis is a important technique .cluster analysis are useful to various task.Dr. R. Geetha Ramani1, S. Shanthi2 [4] used predicated model technique. In this paper technique algorithm are applied on the like random tree c4.3 tree and j4.3. In this paper researcher are discussions about classifier and predication technique to data mining. In this paper predication of road accident

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

patterns related to pedestrian characteristics. This classifier is voided using cross validation with k folds and evaluated using the accuracy measures: precision and recall and roc. In this paper random tree classifier are given to better result as compared to decision stump [13]. Seoung-hun Park and Young-guk Ha is used imbalance technique and map reduce algorithm .imbalance data means data that have a huge difference between the obverted sizes from one data set. So researcher are solved the problem to used sampling technique. There are two type sampling are:over sampling and under sampling .over sampling is to use all observation value in a big class and increase size of observation value in a small class and use this value. Under sampling are those who used lost data. Other problem are occur the researcher are data processing[12] .in this case training set of data make multiple feature .it take time so much so that researcher are solve the problem in map reduce algorithm.mapreduce algorithm are used tobig processing technique

The main improvement of our algorithmic program is to optimize the frequent single things and people things co-occurrence with them.The data structure Bitable is additionally used horizontally and vertically to calculate the token array and count supports, severally. token array and also the corresponding computing technique area unit planned. By computing the token, those item sets that co-occurrence with representative item is known quickly. The frequent item sets, as well as representative item and having constant support as representative item, is known directly by connecting the representative item with all the combos of things in its subsume token therefore, the value for process this sort of item sets is lowered , and also the potency is improved.

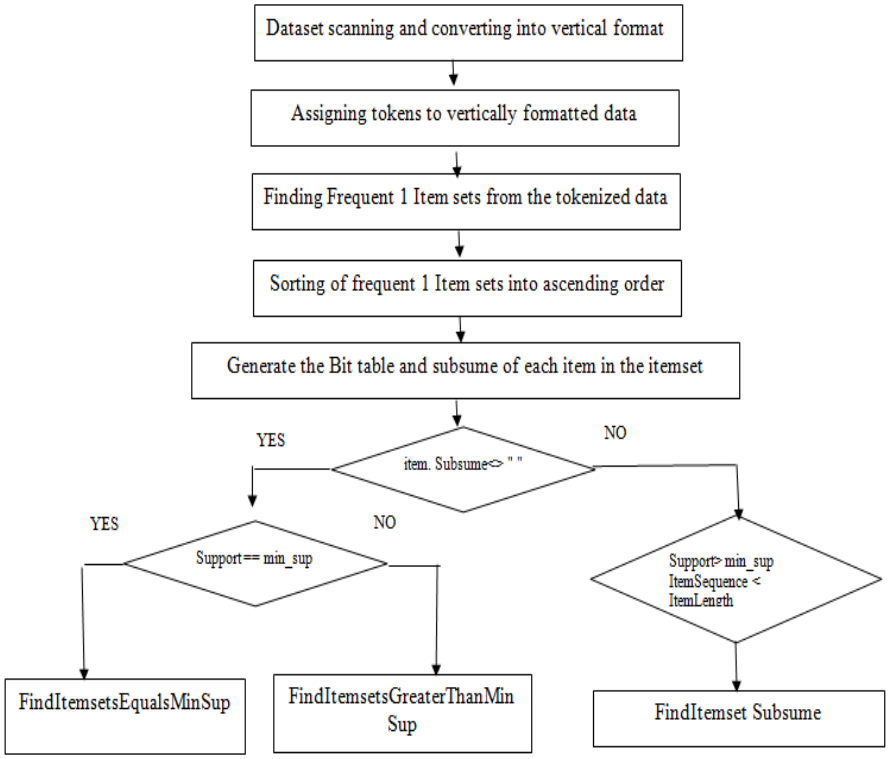


Fig.2 Flow chart of research methodology

Flowchart of Proposed Technique-The flowchart description are as follows:

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

A. **Read Road data Accident**- In this we take the image of objects from database.The input image is used to acquire an image from the databases.

B. **Pre-processing**- To analyze the info, we have a tendency to develop a framework as shown in Fig. 1. The elaborate description of the framework is as follows:
Data preprocessing

- Data preprocessing is one amongst the necessary tasks in data processing. information preprocessing principally deals with removing noise, handle missing values, removing unsuitable attributes so as to create the info prepared for the analysis. during this step, our aim is to preprocess the accident information so as to create it applicable for the analysis.
- Clustering algorithm There area unit many clump algorithms exist within the literature. the target of clustering algorithmic program is to divide the info into totally clusters or teams specified the objects inside a bunch area unit like whereas objects in other clusters area unit different from one another

C. **Read Road data Accident**- In this we take the image of objects from database.The input image is used to acquire an image from the databases.

D. **Pre-processing**- To analyze the data, we develop a framework as shown in Fig. 1. The detailed description of the framework is as follows:

- Data preprocessing [14] is one of the important tasks in data mining. Data preprocessing mainly deals with removing noise, handle missing values, removing irrelevant attributes in order to make the data ready for the analysis. In this step, our aim is to preprocess the accident data in order to make it appropriate for the analysis.
- Clustering algorithm There are several clustering algorithms [14, 18] exist in the literature. The objective of clustering algorithm is to divide the data into different clusters or groups such that the objects within a group are similar to each other whereas objects in other clusters are different from each other [19].

3. Experimental Results

The experimental results are given below and we compare the execution time and accuracy using improved apiriori algorithm
RESULTS

1 Browsing ,uploading and viewing the uploaded dataset

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

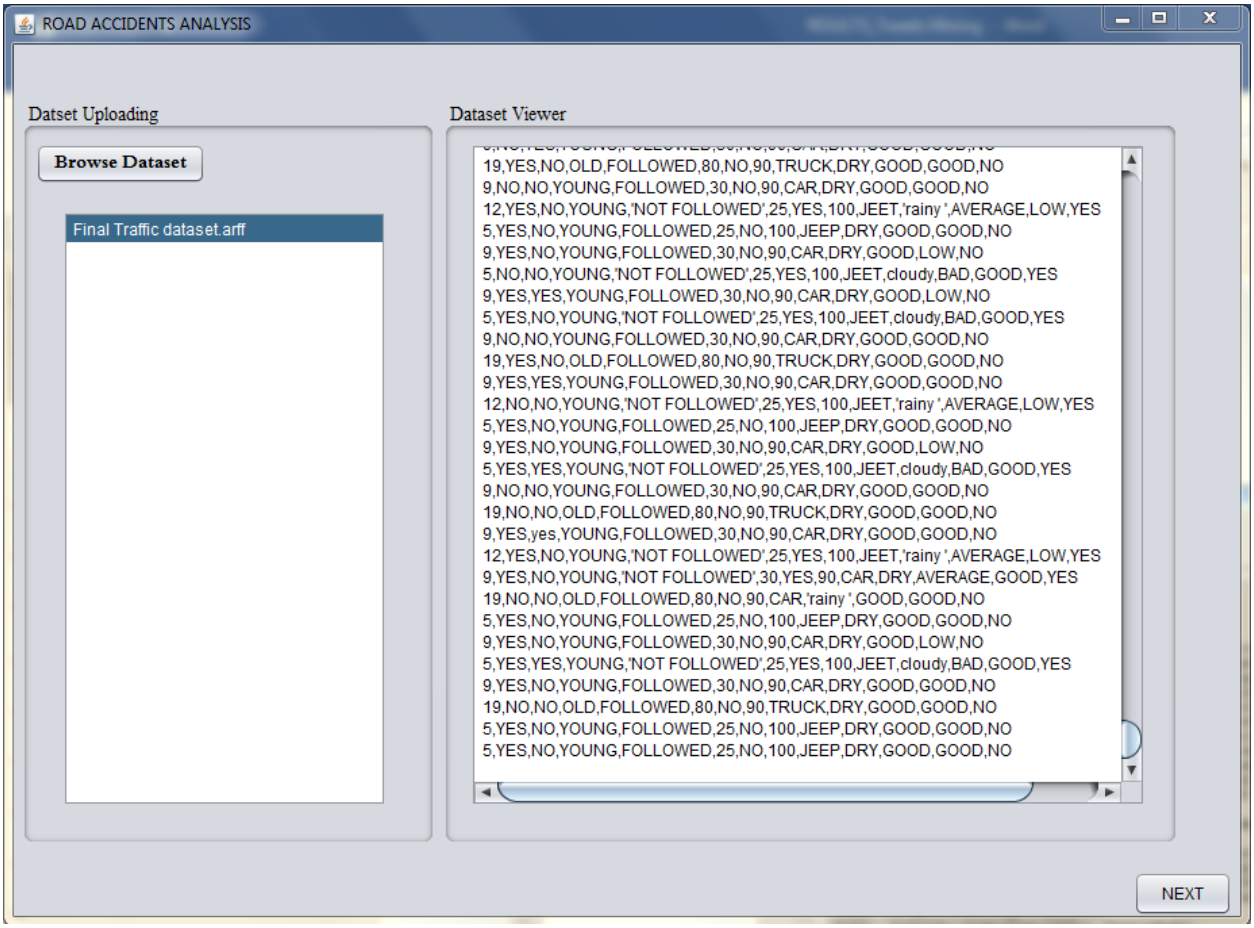


Fig1: Browsing ,uploading and viewing the uploaded dataset

2 Replace Missing Value filter applied to dataset

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

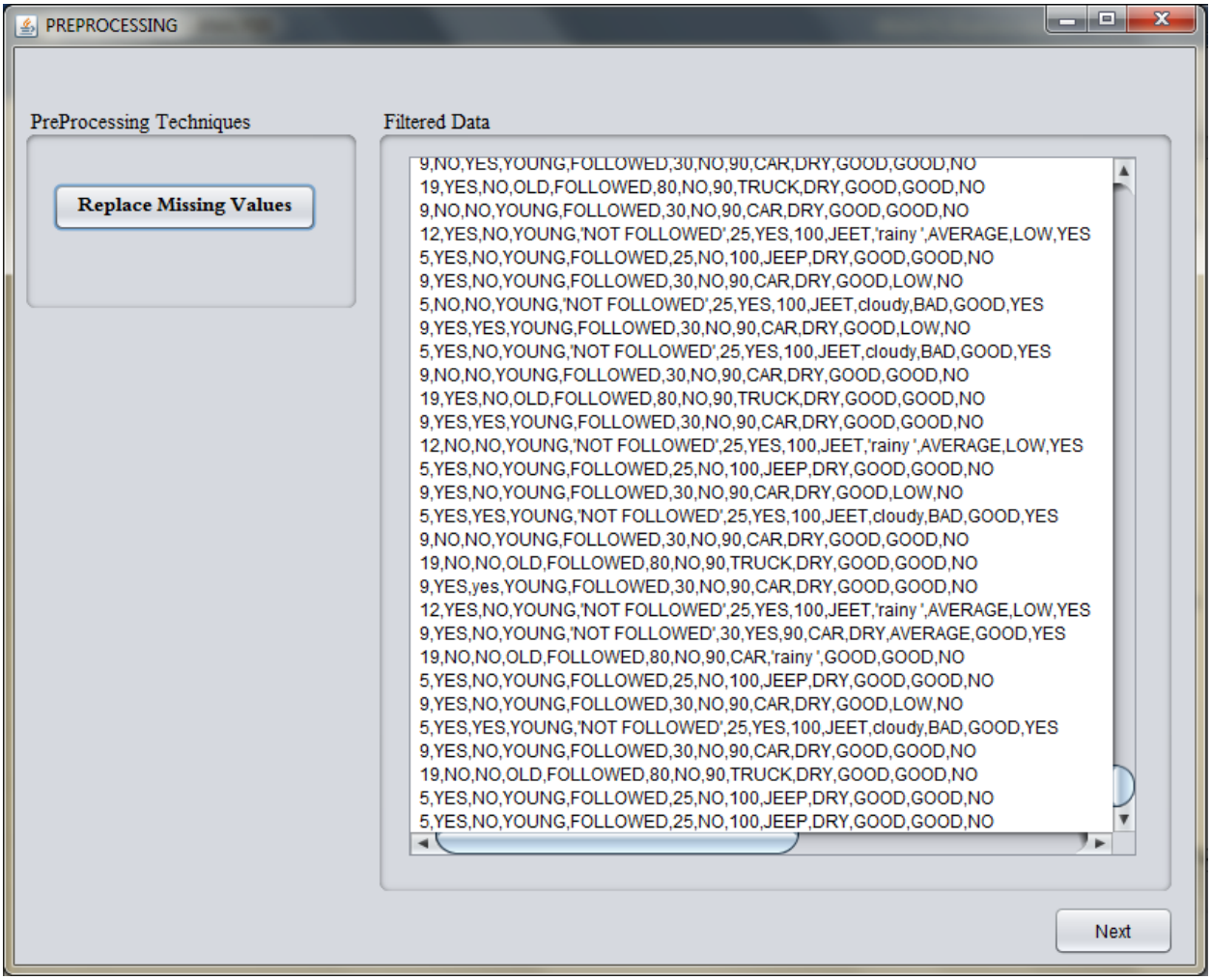


Fig2: Replace Missing Value filter applied to dataset

3 Showing the results of Kmeans. It showing 203ms time taken for clustering

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

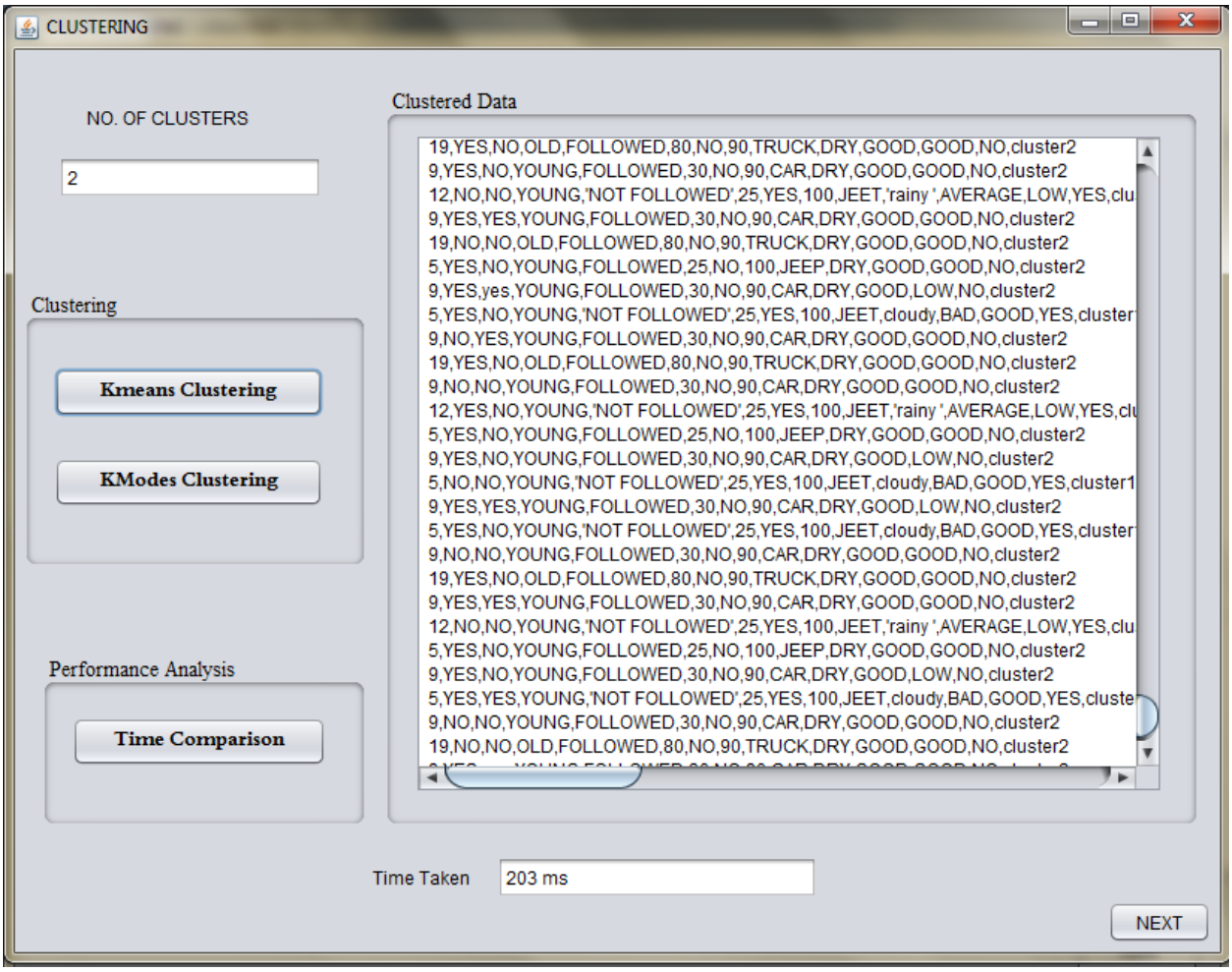


Fig3: Showing the results of Kmeans. It showing 203ms time taken for clustering

4 Showing the results of KmodesIt showing 172ms time taken for clustering

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

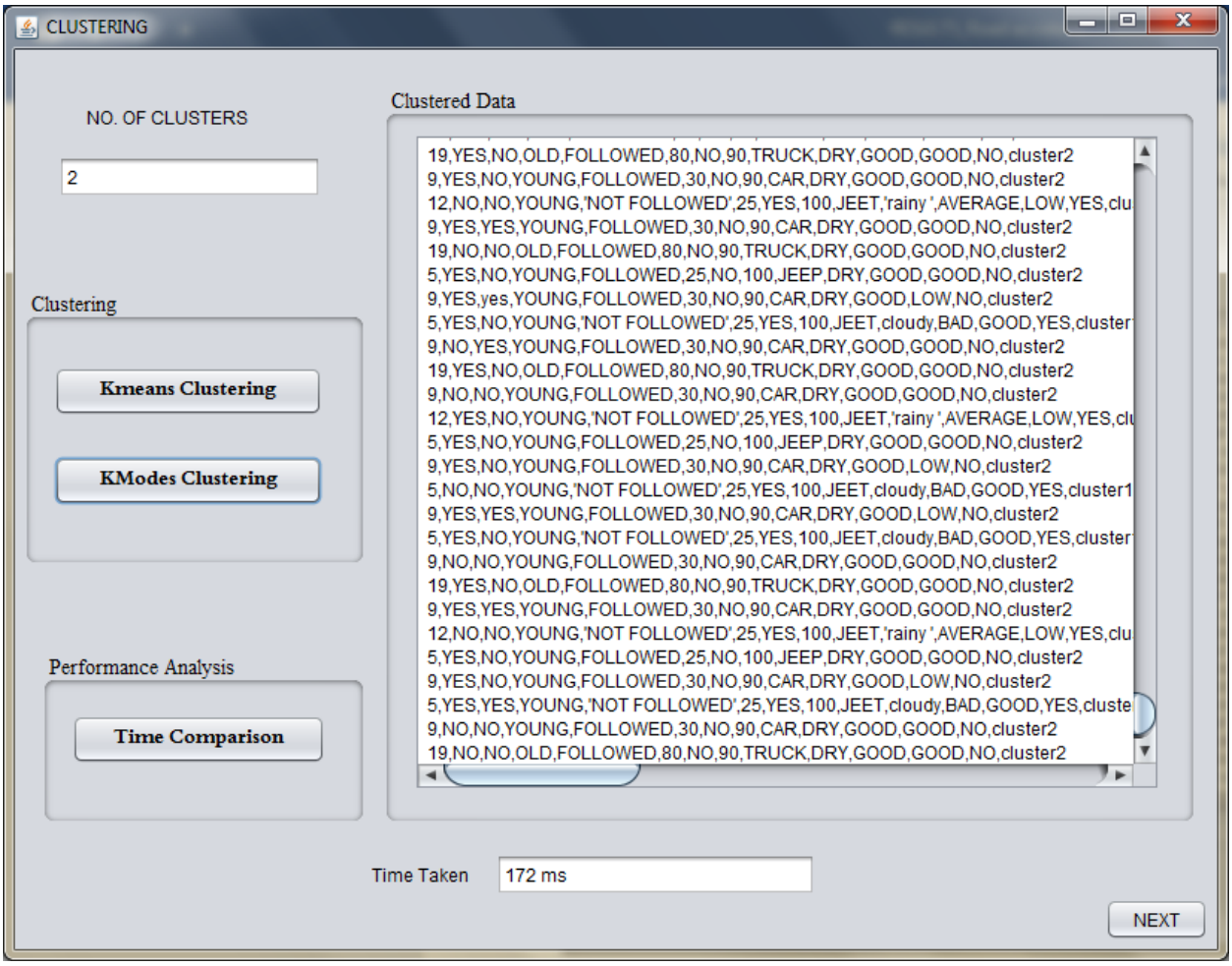


Fig4: Showing the results of KmodesIt showing 172ms time taken for clustering

5 Showing the comparison of execution time of KMeans and the K-Modes

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Fig5: Showing the comparison of execution time of KMeans and the KModes

6 Showing the results of Apriori algorithm

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

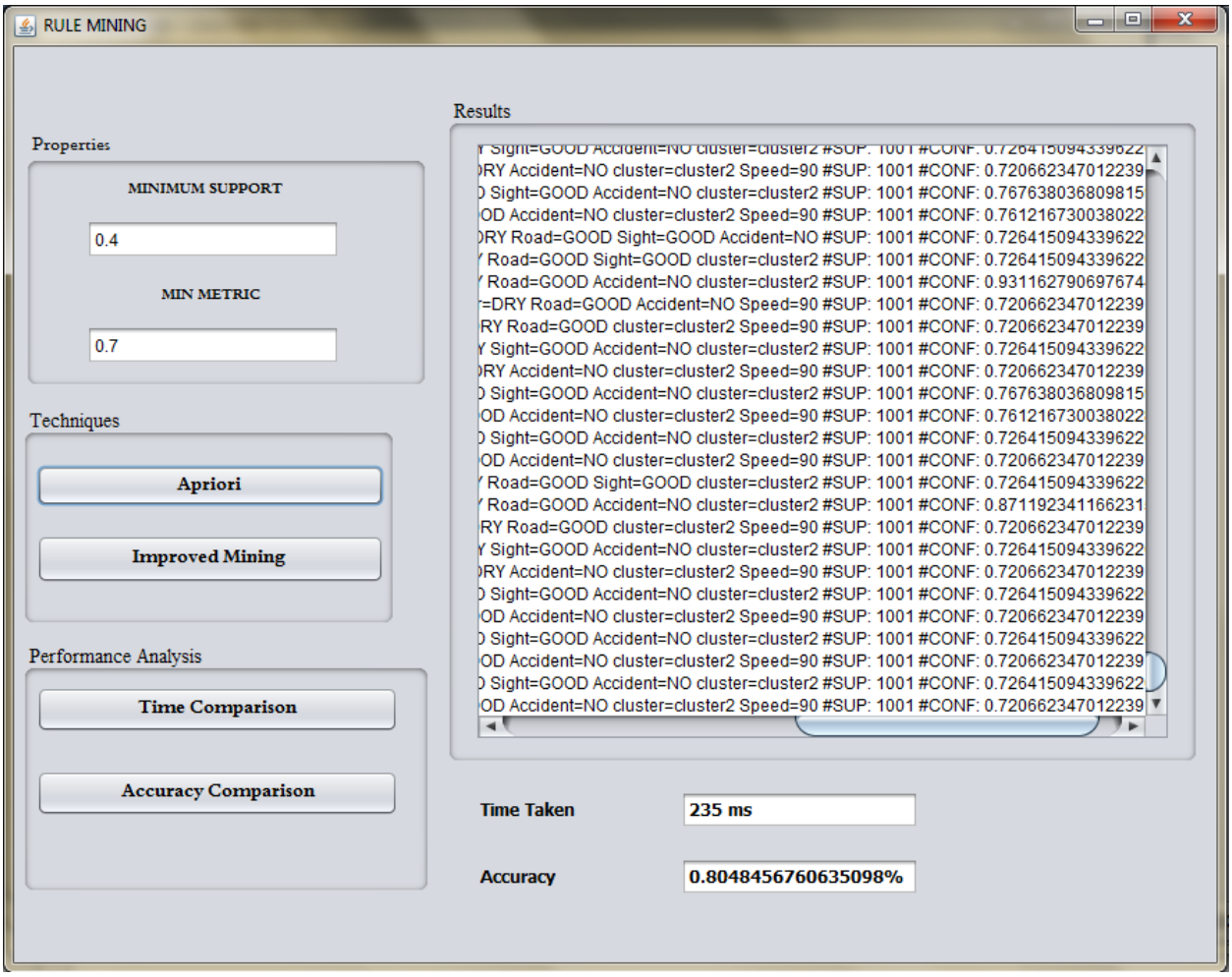


Fig 6: Showing the results of Apriori algorithm

7 Showing the results of Improved Apriori algorithm

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

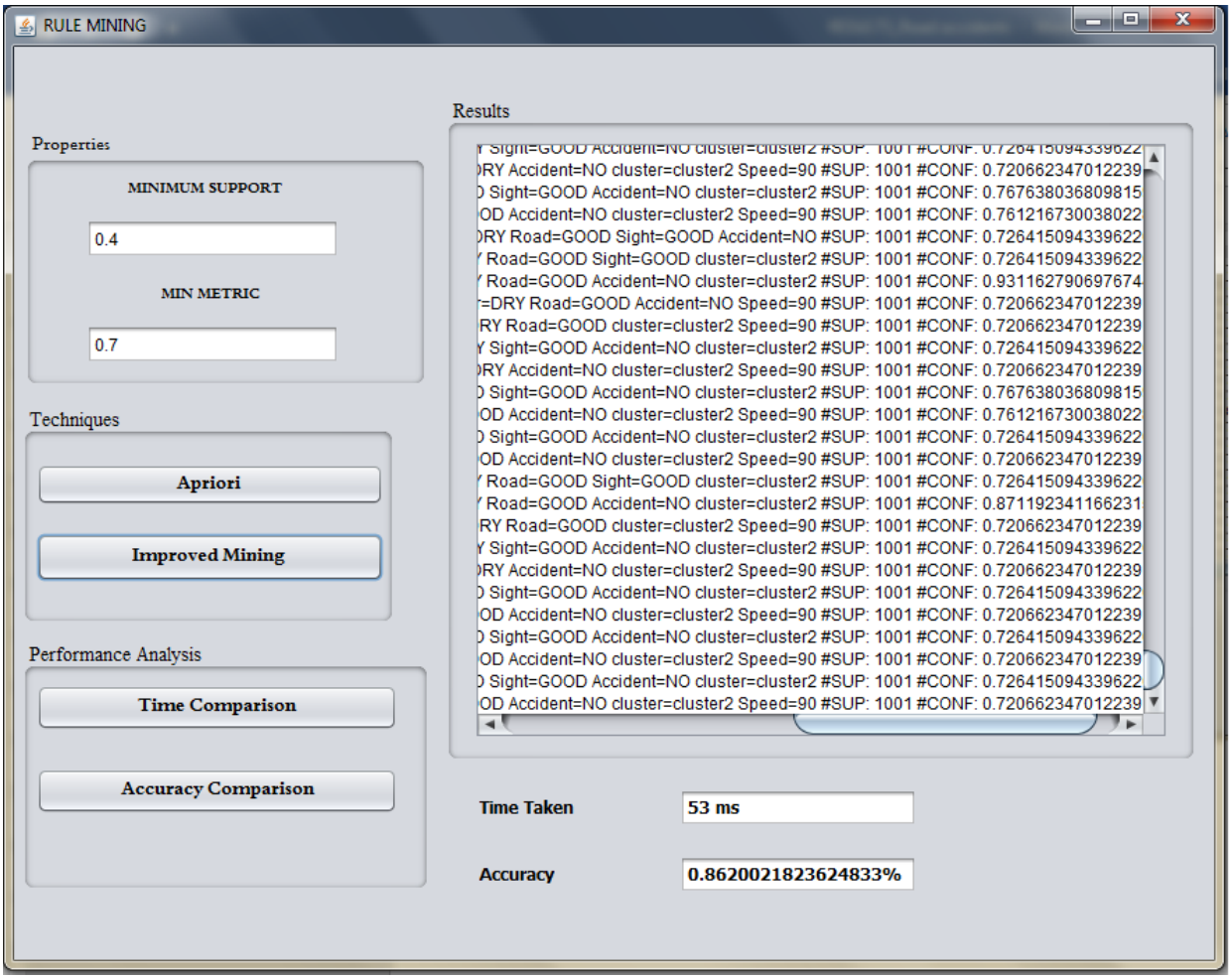


Fig 7: Showing the results of Improved Apriori algorithm

8 Showing the comparison of execution time of Apriori and the improved apriori

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Fig 8: Showing the comparison of execution time of Apriori and the improved apriori

9 Showing the comparison of Accuracy time of Apriori and the improved apriori

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

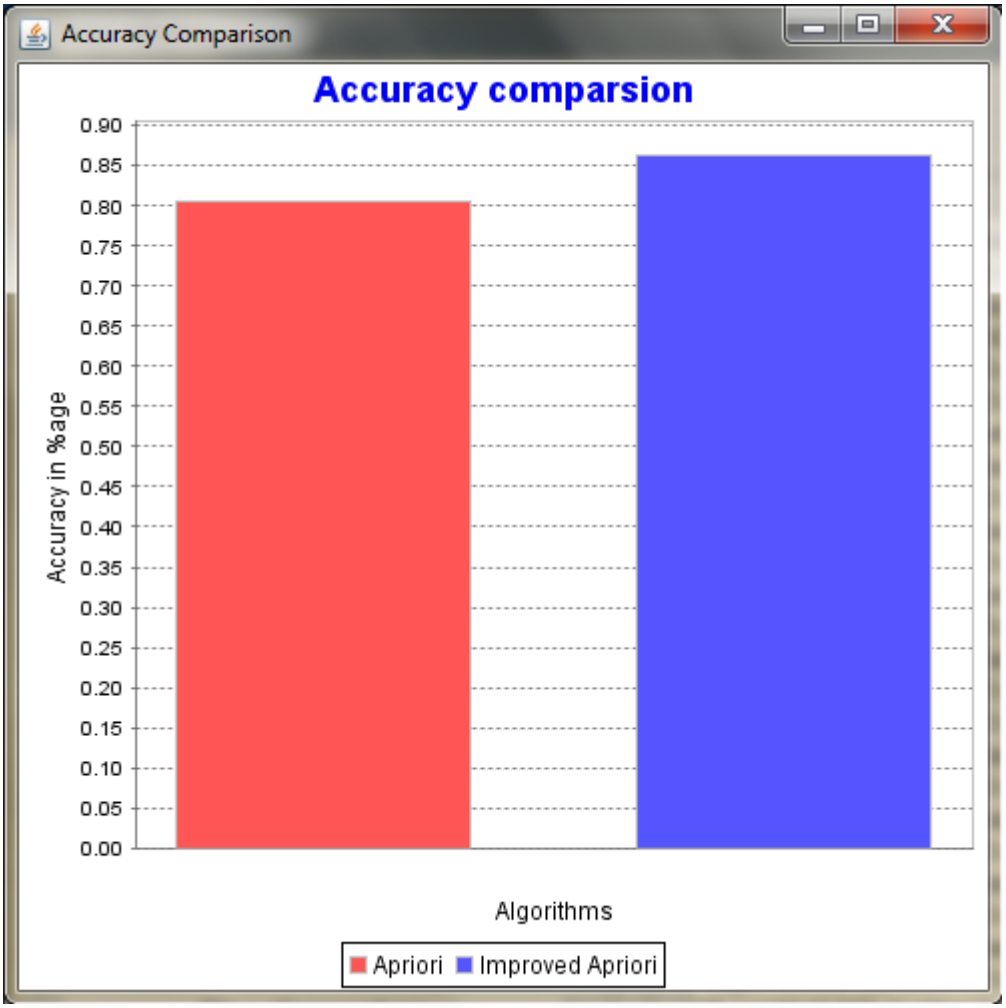


Fig 9: Showing the comparison of Accuracy time of Apriori and the improved apriori

3. Conclusion

In this paper,we main improvement of our algorithm is to optimize the frequent single items and those items co-occurrence with them.The data structure Bitable is also used horizontally and vertically to calculate the token array and count supports, respectively. token array and the corresponding computing method are proposed. By computing the token, those item sets that co-occurrence with representative item can be identified quickly. The frequent item sets, including representative item and having the same support as representative item, can be identified directly by connecting the representative item with all the combinations of items in its subsume token Thus, the cost for processing this kind of item sets is lowered, and the efficiency is improved.

References

1. D. Khera, W. Singh, “A Review on Injury Severity in traffic System using various Data Mining Techniques”, International Journal of Computer Applications, vol.100-no.3, pp 0975- 8887, 2014.
2. P. Verma, D. Kumar, “Association Rule Mining Algorithm’s Variant Analysis”, International Journal of Computer Applications, vol.78-no.14, pp 0975- 8887, 2013.
3. S. Kumar, D. Toshniwal, “A Data Mining framework to analyze road accident data”, Journal of Big Data, Springer, vol.2-no.1, pp 1-18, 2015.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

4. A. Jain, G. Ahuja, Anuranjana, D. Mehrotra, "Data Mining Approach to Analyse the Road Accidents in India", 5th International Conference on Reliability, Infocom Technologies and Optimization (ICRITO), Sep. 7-9, 2016.
5. A. T. Kashani, A. Shariat-Mohaymany, A. Ranjbari, "A Data Mining Approach to Identify Key Factors of Traffic Injury Severity", Promet Traffic & Transportation, Vol. 23, No. 1, pp11-17, 2011.
6. B. Depaire, G. Wets and K. Vanhoof, "Traffic accident segmentation by means of latent class clustering, accident analysis and prevention", vol. 40,Elsevier,2008.
7. https://www.datascience.com/blog/introduction-to-k-means-clustering-algorithm-learn-data-science-tutorials accessed on 24/1/2017
8. V. Vijayalakshmi, A. Pethalakshmi, "Mining of Frequent Itemsets with an Enhanced Apriori Algorithm", International Journal of Computer Applications , Vol. 81 – No.4, pp 0975 – 8887, November 2013.
9. http://sites.ndtv.com/roadsafety/important-feature-to-you-in-your-car-5/ accessed on 25/1/2017.
10. Ali et al.," A Data Mining Approach to identify key factors of traffic injury severity" Traffic & Transportation, Vol. 23, 2011, No. 1, 11-17.
11. Bouckaert Remco, Eibe Frank, Mark Hall, Richard Kirkby, Peter Reutemann, and AlexSeewald, 2008.WEKA Manual for Version 3-6-0. University of Waikato, New Zealand.
12. Brijesh Kumar Baradwaj, Saurabh Pal," Mining Educational Data to Analyze Students Performance" (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 2, No. 6, 2011.
13. Chaozhong et.al.,"Severity Analyses of Single-Vehicle Crashes Based on Rough Set theory" 2009 International Conference on Computational Intelligence and Natural Computing.
14. DipoT.Akomolafe, Akinbola Olutayo," Using Data Mining Technique to Predict Cause ofAccident and Accident Prone Locations on Highways", American Journal of Database Theory and Application 2012, 1(3): 26-38.
15. Han, Jiawei and Kamber, Micheline. (2006)," Data Mining: concepts and Techniques. San Fransisco", Morgan kufman Publishers.
16. Hand, D.J., Mannila, H., and Smyth, P. (2001) ,"Principles of Data Mining" ,MIT Press.
17. Liping et al.," Traffic Incident Duration Prediction Based on Artificial Neural Network" 2010 International Conference on Intelligent Computation Technology and Automation.
18. Mehmed Kantardzic(2003),"Data Mining: Concepts, Models, Methods, and Algorithms" ISBN13: 9780471228523, John Wiley & Sons Publisher.
19. Pasko Konjevoda and Nikola Stambuk, "Open-Source Tools for Data Mining in Social Science," Theoretical and Methodological Approaches to Social Sciences and Knowledge Management, pp.163-176.
20. S.Krishnaveni, Dr. M.Hemalatha," A Perspective Analysis of Traffic Accident using Data Mining Techniques", International Journal of Computer Applications (0975 – 8887) Volume 23– No.7, June 2011.
21. S.Shanthi, R.Geetha Ramani " Feature Relevance Analysis and Classification of Road Traffic Accident Data through Data Mining Techniques" Proceedings of the World Congress on Engineering and Computer Science 2012 Vol. I WCECS 2012, October 24-26, 2012, San Francisco, USA.
22. Tanagra – a Free Data Mining Software for Teaching and Research, Available at: http://eric.univ-lyon2.fr/~ricco/tanagra/en/tanagra.html, (Accessed 20 June 2014).
23. Tibebe Shah, Shawndra Hill (2013)" Mining Road Traffic Accident Data to Improve Safety Safety: Role of Road- related Factors on Accident Severity in Ethiopia".
24. Poch M, Mannering F. Negative binomial analysis of intersection-accident frequencies. J Transp Eng. 1996;122.
25. Abdel-Aty MA, Radwan AE. Modeling traffic accident occurrence and involvement. Accid Anal Prev Elsevier. 2000;32.
26. Joshua SC, Garber NJ. Estimating truck accident rate and involvements using linear and poisson regression models. Transp Plan Technol. 1990;15.;33:387–410.

Private Recommendation: Extending Capabilities of Privacy-Protection Recommender Systems

Rubya Shaharin
Lecturer
Dept. of Computer Science and Engineering
Jatiya Kabi Kazi Nazrul Islam University
Mymensingh, Bangladesh

Uzzal Kumar Prodhan
Assistant professor
Dept. of Computer Science and Engineering
Jatiya Kabi Kazi Nazrul Islam University
Mymensingh, Bangladesh

***Abstract*—Recommender systems are widely used to help deal with the problem of information overload. However, recommenders raise serious privacy and security issues. The personal information collected by recommenders raises the risk of unwanted exposure of that information. Also, malicious users can bias or sabotage the recommendations that are provided to other users. The goal of this paper is to compare different recommendation techniques, analyses how the privacy has been maintained and briefly makes comparative analysis among those. We propose some future directions briefly specifying how these techniques can be made more practical so that the trade-off between utility and privacy remains acceptable.**

Keywords- Private recommendation; Privacy; Recommender systems; Collaborative filtering, Differential privacy;

I. INTRODUCTION

From the advent of the Internet and the World Wide Web, the amount of information available to users has grown exponentially. As a result, the ability to find information relevant for their interests has become a central issue in recent years. People consume media (Youtube, Flickr, LastFM), do their shopping (Amazon, eBay), and interact (Facebook, Gmail) online. Because the range and amount of content that is offered to users is often huge, automated recommender systems are employed. By providing personalized suggestions, these systems can help people find interesting media boost sales through targeted advertisements, or help people meet new friends. Because of their automated nature, recommender systems can meet the demands of large online applications that operate on a global scale.

All recommender systems share a common trait: in order to generate personalized recommendations, they require information on the attributes, demands, or preferences of the user. Typically, the more detailed the information related to the user is, the more accurate the recommendations for the user are. Service providers running the recommender systems collect information where possible to ensure accurate recommendations. The information supplied can either be automatically collected, or specifically provided by the user. Automatically collected information is the result of users interacting with the recommender systems and making choices based on recommendations. For example, page views on eBay are used to automatically present a selection of recommended similar items (recommendations for you). Similarly, recommended videos on Youtube are influenced by recently viewed videos. Based on purchases by other users, items on Amazon are accompanied by package deals (frequently bought together) or related items (customers who bought this item also bought). Based on sites visited, Google serves personalized advertisements. Based on your friends and social interactions, Facebook suggests new friends to make. LinkedIn, based on a users cv and connections, recommends interesting companies, job offers, and news. Vice-versa, LinkedIn also recommends people to recruiters posting new job openings. Many dating sites, such as Match.com or PAIQ, recommend partner matches to its users. Many more examples of such systems exist and they will continue to exist in the future. Users can also specifically provide information. In this way, users build their own profile specifying their likes and dislikes, or containing general information (such as age and gender) about themselves. For example, LastFM and Youtube allow users to specify their favorites. Facebook allows listing profile information as well as interests.

However, potential threats to user privacy are often underestimated. The more detailed the information related to the user is, the larger the threat to the users privacy is. In order to enhance their recommender systems, service providers are collecting and consolidating more and more information. For example, in recent privacy policy updates Google stated that they consolidate information from all their services to a single profile. Facebook continues to expand its reach around the internet, giving the ability to share more and like almost everything. Information might be abused by the service provider, sold to a third party, or leaked by a hacker. There is an inherent trade-off between utility (getting accurate personalized recommendations) and privacy. Research into regulations, anonymization and privacy-preserving algorithms aims to improve privacy, while maintaining utility.

An illustrative example is **[1]**, which demonstrates that it is possible to unveil sensitive information about a person from their movie rating history by cross-referencing data from other sources. The authors (http://en.wikipedia.org/wiki/Netflix Prize) analysed the Netflix Prize data set, which contained anonymous movie ratings of around half a million users of Netflix, and were able to uncover the identity, political leaning and even sexual orientation of some of those users, by simply correlating their ratings with reviews they posted on the popular movie Web site IMDb. Apart from the risk of cross-referencing, users are also concerned that the systems predictions may be totally erroneous and be later used to defame them. Lastly, other privacy risks embrace unsolicited marketing, information leaked to other users of the same computer, court subpoenas, and government surveillance.

As a result of all this, it is not surprising that some users are reticent to reveal their interests. In fact, **[2]** reports that the

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

24 percent of Internet users surveyed provided false information in order to avoid giving private information to a website. It also finds that 95 percent of the respondents refused, at some point, to provide personal information when requested by a Web site. In closing, these studies seem to indicate that submitting false information and refusing to give private information are strategies accepted by users concerned with their privacy.

1.1. Scope of this paper

The paper is organised as follows: In section 2 and 3, we briefly present some preliminaries as well as background surveys where we define recommendation system, types of recommender systems, information in recommender system and privacy concerns. In section 4 we have made comparative analysis among the privacy protecting technologies. In section 5 we briefly discuss some future directions specifying how the capabilities of recommender systems can be extended. We analysed each section depending on papers listed in reference section and motivation here is to discuss the papers on critique point of view.

II. RECOMMENDER SYSTEMS

In this section, we give an overview of the different recommender system types. We then list the information present in recommender systems. Finally, we show what information is typically used in which recommender type. This relationship will serve as a basis, to describe the privacy concerns in the next section.

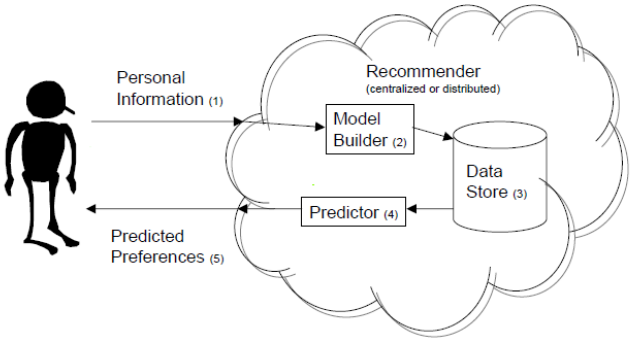


Fig.1: Conceptual model of the interaction between a user and a recommender system.

A recommender system provides a set of items (e.g. content, solutions, or other users) that is most relevant to a particular user of the system. Typically, recommender systems achieve this by predicting relevance scores for all items that the user has not seen yet. Items that receive the highest score get recommended (typically the top-N items, or all items above a threshold t). The prediction is made by considering both the traits of the item and user. Typically, systems look at similarities between items, similarities between users, or relations between particular types of items and particular types of users. The performance of a recommender system is determined by looking at the recommendation accuracy, i.e. the error between given and expected results.

2.1. Recommender System Types

There are four basic recommender types. Improved recommender types build upon basic recommender types by combining them or adding new information. Any improved recommender type can be combined with the basic recommender types. The following basic recommender system types have been around for quite some time:

Collaborative Filtering. One of the first collaborative filtering recommender systems is Tapestry, by Goldberg et al. **[16]**. This system was designed to retrieve email messages from Usenet mailing lists, relevant to a user's particular interests. Goldberg et al. observed that conventional mailing lists are too static, and rarely form a perfect match to a user's demands. Tapestry relies on what the authors termed *collaborative filtering techniques*, which are still widely used today. In collaborative filtering, each user rates content items. These ratings determine similarity between either users (similar users like similar items) or items (users like items similar to highly rated items). Different metrics exist to compute similarity. Recommended for the current user are those items that are rated highest by his most similar peers, or contain those items that are rated most similar to his favorite items.

Content-based. Content-based recommender systems use item similarity to determine recommendations. Unlike the collaborative filtering method, item similarity is computed by item meta-data. Examples of meta-data are, kitchen for restaurants, genre for movies, and artist for music. Recommended are those items that are most similar to the user's favorite items. An example of a content based recommender system is Newsweeder.

Demographic. When detailed information about the user's preferences is not available, demographic information can lead to somewhat personalized recommendations. Demographic information may include age, gender, country of residence, education level, etc. The demographic information is matched to a stereotype, and the items attached to this stereotype are recommended. Personalization for the user is limited due to the generalization to a stereotype.

Knowledge-based. When requiring a recommendation, the user enters his preferences in the recommender system. The system then outputs (number of) potential recommendations based on (expert) knowledge contained in the system. Possibly, the user can give feedback and the recommendation is refined. After a few iterations, the recommendation is tailored to the user. Entree **[7]** is an example of such a system, built to help diners find a suitable restaurant. In learning knowledge-based recommender systems, feedback from the user is fed back into the system to add to the knowledge.

The following improvements have been proposed to the basic recommender systems mentioned above:

Context-aware. In many application domains, contextual information is available, which can be used to improve recommendations. Common examples of contextual information are location, group dynamic, time, date, and purpose. While user preferences and domain knowledge are relatively static, context is highly dynamic in nature.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Every recommendation, even for the same user, may have a completely new context. Adomavicius and Tuzhilin **[2]** provided a discussion on contextual information in recommender systems. They showed three ways in which such contextual information can be added to existing recommender systems: (1) Use a pre-filter to remove content items (and information associated with them) that do not fit the context from the system. (2) Use a post-filter to remove recommendations that do not fit the context. (3) Add the context to the model of the recommender system and use the contextual information during the recommendation process.

Ensemble. Ensembles of recommender systems combine several of the same type of recommender system to improve performance. The idea behind ensembles is to get multiple opinions before making a decision. Schclar et al. **[22]** detailed the use of ensembles on collaborative filtering.

Hybrid. Hybrid recommender systems, like ensembles, combine multiple recommender systems. However, in a hybrid system, multiple different types of recommender systems are combined. A comprehensive overview of different hybridization techniques is given by Burke **[8]**. As concluded by Burke, given certain hybridization, not all basic recommender systems can be (straightforwardly) combined.

Social. The rise of online social networks increased the availability of a user's social information (for example, the friendship network). Because friends typically share interests, the information they supply to the recommender system is more likely to fit with the user. Or alternatively, the social information can be used to infer communities of similar users. As an example, Konstas et al. **[21]** utilized the social information in LastFM to improve collaborative filtering.

2.2. Information in Recommender Systems

We now discuss the different types of information typically used in recommender systems. We do not aim to give a complete categorization of information used, but instead to explore the diversity of information used in recommender systems.

Behavioural information is the implicit information that the recommender system can gather while the user interacts with the broader system. For example, product views in a web-shop, or not fully watching a movie on a video on demand site.

Contextual information describes to the context in which a recommendation query is made. Common examples of contextual information are location, social group, time, date, and purpose.

Domain knowledge specifies the relationship between a user stereotype and content items. Domain knowledge is usually static, but can change over time.

Item meta-data is descriptive information about content items. Examples of metadata are kitchen for restaurants, genre for movies, and artist for music.

Purchase or consumption history is the list of content that has previously been purchased or consumed by the user.

Recommendations are the output of a recommender system, typically a ranked list of items. In some systems, the relevance score for each content item is also given to the user.

Recommendation feedback is information about the recommendation provided by the user. Feedback can be expressed as positive, negative, or something more nuanced (stating a reason as well).

Social information describes the relationship between different users. Many sites allow users to specify a friendship relation (or similar) to other users, community membership, or both.

User attributes describe the user. Examples of user attributes are demographic information, income and marital status.

User preferences are explicitly stated opinions about items or groups of items. Preferences are expressed by either a scalar measure (rating items on a scale of 1-5 stars), a binary indicator (keeping a list of favourites), or text (tags and comments).

2.3. Summary

Table 1 shows the type of information used by the type of recommender system. Information is ■ almost always present, ▪ sometimes present, or ▫ almost never present in a recommender system. For improved recommender types, we mark what information is added to the basic recommender types. There is a clear distinction between the information used in the basic recommender types. The improved recommender types either add new types of information, or combine multiple basic recommender systems.

Table-1. Information that is present in different recommender system types.

Info. → / ↓ Rec. Sys.	Behavioral	Contextual	Domain Knowledge	Item Meta-data	History	Recommendation	Feedback	Social	User Attributes	User Preferences
Collaborative Filtering	▪	▫	▫	▫	▪	■	▫	▫	▫	■
Content-based	▫	▫	▫	■	▪	■	▫	▫	▫	■
Demographic	▫	▫	■	▫	▫	■	▫	▫	■	▫
Knowledge-based	▪	▫	■	▪	▫	■	▪	▫	▪	■
Context-aware	▪	■	▪	▪	▫	▫	▫	▫	▪	▫
Ensemble	▫	▫	▫	▫	▫	■	▫	▫	▫	▫
Hybrid	▫	▫	▫	▫	▫	■	▫	▫	▫	▫
Social	▫	▫	▫	▫	▫	▫	▫	■	▫	▫

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

III. PRIVACY CCNCERNS IN RECOMMENDER SYSTEMS

Because users need to reveal information in order to make use of the desired functionality of a recommender system, a trade-off exists between utility and user privacy. Obtaining accurate recommendations is one thing, but sharing personal information may also lead to privacy breaches. In this section, we will look into privacy in recommender systems, and potential privacy concerns with a focus on user privacy.

3.1. Privacy and Confidentiality

The word privacy has many subtly different meanings, each with their own definition. Privacy on the internet revolves mainly around information privacy. Kang **[3]** used the wording of the Information Infrastructure Task Force (IITF), as cited below:

"Information privacy is an individual's claim to control the terms under which personal information identifiable to the individual is acquired, disclosed or used."

This concept of information privacy is strongly related to the notion of confidentiality, from the field of information security, but not to be used interchangeably. Confidentiality is concerned with the secrecy of individual pieces of information. Information privacy focuses on the individual, who is the subject of said information, the effects that disclosure have on this person, and his or her control and consent. In our overview of privacy-protection technologies, the focus will lie on preventing unwanted disclosure and usage of information, but not on the effects on the person.

When using online applications, users generally share a lot of (personal) information. Whether it is uploading ratings or comments, posting personal information on a profile, or making purchases, information is always shared within a particular scope. Privacy involves keeping a piece of information in its intended scope. This scope is defined by the size of the audience (breadth), by extent of usage allowed (depth), and duration (lifetime). When a piece of information is moved beyond its intended scope in any of these dimensions (be it accidentally or maliciously), a privacy breach occurs. So, a breach may occur when information is disclosed to a party for whom it was not intended, when information is abused for a different purpose than was intended, or when information is stored beyond its intended lifetime.

On the traditional Web, privacy is maintained by limiting data collection, hiding user's identities and restricting access to authorized parties only. Often, in practice, information and identity become closely linked and visible to large groups of people. Profiles may be publicly visible, comments can be seen by all viewers of a content item, and some sites list the last users to visit a particular page. It becomes harder for a user to monitor and control his personal information, as more of it becomes available online. This problem mainly applies to systems where the user logs in to an account, and where tools are available to express user's preferences.

3.2. Privacy Concerns

Privacy breaches can involve a variety of parties (fellow users, the service provider, or outsiders) and may be a deliberate act (snooping, hacking), or accidental (mismanagement, lingering data). Depending on the sensitivity of information involved, such incidents may have serious consequences. Lam in **[4]** already identified some threats to privacy in recommender systems. Their concern is the amount of (personal) information that is collected by the service provider and the potential leakage of this information. Independent of their work, we explicitly identify the privacy concerns in recommender systems and classify them as follows:

Data Collection. Many users are not aware of the amount and extent of information that a service provider is able to collect, and what can be derived from this information. This may be due to the fact that privacy statements are seldomly read, and people have become used to pursuing online activities. Usually there is no way to opt-out of such data gathering, other than not using the system at all. As collection practices do not match with the users expectations, this concern relates to the extent of information usage.

Data Retention. On-line information is often difficult to remove. The service provider may even intentionally prevent or hinder removal of data. This is because there is commercial value in user information, for both competitive advantages through analysis and/or data sales. Furthermore, information that is apparently erased from one place may still reside somewhere else in the system, for example in backups, to be found by others. The data retention concern relates to the intended lifetime, as information can be available longer than intended.

Data Sales. The wealth of information that is stored in online systems is likely to be of value to third parties and may be sold in some cases. Users ratings, preferences, and purchase histories are all potentially interesting for marketing purposes. Data sales usually conflicts with the privacy expectations of users. Even though data is often anonymized before being sold to protect user privacy, re-identification is a threat that is often overlooked or ignored. For example, the information published by Netflix as part of their recommender systems prize, though anonymized, allowed for reidentification. Narayanan and Shmatikov (How to break anonymity of the netflix prize dataset) linked the anonymized records to publicly available records (such as IMDb) based on rating similarity and time of rating. If two records give a similar rating to a movie around the same time, they are likely to be from the same person. A higher number of similar movie ratings (in rating and in time) increase the confidence of the link between the records. This concern relates mainly to the extent of information usage.

Employee Browsing Private Information. The service provider as an entity has full access to the information, and its employees might take advantage of this. This is in conflict with the intended breadth of the audience, and the privacy that the service provider has promised its users.

Recommendations Revealing Information. Recommendations inherently are based on the information contained in the recommender system. For example, in collaborative filtering that information is the ratings of all the users, or in knowledge-based recommender systems it is the expert knowledge. Each recommendation reveals a tiny piece of information about the private information. It is unclear how a large number of recommendations impact the disclosure of information. This could be used to reveal information about other users (compromising their privacy), or information about the recommender system itself (potentially leading to reverse

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

engineering of the system). Here, we focus on the privacy of the user, not the security of the system. From a graph perspective, when looking at recommendation results, these users are at a higher risk than average users. As eccentric users cannot hide in crowds of other users, when their data is used for making recommendation, other data is often not. The recommendations output by the system are then based on only a few users, with a strong correlation between the input of the eccentric users and the recommendation output. This is in conflict with the intended breadth of the audience.

Shared Device or Service. Privacy at home can be just as important as privacy online. When sharing a device like a set-top box or computer, or a login to an online service, controlling privacy towards family and friends may be difficult. For example, a wife who wants to hide from her husbands the fact that she purchased a gift for him. Unless she has a private account, her husband might inadvertently see her purchase, or receive recommendations based on it. Many would want to keep some purchases private from their kids, or their viewing behaviour from their housemates. While some services allow for separate accounts, this is not always possible. For example, targeted advertising works with cookies that are stored in the browser, which is implicitly shared on a computer. This is related to the intended breadth of the audience.

Stranger Views Private Information. Users can falsely assume some information to be kept restricted to the service provider or a limited audience, when in reality it is not. This can be due to design flaws on the part of the service provider, or a lack of the users own understanding or attention to his privacy. When a stranger views such private information, there is a conflict with regards to the intended breadth of the audience.

IV. Research Into Privacy-Protection Technologies -A Comparative Analysis

We have seen a wide variety of privacy issues associated with recommender systems. Research from many areas could be applied to alleviate some of the aforementioned concerns. We will provide an overview of research areas, and briefly discuss their mechanisms, advantages, and limitations.

4.1. Awareness

Research in this mainly social field aims to enhance user awareness of the privacy issues that exist within online systems. It can aid users in specifying their privacy boundaries. The *Platform for Privacy Preferences (P3P)* **[5]** is an initiative that aims to provide websites with a standardized format in which they can define their privacy policy. Visitors of the website can then, through client-side user agents (e.g. plugins for their browser or applets), easily check the details of a privacy policy and see what will happen to information they submit. This system can help to increase user awareness, but only for users that employ agents and if websites properly define their privacy policies and adhere to them. When privacy information is shown more prominent, and users are made more aware of the privacy consequences, privacy is taken into account when shopping online. We observe that some users are even willing to pay more for the product, if it means getting more privacy. Offering users the ability to opt-out for, or opt-in to data collection would in many cases level the playing field between users and service providers.

4.2. Law and Regulations

This legal field of research aims to find proper and broad laws and regulations that protect the user's privacy, while not greatly hindering businesses. It also focuses on compliance of both users and service providers to established laws and social conducts. Laws and regulations form an important and much needed tool.

This legal approach runs after the technology, as specific laws dealing with personal information as related to the internet often take long to be developed. Also, laws are generally used to solve matters after things go wrong, whereas most technical solutions attempt to prevent violations.

4.3. Anonymization

As pointed out in Sections 2, sales of information can be a major source of revenue for service providers. If this were to be done without any further consideration for privacy, users might take offense and stop using the system (thus hurting revenue), or take justified legal action. Service providers may try to remove the privacy issues associated with data sales, by obscuring the link between users and data sold.

This can be done through anonymization, which involves removing any identifying (or identifiable) information from the data, while preserving other structures of interest in the data. As mentioned before, the information published by Netflix as part of their recommender systems prize, though anonymized, allowed for re-identification. This mainly stems from the fact that information can only be partially removed or obfuscated, while other parts must be kept intact for the dataset to remain useful. In the real world, it is difficult to predict which external sources of information may become available, allowing pieces of data to be combined into identifiable information.

When looking at anonymization during recommendation, Cissee and Albayrak **[6]** utilized trusted agents (essentially moving the trust around) to act as a relay and filter the information that is sent. This way the user can interact (through the agent) with the recommender system in an anonymous way. The user hides his personal information from the service provider, and is safe from the service provider linking his rating information to a person. However, the user still needs to trust that the agents (either hardware or software based) and the service provider do not collude.

4.4. Randomization and Differential Privacy

In randomization (sometimes referred to as perturbation), the information fed into the system is altered to add a degree of uncertainty.

Polat and Du **[7]** proposed a singular value decomposition predictor based on random perturbation of data. The users data is perturbed by adding a random value (from a fixed distribution) to each of the ratings, unknown ratings are filled in with the mean rating. They go on to show the impact on privacy and accuracy, and their inherent trade-off due to perturbation. In other work their setting is different. A user wants two companies to collaboratively compute recommendations for him. This user acts as a relay for the two companies. The user's privacy is based on randomizing values.

Berkovsky in **[8]** proposed to combine random perturbation with a peer-to-peer structure to create a form of dynamic

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

random perturbation. For each request, the user can decided what data to reveal and how much protection is put on the data. Different perturbation strategies are compared based on accuracy and perceived privacy.

Shokri in **[9]** added privacy by aggregating user information instead of perturbing. Aggregation occurs between users, without interaction with the recommender system. Thus, the recommender system cannot identify which information is part of the original user information and what is added by aggregation. A degree of uncertainty is added to the user's information similar to randomization.

Recently the field of randomization is shifting towards differential privacy **[10]**, which aims to obscure the link between single user's information in the input (the user's information) and output (the recommendation). This is accomplished by making users in released data computationally indistinguishable from most of the other users in that data set. This is typically accomplished by adding noise to the inputs or output, to hide small changes that arise from a single user's contribution. The required level of noise depends on how and how often the data will be used, and typically involves a balancing act between accuracy of the output and privacy of the input. Such indistinguishability also applies strongly to collaborative recommender systems, where a user should be unable to identify individual peer's ratings in the output he receives. As each recommendation leaks a little bit of information about the input (even with noise), with a larger number of recommendations, the added noise should be greater to provide the same level of privacy.

McSherry and Mironov **[11]** proposed collaborative filtering algorithms in the differential privacy framework. Noise is added to the item covariance matrix (for item similarity). Since the item covariance matrix is smaller than the user covariance matrix, less noise needs to be added and more accuracy is preserved.

The drawback of these techniques is that the security of these methods is hard to be formally proven, as is done in classical cryptography. The noise levels in differential privacy techniques must not overwhelm the initial output data and thus remove utility of the results completely. At the same time, enough noise must be added in order to hide the contribution of a user. When combined with multiple computational results and external information, even more noise is needed to protect the privacy of a user.

4.5. Privacy-Preserving Cryptographic Protocols

We first give an overview of some of the tools used in privacy-preserving cryptographic protocols, before addressing the protocols themselves. Among the tools **[12]** are secure multi-party computations, secret sharing, homomorphic encryption, and zeroknowledge proofs.

Secure multi-party computations are a class of protocols that allow two or more parties to collaboratively compute a function based on input held by each of them. The output of this function can be given to one of the parties or all of them. Any function can be computed, but the complexity of the protocol depends on the function. For example, multiplication and integer comparison.

Secret sharing distributes a number of shares of a value among different parties. The shares of a fixed number of parties need to be combined in order to reconstruct the original value. With less than the fixed number of shares, no information about the value can be obtained. Some secret sharing schemes allow basic operations (such as addition) to be performed.

Homomorphic encryption allows one (or sometimes more) operation (for example addition or multiplication) on the encrypted values, by performing a corresponding operation on the cipher texts. This allows anyone to compute a (basic) function on the encrypted values, without knowledge of the actual values. Decryption is then required to get the result of the function.

Zero-knowledge proofs allow a user to prove a property about a value, without revealing that value. For example, that a value is in a given range of possible values. To do this, the user first sends a commitment to the verifier. Then the verifier asks the user to open the commitment in a certain way. The commitment can only be opened correctly when the property of the value holds. With a certain probability the user can correctly open the commitment even if the property does not hold. However, by running multiple zero-knowledge proofs this percentage can be reduced.

4.6. Privacy-Preserving Cryptographic Protocols without Server

Privacy-preserving cryptographic protocols without a central server aim to remove the trust that is placed in service providers by removing them from the picture. Secure multi-party computations protect the privacy of users against each other.

Canny in **[13]** used a combination of secure multi-party computation, homomorphic encryption, and zero-knowledge proofs to create a privacy-preserving recommender protocols without a central server. The users collaborate to privately compute intermediate values of the collaborative filtering process. These intermediate values (based on all users) are then made public. In the next step the users perform singular value decomposition and factor analysis, which leads to a model for recommendations. This model is made publicly available and can be used by each user independently to compute recommendations for them.

The system proposed by Hoens in **[14]** allowed trusted friends to collaboratively compute recommendations with each other. They rely on Facebook for retrieving friendship information and a server to facilitate asynchronous messaging. Homomorphic cryptography and secure multi-party protocols are used to compute the actual recommendations for a given item.

Because a decentralized structure works strongly towards taking power away from the service provider, it is contrary to existing business models. This means that existing companies are not likely to adopt such a structure, or aid its development. Another drawback is the involvement of many users, that is required to make (the model for) the recommendations. These users need to interact with each other, but not all users will be available at the same time. This can lead to considerable delays, or a loss of accuracy.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

4.7. Privacy-Preserving Cryptographic Protocols with Server

Privacy-preserving cryptographic protocols with a central server, aim to make use of the centralization offered by the service provider, while using secure two-party computation and encryption to ensure the privacy of the users. Good motivations for the service provider would be a reduced liability for the data collected, an increased perception of security among users (and thus, a competitive advantage), and adherence to possible stricter future laws.

Aimeur **[15]** provided a framework for collaborative filtering, where user information is separately stored over two parties. An agent has access to ratings and the company has access to the items, so that they together can generate recommendations for the user. The centralized structure is preserved, but neither the agent nor the company can link the user's ratings to the items.

Erkin in **[16]** proposed a collaborative filtering algorithm based on homomorphic cryptosystems. In their framework, a central server acts as a mediator between the users and is in charge of combining the results given by different users. When desiring a recommendation, a user sends an encrypted request to the central server. The server distributes this request to other users that can work on the request by using the homomorphic properties of the cryptosystem. A secure two-party computation then determines for each user if their information should be included in the recommendation or not. The central server then combines the (still encrypted) results to generate the recommendation.

Basu in **[17]** proposed a privacy preserving version of the slope one predictor for collaborative filtering. The assumption is that different parties hold different parts of the information; this essentially allows multiple companies to collaborate. They precompute the deviation and cardinality matrices under encryption and make the cardinality matrix public. Then the prediction for a single item can be computed under encryption and all parties collaborate to decrypt the result.

The drawback of these schemes (that add a layer of encryption) is efficiency. The homomorphic operations and secure two-party computations are always more expensive than their unprotected counterparts. In fact, the discrepancy is often huge. This results in poor efficiency and scalability for these protocols, an issue that the research tries to address.

V. Extending Capabilities Of Recommender Systems - Future Directions

Recommender systems, as described in Section 2, can be extended in several ways that include improving the understanding of users and items, incorporating the contextual information into the recommendation process, supporting multi-criteria ratings, and providing more flexible and less intrusive types of recommendations. Such more comprehensive models of recommender systems can provide better recommendation capabilities. In the remainder of this section, we describe the proposed extensions and also identify various research opportunities for developing them.

5.1. Comprehensive Understanding of Users and Items

As was pointed out in section 2, most of the recommendation methods produce ratings that are based on a limited understanding of users and items as captured by user and item profiles and do not take full advantage of the information in the users transactional histories and other available data. For example, classical collaborative filtering methods do not use user and item profiles at all for recommendation purposes and rely exclusively on the ratings information to make recommendations. Although there has been some progress made on incorporating user and item profiles into some of the methods since the earlier days of recommender systems these profiles still tend to be quite simple and do not utilize some of the more advanced profiling techniques. In addition to using traditional profile features, such as keywords and simple user demographics more advanced profiling techniques based on data mining rules, sequences, and signatures that describe a users interests can be used to build user profiles. Also, in addition to using the traditional item profile features, such as keywords, similar advanced profiling techniques can also be used to build comprehensive item profiles. With respect to recommender systems, advanced profiling techniques that are based on data mining have been used mainly in the context of Web usage analysis i.e., to discover the navigational Web usage patterns (i.e., page view sequences) of users in order to provide better Web site recommendations; however, such techniques have not been widely adopted in rating-based recommender systems.

5.2. Extensions for Model-Based Recommendation Techniques

Some of the model-based approaches provide rigorous rating estimation methods utilizing various statistical and machine learning techniques. However, other areas of mathematics and computer science, such as mathematical approximation theory can also contribute to developing better rating estimation methods. One of the advantages of radial basis functions is that they have been extensively studied in approximation theory and their theoretical properties and utilization of radial basis functions in many practical applications have been understood very well **[18]**. Therefore, it should be interesting to apply them to estimating unknown ratings in recommender systems.

5.3. Multidimensionality of Recommendations

The current generation of recommender systems operates in the two-dimensional User x Item space. That is, they make their recommendations based only on the user and item information and do not take into consideration additional contextual information that may be crucial in some applications. However, in many situations, the utility of a certain product to a user may depend significantly on time (e.g., the time of the year, such as season or month, or the day of the week). It may also depend on the person(s) with whom the product will be consumed or shared and under which circumstances. In such situations, it may not be sufficient to simply recommend items to users; the recommender system must take additional contextual information, such as time, place, and the company of a user, into consideration when recommending a product.

For example, when recommending a vacation package, the system should also consider the time of the year, with which the user plans to travel, traveling conditions and restrictions at that time, and other contextual information. As another example, a user can have significantly different preferences for

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

the types of movies she wants to see when she is going out to a movie theater with a boyfriend on a Saturday night as opposed to watching a rental movie at home with her parents on a Wednesday evening.

5.4. Multcriteria Ratings

Most of the current recommender systems deal with single criterion ratings, such as ratings of movies and books. However, in some applications, such as restaurant recommenders, it is crucial to incorporate multi criteria ratings into recommendation methods. For example, many restaurant guides, such as Zagats Guide, provide three criteria for restaurant ratings: food, decor, and service. Although multi criteria ratings have not yet been examined in the recommender systems literature, they have been extensively studied in the Operations Research community **[19]**. Typical solutions to the multi criteria optimization problems include:

1. Finding Pareto optimal solutions.
2. Taking a linear combination of multiple criteria.
3. Reducing the problem to a single-criterion optimization problem.
4. Optimizing the most important criterion and converting other criteria to constraints.
5. Consecutively optimizing one criterion at a time, converting an optimal solution to constraint(s), and repeating the process for other criteria. An example of the latter approach is the method of successive concessions **[20]**.

5.5. Flexibility

Most of the recommendation methods are inflexible in the sense that they are hardwired into the systems by the vendors and, therefore, support only a predefined and fixed set of recommendations. Therefore, the end-user cannot customize recommendations according to his or her needs in real time. This problem has been identified in **[20]** and Recommendation Query Language (RQL) has been proposed to address it. RQL is SQL-like language for expressing flexible user-specified recommendation requests. For example, the request recommend to each user from New York the best three movies that are longer than two hours can be expressed in RQL as:

```
RECOMMEND Movie TO User
BASED ON Rating
SHOW TOP 3
FROM MovieRecommender
WHERE Movie.Length = 120
AND User.City = New York.
```

5.6. Effectiveness of Recommendations

The problem of developing good metrics to measure the effectiveness of recommendations has been extensively addressed in the recommender systems literature. In most of the recommender systems literature, the performance evaluation of recommendation algorithms is usually done in terms of coverage and accuracy metrics. Coverage measures the percentage of items for which a recommender system is capable of making predictions. Accuracy measures can be either statistical or decision-support. Statistical accuracy metrics mainly compare the estimated ratings against the actual ratings R in the User x Item matrix and include Mean Absolute Error (MAE), root mean squared error, and correlation between predictions and ratings. Decision support measures determine how well a recommender system can make predictions of high-relevance items (i.e., items that would be rated highly by the user). They include classical IR measures of precision (the percentage of truly high ratings among those that were predicted to be high by the recommender system), recall (the percentage of correctly predicted high ratings among all the ratings known to be high), F measure (a harmonic mean of precision and recall), and Receiver Operating Characteristic (ROC) measure demonstrate the trade-off between true positive and false positive rates in recommender systems.

VI. CONCLUSION

We have seen that recommender systems play an important role in the online experience of millions of people. While accuracy has been the focus in recommender system development, we argue that privacy should not be overlooked. We have seen that depending on the type of information utilized by a recommender system, various privacy concerns exist. The fact that trust in the service provider is not always justified further complicates matters. With increased information-sharing, users must weigh the advantages of getting (more accurate) recommendations against the privacy risks, and should more often be given the choice to opt-in or opt-out of data collection.

Many areas of research can help to protect user privacy, ranging from technical (e.g. system design and cryptography) to non-technical (e.g. sociology and law). However, we must realize that one single research area cannot address all privacy concerns. Furthermore, we notice a trend in the different research areas. The areas of awareness and law do not focus on any single specific type of recommender system. However, the areas that provide technical solutions mainly focus on collaborative filtering recommender systems. The other types of recommender systems are barely (if at all) represented.

As commonly known, in the technical solutions there is an inherent trade-off between privacy, accuracy, and efficiency. Randomization techniques increase privacy by lowering accuracy, and leaving efficiency the same. Cryptographic and secure multiparty computation protocols increase privacy by lowering efficiency, and leaving accuracy the same. However, when aiming for a specific trade-off in a certain scenario and goal, it is difficult to choose the right solution. Comparison is difficult, because researchers use different datasets and different measures for accuracy. It is an open question how different privacy-protection techniques compare to each other when applied to the same dataset, with the same accuracy measure, and the same programming language and hardware.

Our conclusion is, that in order to develop a full solution to protect user privacy, the strengths of several research areas will need to be brought together. Ideally, privacy protection techniques are built into the system design. These privacy protection techniques should not harm the operations of the recommender system. Therefore, the users and the service provider should not be overburdened, and the functionality and accuracy of the recommender system should not be hampered.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

REFERENCES

[1] A Narayanan, V Shmatikov: "Robust de-anonymization of large sparse datasets". Security and Privacy, 2008. SP 2008. IEEE Symposium on, 111-125.

[2] S. Fox, "Trust and privacy online: Why americans want to rewrite the rules". Pew Internet, Amer. Life Project, Res. Rep., Aug. 2000.

[3] Jerry Kang: "Information privacy in cyberspace transactions". Stanford Law Review, Vol. 50, p. 1193, 1998.

[4] Shyong K. Lam, Dan Frankowski, John Riedl: "Do You Trust Your Recommendations? An Exploration Of Security and Privacy Issues in Recommender Systems". In Proceedings of the 2006 International Conference on Emerging Trends in Information and Communication Security (ETRICS), Freiburg, Germany, 2006.

[5] Lorrie Cranor, Marc Langheinrich, Massimo Marchiori, Martin Presler-Marshall, and Joseph Reagle: "The platform for privacy preferences 1.0 (p3p1.0) specification". online. http://www.w3.org/TR/P3P/

[6] Richard Cissée, Sahin Albayrak: "An agent-based approach for privacy-preserving recommender systems". AAMAS 2007: 182.

[7] Huseyin Polat and Wenliang Du: "SVD-based collaborative filtering with privacy". Proceeding SAC '05 Proceedings of the 2005 ACM symposium on Applied computing. Pages 791-795.

[8] Shlomo Bercovsky, Yaniv Eitany, Tsvi Kuflik and Francesco Ricci: "Enhancing Privacy and Preserving Accuracy of a Distributed Collaborative Filtering". ACM conference on Recommender systems, 2007, Minneapolis, MN, USA October 19 - 20, 2007, pp 9-16.

[9] Reza Shokri, Pedram Pedarsani, George Theodorakopoulos, and Jean-Pierre Hubaux: "Preserving Privacy in Collaborative Filtering through Distributed Aggregation of Offline Profiles", In The 3rd ACM Conference on Recommender Systems (RecSys), New York, October 2009.

[10] Cynthia Dwork: "Differential Privacy". Inproceedings of 33rd International Colloquium on Automata, Languages and Programming, part II (ICALP 2006). Volume: 4052. Pages: 1-12.

[11] Frank McSherry, Ilya Mironov: "Differentially Private Recommender Systems: Building Privacy into the Netflix Prize Contenders". KDD 2009: 627-636.

[12] Oded Goldreich: "Foundations of Cryptography (a primer)", July 2004.

[13] John Canny: "Collaborative Filtering with Privacy", IEEE Conf. on Security and Privacy, Oakland CA, May 2002.

[14] T. Ryan Hoens, Marina Blanton and Nitesh V. Chawla: "A Private and Reliable Recommendation System for Social Networks". IEEE International Conference on Information Privacy, Security, Risk and Trust (PASSAT), Minneapolis, MN. August 2010.

[15] Aimeur, E., Brassard, G., Fernandez, J.M., Mani Onana, F.S.: "ALAMBIC: A Privacy-Preserving Recommender System for Electronic Commerce". International Journal of Information Security, Vol. 7, no 5, pp.307-334, 2008.

[16] Erkin, Zekeriya and Beye, Michael and Veugen, Thijs and Lagendijk, Reginald L.: "Privacy enhanced recommender system". In: 31st Symposium on Information Theory in the Benelux, WIC 2010, 11-12 May 2010, Rotterdam, the Netherlands (pp. pp. 35-42).

[17] Anirban Basu, Hiroaki Kikuchi and Jaideep Vaidya: "Privacy-preserving weighted slope one predictor for item-based collaborative filtering". Trust and Privacy in Distributed Information Processing (workshop at the IFIPTM), Copenhagen, Denmark. January 2011.

[18] M.D. Buhmann: "Approximation and interpolation with radial functions". Cambridge University Press. pp. 25-43. July 2010.

[19] Roman Statnikov, J.B. Matusov: "Multicriteria Optimization and Engineering". Springer; 1995 edition (March 31, 1995).

[20] Gediminas Adomavicius, Alexander Tuzhilin: "Multidimensional Recommender Systems: A Data Warehousing Approach". WELCOM 2001: 180-192.

[21] Ioannis Konstas, Vassilios Stathopoulos, Joemon M. Jose: "On social networks and collaborative recommendation". In SIGIR, pages 195-202, Boston, MA, USA.

[22] Alon Schclar, Alexander Tsikinovsky, Lior Rokach, Amnon Meisels, Liat Antwarg: "Ensemble methods for improving the performance of neighborhood-based collaborative filtering". RecSys 2009: 261-264.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Hiding an Image using Mandelbrot Fractal

Mustafa M. Auda
Dept. of Computer Science,
Deanship of Academic Services,
Taibah University,
P.O Box 344,
Postal code: 41141
Madinah, Saudi Arabia

***Abstract*— In this era of advancement in technology, Information Security (IS) is very curtail especially during the transmission process. In this paper a new approach for Image-Hiding, i.e. steganography, using iterated function systems of Fractals is proposed. This approach uses the main feature of fractals focusing on the idea that intruders trying to find the image being transformed would not be able to locate it. Therefore, a decoding process to reverse the transformation is needed to secure the information transmitted. In this work, the Mandelbrot fractal is applied to hide images; the results show the possibility of using fractals in steganography.**

***Index Terms*— Fractals, IFS, Steganography, Cryptography, Mandelbrot Set, RGB.**

I. Introduction

Information security (IS) is to protect information from unauthorized access, use, disclosure, disruption, modification, or destruction [1]. The history of IS reaches back to ancient times. It started with the need to secure communication during war times [2]. This is the generic name for the collection of tools designed for protecting data from eavesdropper. We can also use this definition for Network Security in respect for the transmitted data. This came from the need to provide the security services that enhance the security of the data in an IS [3]. It is something that enhances the security of the data processing and communication systems of an organization. Security service can be as one or more of security mechanisms in order to ensure that this service has a maximum-security attack handling. For example, having signatures, dates; need protection from disclosure, tampering, or destruction; be recorded or licensed; be notarized or witnessed [4]. The reason of securing the information is to prevent attacks such as [5]:

- Normal Flow: is the flow of information from the source to the destination.
- Interruption: that affects the availability of the information.
- Interception: that affects the confidentiality of connection.
- Modification: that affects the integrity of the information.
- Fabrication: that affects the authenticity of insuring the source of information.

In this work, the use of fractals will be exploited for hiding images, i.e., steganography. Steganography is the practice of hiding information, such as text, image, or video within another text, image, or video. In this work, the objective is to hide an image in another image using fractals. Many techniques for steganography to hide images have been published these techniques are based on hiding the images in the spatial domain, frequency domain or adaptive steganography, which used both domains.

The use of fractals in steganography has not been widely exploited. A fractal demonstrates a limit, i.e., fractals usually model complex dynamical systems and physical processes. Hence, the underlying principle of fractals is that a simple process goes through infinitely numerous iterations which turn into a very complex process. Therefore, fractals attempt to model the complex process by searching for the simple process underneath.

Most fractals operate on the principle of a feedback loop. A simple operation is carried out on a piece of data then it is fed back in again. This process is repeated infinitely many times and the limit of the process produced is the fractal [6]. Thus, all fractals are at least partially self-similar. This means that a part of the fractal is identical to the entire fractal itself except that it is smaller as seen in Fig. 1 below. An object is self-similar only if you can break the object down into an arbitrary number of small pieces, and each of those pieces is a copy of the whole structure. Figure 1 provides an example of a self-similarity for the Sierpinski Gasket. The red rectangles indicates a few of the self-similarities of the object [7].

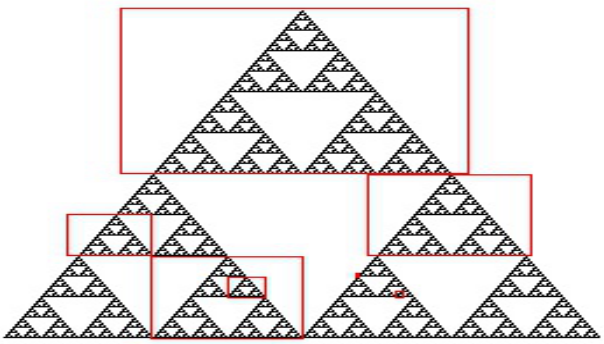


Fig. 1: The Sierpinski Gasket

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Fractals can look very complicated. Yet, usually they are very simple processes that produce complicated results and this property transfers over to Chaos Theory. If something has complicated results, it does not necessarily mean that it had a complicated input. Therefore, fractal dimensions are used to measure the complexity of objects. This provides ways of measuring things that were traditionally impossible or meaningless to measure.

Following this introduction, the paper is organized as follows. Section 2 provides the related work. Section 3 presents the proposed method. Section 4 explains the implementation. Section 5 presents the results and discussion. Finally, section 6 concludes this paper.

II. Related Work

This section presents some of the work found in the area of steganography using fractals. Thamizhchelvy and Geetha, [8], proposed an algorithm for data-hiding using chaos theory. Chaos is an unpredictable behavior, which arises on the dynamical system and in turns explains the non-linearity and randomness. The initial condition acts as a key, which is produced by the Pseudo-Random Number Generator (PRNG). The fractal-image generation method is used to generate the fractals; then while generating the fractal itself the data is hid. The generated fractal-images are watermarked and can be used as a digital signature for any online applications.

Wu and Noonan, [9], proposed an algorithm for embedding secret image information into digital images. The proposed algorithm uses a fractal-image as the cover image, takes a random-like sequence produced by a chaotic map as the reference for embedded positions, and employs a wavelet transform to realize the embedding procedure. The fractal cover-image that can be parametrically generated implies a cover-image that could be unique in the world. The chaotic logistic map guarantees that the sequence of embedding positions is completely unknown for an adversary and the embedding procedure is almost random-like. In addition, the wavelet transform ensures the secret information is only embedded within the edges; i.e., with the least visual distortion. The proposed scheme is tested over different cover-images and secret-images and the simulations results demonstrate its effectiveness and robustness.

Abbas and Hamza, [10], proposed an algorithm for hiding information in an image by detecting features of the regions of the cover-image depending on applying fractal technique on the cover-image. Then chooses the regions that will be hiding within it by using an algorithm to determine the regions that will hide the fractal. The fractal techniques can be used to hide a maximum amount of data in an image without degrading its quality. In addition, it makes the hidden data robust enough to withstand image processing which do not change the appearance of the image.

Al-Saidie and Kadhim [11] proposed an algorithm for information hiding using iterated function system (IFS). This approach exploits the main feature of fractals, so that any individual that happens to find the transformed message, will not be able to understand it; without the correct method that will reverse the transformation, usually through some knowledge of key agreement, with the original encryption. In addition, to making the encoding more difficult to introducers a stenographic method was used to hide the attractor image in another colored image 256×256 pixels size.

Finally, Fractal research is a new field of interest. Nowadays, fractals can be generated and decoded with graphical representations. Fractal-image Compression (FIC) is one of the interesting areas of research. The main disadvantage with FIC and Fractals, in general, is the computational power needed to encode and decode them. However, with personal computers becoming faster, this area of research needs more attention of researchers in the area of IS.

III. Proposed Method

The general formal definition for Mandelbrot set, a set, M, is defined by $P_c : \mathbb{C} \to \mathbb{C}$

Which is given by $P_c : Z \to Z^2 + C$, where *C* is a complex parameter. For each *C*, one considers the behavior of the sequence $(0, p_c(0), p_c(p_c(0)), p_c(p_c(p_c(0))), ...)$ obtained by $P_c(z)$ where the iterating starts at critical point $z = 0$. Which either escapes to infinity or stays within a disk of some finite radius. Therefore, the Mandelbrot set is defined as the set of all points *c*, such that, the above sequence does not escape to infinity. More formally, if $P_c^n(z)$ denotes the nth iteration of, (i.e. Composed with itself *n* times), the Mandelbrot set is the subset of the complex plane given by M below [12]:

$$M = \{c \in : \exists s \in R, \forall n \in N, | P_c^n(n) | ^\circ s\}$$

On other hand, we can say that the Mandelbrot set is based on the calculation of the iteration process compared to what we are used to in the mathematical equations where we see an equal sign. (=), instead, Mandelbrot set uses an 'iterates to' symbol.

If we had a mathematical statement says '*a* iterates to *a+ c*' then *a* becomes *a+c*. So *a+c* becomes the new *a*. Next, the new *a*, which is *a+c*, runs through the iteration process again and becomes *(a + c) + c*. Then the next iteration becomes *[(a+c) +c] +c*. The process is then repeated for the number of iterations required where at each iteration a *c* is added; this is in brief the concept of repetition

a becomes *a+c*,
a which is (*a+c*) iterates again to become ((*a+c*)+*c*)
then, ((*a+c*)+*c*) becomes ((*a+c*)+*c*)+*c*,
((*a+c*)+*c*)+*c* becomes (((*a+c*)+*c*)+*c*)+*c* and so on .....

In theory, this can continue forever. If we say *a* = 1 and *c* = 2, then the iterations are as follows: 1,3,5,7,9,11... until it reaches infinity. The statement that generates the Mandelbrot set, has the simple formula of *z* iterates to *c*, in this case *c* is a complex number.

A graph is created with real numbers along one axis and complex numbers along the other axis. Every point that is created on the plane is then iterated to $z = z^2 + c$. Therefore, when we take any number and multiply it by itself, repeatedly one of two things will happen. If *z* is greater than one, the

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

resulting number will get bigger and bigger until it becomes infinite. However, if *z* is a number between zero and one, the result will get smaller and smaller approaching closer to zero with iterations.

When graphed, the points on the Mandelbrot set which tend to go closer to zero as they are iterated are given the color black. On the other hand, the points that tend to go towards infinity as they are iterated are assigned a different color depending on how fast the number approaches infinity [13].

So if we want to implement this equation for hiding an image:

$$f(Z)=\begin{cases} Z_k^2+c & if\ K<i,j \\ Z_i^2+c & if\ K\ i,j>k \end{cases}$$

K is the number of image bytes where *i* and *j* are the width and height of fractal-image.

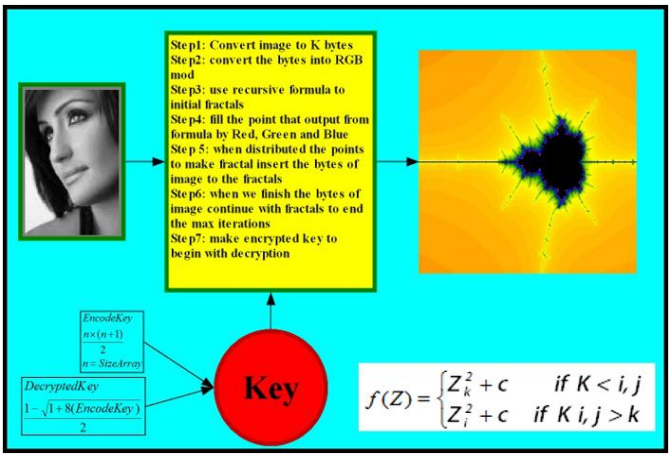


Fig. 2: Encode Image by fractals

IV. Implementation

To hide data into Mandelbrot set, the following steps are used:

1. Convert image into bytes.
2. Write the algorithm to draw Mandelbrot set using RGB model.
3. During the process of creating the fractal, imped the bytes of the image like value color into the fractal.
4. Use an encryption key to make steganography more secure.

The proposed algorithm was implemented using C#, C Sharp programming. First, the image was converted to a matrix of bytes, "Pix_Array". Then, the Mandelbrot fractal was implemented using the following steps presented in the pseudocode below:

Step 1: *i* =0 To fractalBitmap.Width DO
Step 2: *i* =0 To fractalBitmap.height DO
Step 3: Complex *c* = new Complex(*X1* + ((double) ((*X2* - *X1*) * *i*) / (double) fractalBitmap.Width), *Y1* + ((double) ((*Y2* - *Y1*) * *j*) /(double)fractalBitmap.Height));
Step 4: Complex *z1*= *z*
Step 5: Complex delta = *c*
Step 6: MaxIterations= *I*
Step 7: *count* < MaxIterations
z.Abs < 1000000
delta.Abs > 0.0000001
Step 8: *z* =*z* * *z* + *c*;
Step 9: *delta*= *z1* - *z*;
Step 10: *z1*= *z*;
Step 11: *count* = *count*+1;

A. Hide an image in a fractal

Now we want to distribute byte image array in the fractal so we use the same initial fractal algorithm to distribute it. Therefore, we replace one of the color component (RGB) for example red component pixel by byte from image and when we finish image byte array return to original pixel from a fractal.

Step 1: *i* = 0 to fractalBitmap.Width DO
Step 2: *i* = 0 to fractalBitmap.height DO
Step 3: Complex c = new Complex (*X1* + ((double)((*X2* - *X1*) * *i*) / (double) fractalBitmap.Width), *Y1* +((double)((*Y2* - *Y1*) * *j*)/(double) fractalBitmap.Height));
Step 4: *count* < MaxIterations
z.Abs < 1000000
delta.Abs > 0.0000001
Step 5: *z* = *z* * *z* + *c*;
Step 6: *delta*= *z1* - *z*;
Step 7: *z1* = *z;*
Step 8: if (*k* + 1==Pic_Array.Length - 1)
{color (int) ((double) count * 255/ (double)MaxIterations);
fractalBitmap.SetPixel(i, j, Color, Color, Color);}
else {fractalBitmap.SetPixel(*i*, *j*, Color, Pic_Array[*k*], Color);}

Fig. 3 shows an illustrated example for the hiding process.

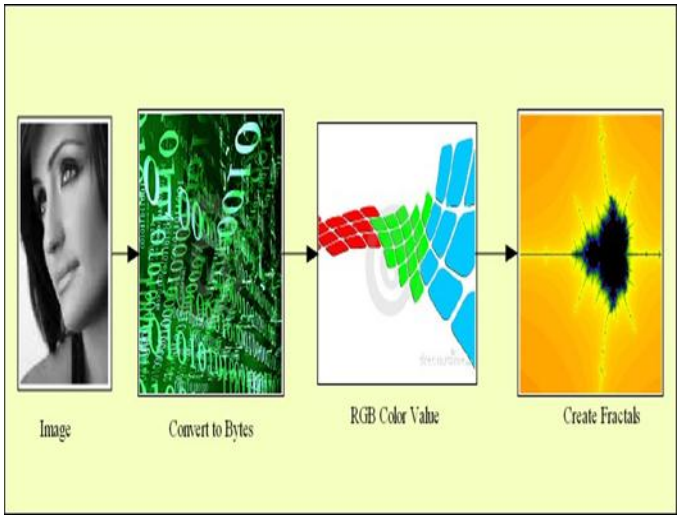


Fig. 3: Hiding image into Mandelbrot set

B. Extract the image using fractals

The same algorithm for hiding an image is used to extract it from fractals, the image bytes are extracted from the fractal-image that was generated by the Mandelbrot fractal.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Step 1: byte[] Pic_ArrayAfter=
x.imageToByteArray(imgAfterResult);
Step 2: *i* = 0 to fractalBitmap.Width DO
Step 3: *i* = 0 to fractalBitmap.height DO
Step 4: Complex *c* =new Complex(*X1* + ((double) ((*X2* - *X1*) * *i*) / (double) fractalBitmap.Width), *Y1* + ((double) ((*Y2* - *Y1*) * *j*) / (double) fractalBitmap.Height));
Step 5: *count* < MaxIterations
z.Abs < 1000000
delta.Abs > 0.0000001
Step 6: if (*prev_count*<>=*count*)
{ {if (*k* + 1==Pic_Array.Length - 1)
Pic_ArrayAfter[*k*]=imgAfterResult.GetPixel(*i*, *j*).G;
byte[] Pic_ArrayAfter_Last = new byte[*k* - 1];}
Pic_ArrayAfter=Array.Copy
(Pic_ArrayAfter,Pic_ArrayAfter_Last, *k* - 1);}

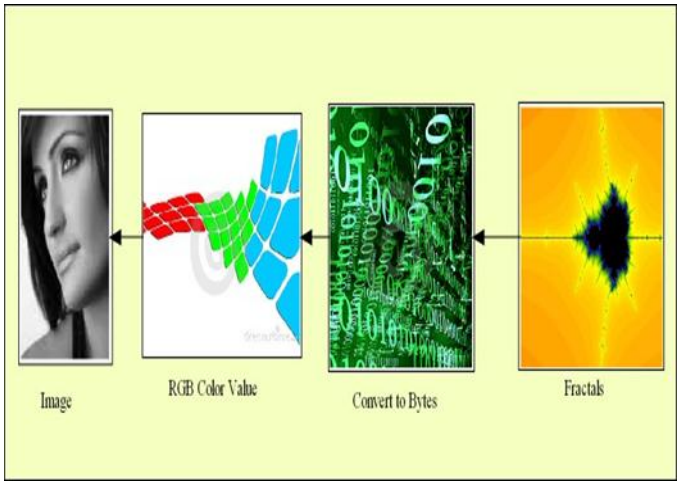


Fig. 4: Extract image from fractals

To test the proposed approach to hide an extract an image using Mandelbrot fractals three different attacks were used in order to test the effect on the hidden image. The three types of attacks used are, change image format, add some effects on the image and apply filtering on the image.

A. Change hidden Image Format

During the process of hiding an image, any image formats can be used. Similarly, after extracting the hidden image we can save it in any format we like. The hidden image in the fractal can be extracted and changed to any format with no loss of information except when it is extracted as jpeg.

B. Add any modification on hidden image

From experimentation, it was noticed that modifications of less than 60% to an image fractal would cause no effect on extracting the correct original image.

C. Use filtering on the hidden image

It is noticed, during experimentation, that using image-filtering tools on the hidden image fractal may cause loss of hidden image data. This is because filters usually modify the pixel values of the image.

V. Results and Discussion

The algorithm was applied to many types of image formats with different image dimensions, Table 1. It is found that the relation between time and dimension is exponential; Fig. 5, here, the time is measured in seconds. This is because it takes longer to complete the shape of the Mandelbrot set fractal, also the larger the dimension the more the computation for the iterations.

Table 1: The timing in seconds for hiding and extracting different image formats and dimensions.

Dim.	Hiding				Extracting			
	png	bmp	jpg	gif	png	bmp	jpg	gif
100x100	5.4	5.9	5.4	5.6	5.5	5.4	5.5	5.4
150x150	12.4	12.1	12.4	12.3	12.1	12.9	12.1	12.8
250x250	34.8	33.5	34.3	33.5	34.4	33.5	34.2	33.4
500x500	154	153	152	153	134	134	135	133
1024x1024	564	564	542	563	574	563	564	563

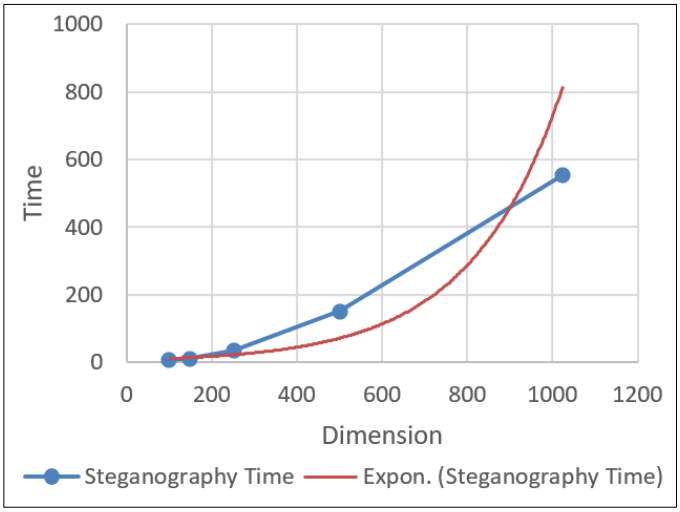


Fig. 5: Relation between Time and Dimension

VI. Conclusions

In this paper, Mandelbrot set fractals are used to hide and extract images. According to the experimental results, the use of Mandelbrot fractals is a very effective and secure method in hiding an image, as it is very difficult to reverse the transformation without using the correct values for number of iterations and extraction key. The results show that any type of image format can be hidden without any loss of information except if we change the hidden image to jpeg format, hidden images can tolerate changes up to 60% without any loss of information and the use of filtering may cause loss of image data due to the modifications in the pixel values. Finally, this work opens future research issues by further studying the effect of using jpeg format, also applying filtering to hidden images.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

REFERENCES

[1] Allen, J., "The CERT® Guide to System and Network Security Practices| Addison-Wesley," 2001.
[2] de Leeuw, K. M. M., & Bergstra, J. (Eds.), "The history of information security: a comprehensive handbook," Elsevier, 2007.
[3] Stallings, W., "Network security essentials: applications and standards," Pearson Education India, 2007.
[4] Stallings, W., "Cryptography and network security: principles and practices. Pearson Education India," 2006.
[5] Androulidakis, I. I. 2016. Confidentiality, Integrity, and Availability Threats in PBXs. In VoIP and PBX Security and Forensics (pp. 9-24). Springer International Publishing.
[6] Zhang, Z., & Zhang, W. 2012, Generation of fractal Chinese characters based on IFS. In Proc. of SPIE Vol (Vol. 8558, pp. 85580R-1). Chicago
[7] Peitgen, H. O., Jürgens, H., & Saupe, D. 1992. Limits and Self-Similarity. In Fractals for the Classroom (pp. 151-208). Springer New York.
[8] K. Thamizhchelvy , G. Geetha. Data Hiding Technique with Fractal-image Generation Method using Chaos Theory and Watermarking. Indian Journal of Science and Technology, Vol 7(9), 1271â€"1278, September 2014.
[9] Yue Wu , Joseph P. Noonan. Image Steganography Scheme using Chaos and Fractals with the Wavelet Transform. International Journal of Innovation, Management and Technology, Vol. 3, No. 3, June 2012.
[10] Prof. Dr. Tawfiq Abdulkhaleq Abbas, Hassanein Karim Hamza. Steganography Using Fractal-images Technique. IOSR Journal of Engineering (IOSRJEN) ISSN (e): 2250-3021, ISSN (p): 2278-8719 Vol. 04, Issue 02 (February. 2014), ||V2|| PP 52-61.
[11] Nadia M. Al-Saidie & Thanaa A. Kadhim. Using Fractals in Information Hiding. Eng. & Tech. Journal ,Vol.27, No.16,2009.
[12] https://en.wikipedia.org/wiki/Mandelbrot_set ,accessed on 25 Jan 2017.
[13] Beardon, A. F,"Iteration of rational functions: Complex analytic dynamical systems (Vol. 132),". Springer Science & Business Media.2000.

Mustafa M. Auda Has a Master Degree in Computer Science from Albalqa University, Jordan, currently. He is a lecturer at Taibah University, Saudi Arabia. His research interests are in the areas of Information Security, Steganography, Data Mining, Pattern Recognition and Image Processing.

Minimize Delay based Routing Protocol (MDRP) for V2V Communication in VANETs

Babu Ram and Dr. Neelendra Badal
Department of Computer Science & Engineering
KNIT, Sultanpur, India
Baburam748@gmail.com, n_badal@hotmail.com

***Abstract*-- The day by day size of city and number of vehicle on the road rapidly increasing, so vehicle to vehicle (V2V) communication networks size keeps on increasing. Vehicle consists of nodes which can act as host as well as router. With the high speed movement of vehicles the configuration of network keeps on changing. So new issues in dynamically change of scenario of routes: one has to devise for appropriate mechanisms, and deployment for determining new routes for vehicle to vehicle communication. In this paper we propose conceptually a routing protocol for VANETs for minimizing time for searching process for new routes as well as minimize the overhead consequently and improving the performance of VANETs.**

KEYWORDS*: VANETs, Backtracking, overhead, V2V*

I. INTRODUCTION

In VANETs, vehicle to vehicle (V2V) reside in a peer to peer fashion and it is connected to each other through single hop as well as multi hop paths. Basically each vehicle acts as an autonomous body in VANETs and these vehicles are involved in route search and route management process. In VANETs V2V communication don't have a fixed infrastructure because random motion of vehicles. Mobile adhoc networks (MANETs) nodes are connected single hop as well as multihop communication path but vehicular adhoc networks nodes are connected single hop, multihop or vehicles are directly connected road side unit. The topology of the vehicular networks keeps on changing very rapidly so calls for new routes and these further demands for increasing maintenance overhead.

However maintaining and discovery of routes is always very difficult task because it is not only the destination node changing its location but also the source node also changing location and in this scenario it again has to deploy from beginning a destination discovery process for finding out a new routing path. Also the path from destination to source in reply process is dynamic which call for similar attention. The routing protocols in vehicle to vehicle communication are based on push-pull strategies which involve greater routing and control packets overhead. This is possible only when enhanced bandwidth which in turn degrades the throughput of overall system. Therefore the effective bandwidth utilization is of prime concern and maintain throughput of all system. Various routing protocols have been devised which have been categorized in three types namely Table Driven Routing, On Demand Routing and Hybrid Routing protocols. Table Driven Routing Involves periodical maintenance of table and this incorporates additional overhead other than routing issues.

On Demand Routing don't need to maintain the tables which reduce the overhead of table maintenance but Packets are communicated in request reply fashion which considerably wastes network bandwidth. In On Demand routing protocol the searching process for new routes is time taking. Hybrid Routing incorporate the better features of both the On Demand and Table Driven Routing protocol. This helps in high level scalability of adhoc networks.

The main objective of this paper is to minimize time for searching process for new routes as well as minimize the overheads involved in route discovery and there after route maintenance..

After this introduction we have given related work in section 2, proposed routing protocol in section 3, performance analysis in section 4 and finally the conclusion and future work in last section 5.

II. RELATED WORK

Routing is a process of sending data packets from source node to destination node, therefore routing in vehicular ad-hoc networks is a critical issue because rate of link failure is high when node is moving fast. we introduce some design goal of routing protocol, first is minimum control of overhead, second is minimum processing of overhead, third is multi-hop routing capability, fourth is dynamic topology maintenance and fifth is distributed routing approach and last scalability, security and quality of service (QoS) etc. Any single protocol not well works in all environments. There are a number of routing protocols existing in various networks such as AODV (Ad-hoc On Demand Distance Vector routing), DSR (Dynamic Source Routing), DSDV (Destination Sequenced Distance Vector routing), FSR (Fisheye State Routing) and some protocols regarding

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

minimization of control overheads mentioned above are DREAM , FSR, MMWN , CGSR , HSR , OLSR ,etc. However again we have some disadvantages in these protocols. Distance routing effect algorithm for mobility (DREAM) [16] requires GPS facility, Fisheye state routing (FSR) [17] reduces accuracy considerably, Multimedia support in mobile wireless networks (MMWN) [18] involves complex mobility management and cluster maintenance, Cluster-head gateway switch routing (CGSR) [11] involves cluster formation and maintenance, Hierarchical state routing (HSR) involves high degree of location management and finally Optimized link state routing (OLSR) [13] disadvantage lies in the fact of 2-hop neighbor knowledge requirement. Bo Zhang and Xiaohua Jia[1] have proposed a protocol for structures for IVANETs with minimize number of roadside Asses points. Kaizhe Hou et al. [2] proposed protocol for packet loss rate is very high between car to car communications when using a fixed value as transmission range. Celimuge Wu et al. [3] proposed protocol for common backbone vehicles for different traffic flows, a high packet delivery ratio and minimize overhead and delay. Xianghui Cao et al. [4] proposed protocol for improve the delay performance of VANETs depend on fifth generation device to device (D2D) technology.

There are also several protocols implementing Reactive Routing (On-demand routing). Ad hoc on-demand distance vector (AODV) is adaptable to highly dynamic topologies however include some scalability issues and large delays. Dynamic source routing (DSR) provides multiple routes but again the disadvantages of AODV are also prevalent here. Light-weight mobile routing (LMR) and Temporally Ordered Routing Algorithm (TORA) [13] provide multiple route but these routing loops are temporary. Associativity-based routing (ABR) [15] and Signal stability adaptive (SSA) provide route stability but ensure some scalability problems. Relative distance micro-discovery ad hoc routing (RDMAR) [16] ad Location-aided routing (LAR) [17] are based on localized route discovery but since no prior information between nodes are available hence flooding concept is utilized. Ant-colony-based routing algorithm (ARA) has low overhead whereas Flow oriented routing protocol (FORP) [5] employs route failure minimization technique. However both employ flooding based route discovery process.

In summary, above several protocol implementing Hybrid Routing. Zone routing protocol (ZRP) has the facility of reduced retransmission but overlapping zones. Zone-based hierarchical link state (ZHLS) works with the concept of Single Point Failure. Scalable location update routing protocol (SLURP) employs location discovery using home regions. Both ZHLS and SLURP have drawback that they require static zone map. Distributed spanning trees based routing protocol (DST) has same advantages of ZRP and has a Single Point Failure due to root node concept. Finally we have Distributed Dynamic Routing (DDR) [7] which has no zone maps which removes several hurdles in routing and the only problem which may arise is that of preferred neighbors which may become bottlenecks.

All these routing protocols might be unicast or multicast in nature. If we have a look over the development scenario of these routing protocols we find that the GSR is derived from the well-known traditional link state and distance vector algorithms and maintains the network connectivity proactively. Hybrid routing protocol is based on both reactive protocol where it maintains inter-zone information as well as proactive protocols where it maintains intra-zone information. Now if we use the GPS we can also make flat addressing even more effective and better manageability. DREAM is one such protocol deploying this method because here the nodes exchange only location information rather than complete link state or distance vector information. DSR and AODV come under On Demand routing and have to face with the scalability problem. To cope up with this problem we can localize the control message propagation to a defined region.

In next section we propose an algorithm for minimizing the constraints of above dealt in algorithms.

III. PROPOSED ROUTING PROTOCOL

The main objective of Minimize delay based Routing Protocol (MDRP) is to remove the overheads involved in On Demand routing protocol. This protocol we use the backtracking method which arises each time any link fails in the network and the size of the routing table is also reduced because more size of routing table take more processing time. Every vehicle maintains the information regarding only those vehicles which are in its range rather than of all vehicles.

Algorithm: Minimize Delay based Routing Protocol (MDRP)

1. S is source node (vehicle) and D is destination node (vehicle).
2. Flag bit = 0
3. Create Array N[i][j]

/* ArrayN[i][j] indicates the distance from vehicle i to vehicle j and distance must be within the range of vehicle i. */

4. Sort array N[i][j]

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

/* sorting Array N[i][j] on the basis of their distance from vehicle i. */

Request (D)

5. Select a minimum path S to D_i

/* D_i is precedent node of the destination node D */

6. If D_i is not updated by destination node (D) then go to step-3
7. Set Flag bit =1 and deliver the request to destination node (D).

Reply(S)

8. Select minimum distance node (M)

/* M is temporary node treated as destination node */

9. If M is source node S then go to step-11
10. Remove entries from Array and go to step-8
11. END

Vehicle S is the source node whereas vehicle D marks the destination node. We use a data structure (Array) for storing information of each vehicle's identity (V-node ID) for the nodes in the route from source to destination. We also maintain a neighborhood table with the fields (V_id, V_dist) for maintaining distance from source to destination. Where V_id represents source node identity and V_dist represents destination node.

Neighbor nodes always are in the range of solicitous node. The distance between two nodes depends upon the duration of time of sending the RREQ (Route Request) and time of receiving the RREP (Route Reply). According this distance we sort the nodes distance and maintain the routing table.

This algorithm selects a minimum path from source node S to node D_i, where D_i is precedent node of the destination node D. If D_i remains updated, which means that destination vehicle moves one place to another place and then we treat D_i as temporary source node and start route request procedure in this protocol. By performing this procedure algorithm minimize the backtracking concept to reasonable level. All these steps are followed recursively, and finally reach the destination node D. All procedures also maintain the information of each and every vehicle, basically their ID store in the data structure; traversed between the Source node vehicle and destination node vehicle.

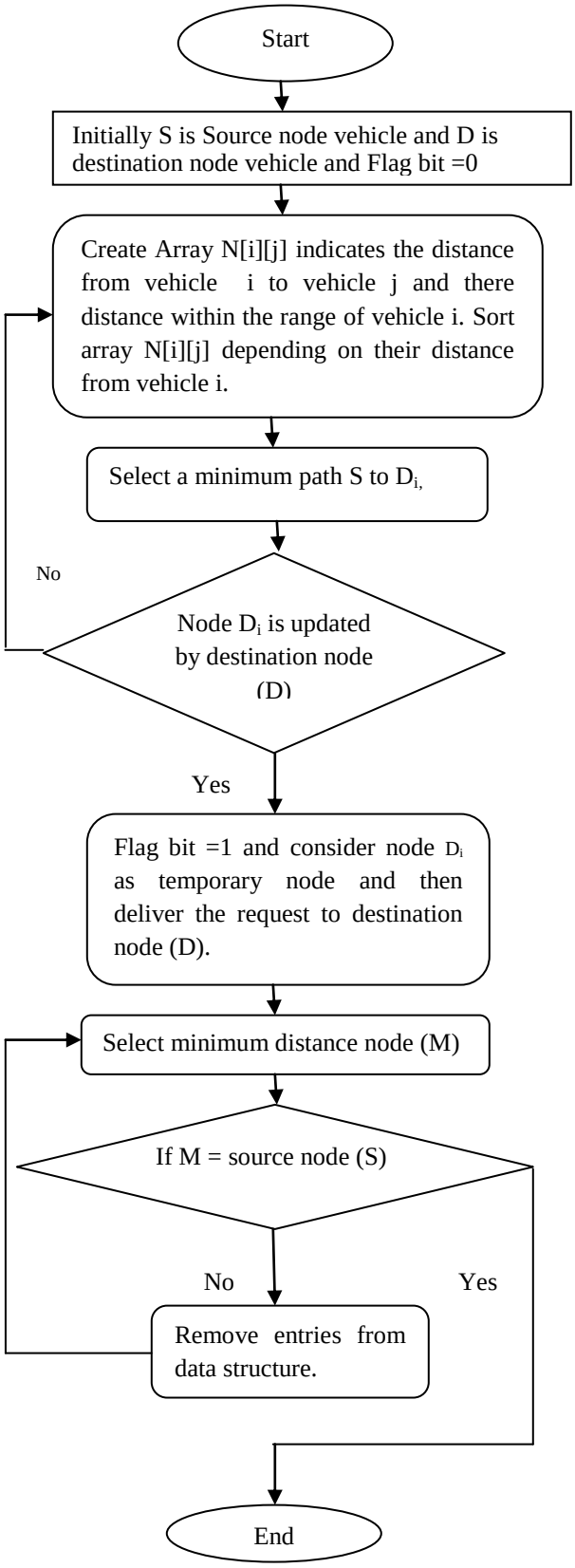


Figure 1: Flow chart of MDRP

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

When destination vehicle received the data and node identifications of traversed node's data structure then start the route reply procedure (RRP).The RRP procedure chose the common nodes between the received data structure and those within the range of destination vehicle D. Now select minimum distance node (M) and entry from the data structure for node (M) is removed. M is now treated as destination node and same procedure apply again and again. This process continues recursively while we get to the source node. In all above process node M acts like as a node D.

Table: 1. Used Parameter

Parameter	Description
S	Source node vehicle
D	Destination node vehicle
(V_id, V_dist)	distance from vehicle source to vehicle destination
D_i	precedent node of the destination node D
Node (M)	M is temporary node treated as destination node
N[i][j]	Array N[i][j] indicates the distance from vehicle i to vehicle j and distance must be within the range of vehicle i.

IV. PERFORMANCE ANALYSIS

In this section, The MDRP algorithm has been implemented in NS-2[19] and road map is generated using SUMO. The results of MDRP protocol are compared and analysis in term of number of vehicle, distance, time and hop count. In Vehicular ad hoc networks the vehicles are not static in nature but moving very fast 120 km/h which causes the topology of the network change very fast. This may cause the destination of vehicle node to move rapidly. In MDRP algorithms to start from the very beginning but here we come up with the concept of temporary vehicle node. In simulation environment we used topology 20km long 4 lane one-way road map, number of vehicle 10 to 300 per kilometer, packet size for data is 512 bytes, IEEE 802.11 P MAC(12 Mbps),vehicle speed maximum 120 km per hour and simulation time 500 second.

From the given figure 2: this paper represents comparison between existing technique AODV, A Backbone-Based Approach (ABBA) [3] and proposed technique Minimize delay based Routing Protocol (MDRP). The proposed MDRP algorithm represents improvement over the existing algorithms. From the given figure 2: this paper concludes that the proposed MDRP algorithm has better successful transmission, and reduces overhead.

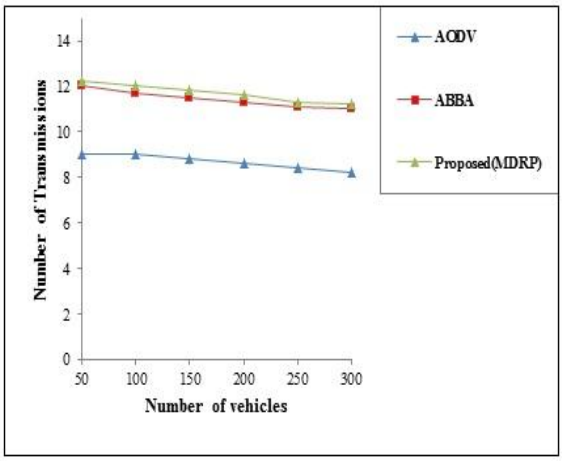


Figure 2: compression for number of vehicles and successful transmission

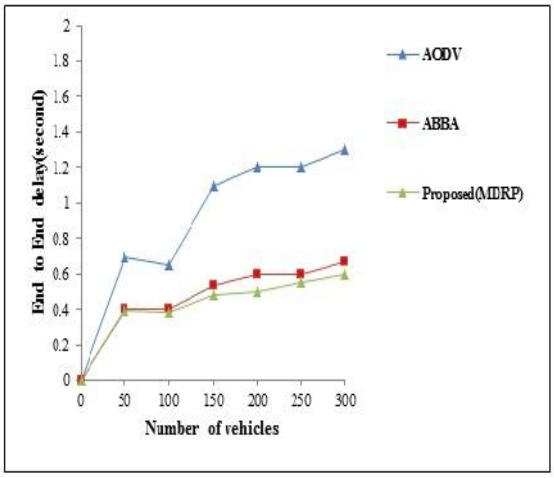


Figure 3: node to node delay

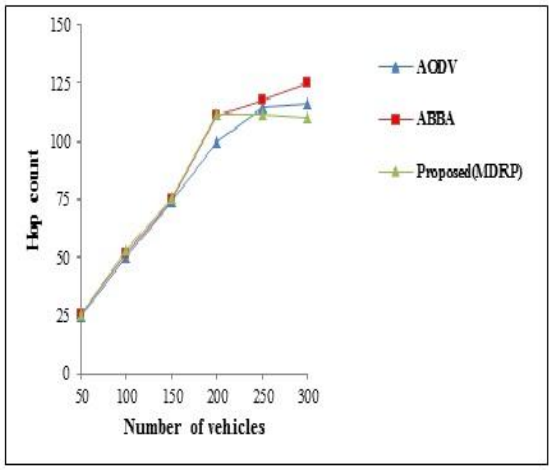


Figure 4: relation between numbers of hop count and number of vehicles

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

From the figure 3: The proposed algorithm MDRP represents the comparison between existing ADOV, A Backbone-Based Approach (ABBA) [3] and proposed algorithm on the number of vehicle and node to node delay. The proposed algorithm shows better result in compare to the existing algorithm. This algorithm reduces the communication delay in compare to existing algorithm hence performance will enhance. In figure: 4 we show the relation between the hop count and number of vehicle (also called number of node). When number of vehicle s increase it increases the time in generally but however after the simulation using ns-2 we found that in MDRP algorithm, when number of vehicle increase in the network then in that case the time will remain stabilized because number of vehicle increase because at that particular point the hop count will remain fixed.

V. CONCLUSION

This paper has developed a Minimize delay based routing Protocol (MDRP) for V2V Communication in VANETs for minimizing the overheads in route maintenance and route discovery. This paper minimizes the backtracking concept up to a level. The network size increases without hindering the performance. The system overall performance thus increase and it is more capable of providing service effectively. The testing of Minimize delay based routing Protocol (MDRP) for V2V Communication in VANETs with very large network has not been undertaken and this lies as a future work for researchers.

REFERENCES

[1] Bo Zhang and Xiaohua Jia,"Design of Analytical Model and Algorithm for Optimal Roadside AP Placement in VANETs," IEEE Transactions on Vehicular Technology, Vol. 65, No. 9, September 2016

[2] Kaizhe Hou, Jianming Hu, Yizhi Wang and Danya Yao, "A new index in vehicular ad-hoc networks connectivity analysis based on generalized packet loss rate model," 12th World Congress on Intelligent Control and Automation (WCICA), ISBN: 978-1-4673-8415-5, June 12-15, 2016, Guilin, China

[3] Celimuge Wu, Satoshi Ohzahata, Yusheng Ji and Toshihiko Kato, "How to Utilize Interflow Network Coding in VANETs: A Backbone-Based Approach," IEEE Transactions on Intelligent Transportation Systems, Vol. 17, No. 8, August 2016

[4] Xianghui Cao, Lu Liu, Yu Cheng, Lin X. Cai and Changyin Sun, "On Optimal Device-to-Device Resource Allocation for Minimizing End-to-End Delay in VANETs," IEEE transactions on vehicular technology, Vol. 65, No. 10, October 2016

[5] Yue Cao, Ning Wang, Zhili Sun and Haitham Cruickshank, "A Reliable and Efficient Encounter-Based Routing Framework for Delay/Disruption Tolerant Networks," IEEE Sensors Journal, Vol. 15, No. 7, July 2015

[6] Yanmin Zhu, Qingwen Zhao and Qian Zhang, "Delay-Constrained Data Aggregation in VANETs," IEEE Transactions on Vehicular Technology, Vol. 64, No. 5, May 2015.

[7] Yi Zhu, Lixing Song, Shaoen Wu, Honggang Wang and Chonggang Wang , "Cooperative Stepwise Relaying and Combining for Multihop Vehicular Wireless Communication," IEEE Transactions on Vehicular Technology, Vol. 64, No. 6, June 2015.

[8] Dmitry Zelikman and Michael Segal, "Reducing Interferences in VANETs," IEEE Transactions on Intelligent Transportation Systems, Vol. 16, No. 3, June 2015

[9] Fang Liu, Zhiyong Chen and Bin Xia, "Data Dissemination with Network Coding in Two-Way Vehicle-to-Vehicle Networks," IEEE Transactions on Vehicular Technology, Vol. 60, No. 2, July 2014.

[10] Jacek Rak, "*LLA*: A New Anypath Routing Scheme Providing Long Path Lifetime in VANETs," IEEE Communications Letters, Vol. 18, No. 2, Feb 2014.

[11] Shilpi Dhankhar and Shilpy Agrawal, "VANETs: A Survey on Routing Protocols and Issues," International Journal of Innovative Research in Science, Engineering and Technology, ,Vol. 3,Issue 6, June 2014.

[12] Haigang Gong, Lingferi Yu, Ke Liu Fulong Yu and Xiaomin Wang," Latency Estimation based Data Delivery Scheme for Vehicular Ad-hoc Networks," International Journal of Distributed Sensor Networks, Vol.2012(2012) Article Id. 527097,2012

[13] Georgios Karagiannis, Onur Altintas, Eylem Ekici, Geert Heijenk, Boangoat Jarupan,Kenneth Lin, and Timothy Weil, "Vehicular Networking:A Survey and Tutorial on Requirements,Architectures, Challenges, Standards and Solutions," IEEE Communications Surveys & Tutorials, Vol. 13, No. 4, Nov 2011.

[14] Jose Santa, Antonio F,Go. Mez-Skarmeta and Marc Sanchez-Artigas, "Architecture and evaluation of a unified V2V and V2I communication system based on cellular networks," Computer Communications Journal, Vol. 31, pp. 2850-2861, 2008.

[15] Hannes Hartenstein, "A Tutorial Survey on Vehicular Ad Hoc Networks," IEEE Communications Magazine, June 2008.

[16] Bhadauria, S.S.; Shrivastava," A wireless ad-hoc network: Design and performance evaluation of dynamic routing model ", International Conference on Recent Advances in Microwave Theory and Applications, 2000, pp. 546 – 549.

[17] S. Barghi, A. Benslimane, and C. Assi, "A lifetime-based routing protocol for connecting vanets to the internet." in WOWMOM. IEEE, 2009, pp. 1–9.

[18] Detti, A. Blefari-Melazzi, N. Loreti, "Overlay, Boruvka-Based, Ad-Hoc Multicast Protocol: Description and Performance Analysis", International Conference on Communication, 2007, pp. 5545 – 5552.

[19] Network simulator 2 (ns2). [Online]. Available: http://www.isi.edu/nsnam/ns/

[20] A. K. Saha and D. B. Johnson, "Modeling mobility for vehicular ad hoc networks," in Proc. 1st ACM Workshop VANETs, Oct. 2004, pp. 91–92.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Dr. Neelendra Badal is an Associate Professor in the Department of Computer Science & Engineering at Kamla Nehru Institute of Technology, (KNIT), at Sultanpur (U.P.), INDIA of Uttar Pradesh Technical University, (UPTU), Lucknow (U.P.) INDIA. He received B.E. (1997) from Bundelkhand Institute of Technology (BIET), Jhansi (U.P.), INDIA, in Computer Science & Engineering, M.E. (2001) in Communication, Control and Networking from Madhav Institute of Technology and Science (MITS), Gwalior (M.P.), INDIA and PhD (2009) in Computer Science & Engineering from Motilal Nehru National Institute of Technology (MNNIT), Allahabad (U.P.), INDIA. He is Chartered Engineering (CE) from Institution of Engineers (IE), India. He is a Life Member of IE, IETE, ISTE, CSI, India. He has published more than 65 papers in International/National Journals, conferences and seminars. His research interests are Distributed System, Parallel Processing, GIS, Data Warehouse & Data mining, Software engineering and Networking.

BABU RAM received his M.Tech degree from NIT Hamirpur in Computer Science & Engineering and B. Tech. degrees in Computer Science & Engineering from Govt. Collage of Agriculture Engineering and Technology Etawah. He is currently pursuing Ph.D. at the Department of Computer Science & Engineering, Kamla Nehru Institute of Technology (KNIT) at Sultanpur (U.P.), INDIA. His current research areas of interest include mobile computing, mobile ad hoc networks and wireless sensor networks. He has published more than 6 research papers in International journals & conferences in these areas.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Interactive Science Learning using Handheld –AR

Nivedha.S[1]
Assistant Professor,
Department of Computer Science and Engineering
Karpagam College of Engineering,
Coimbatore- 641 032
nivedha.nivi6@gmail.com

Hemalatha.S[2]
Assistant Professor,
Department of Computer Science and Engineering
Sri Shakthi Institute of Engineering and Technology
Coimbatore-641 062
hemalatha@siet.ac.in

Abstract **-**Current Education system is rapidly growing in complexity, uncertainty, size, and interdisciplinary characteristics. Number of students complains that there exists a lack of engagement and interaction with the learning environment. A major issue is that most of the teachers rely on traditional aids for teaching and it includes very little visual information. According to a number of recent surveys, these traditional techniques are considered as less interactive. Apart from the class room, the engagement of student with the study material is almost nonexistent. At the same time, the influence of smart phones in every aspect of daily life has changed students' view of learning and their expectation about the Study materials' presentation. Smart phones have all components that are required to implement an Augmented Reality (AR) application, where the virtual 3D Objects are superimposed on the real world.
The paper proposes an innovative mobile based application for learning that uses AR, thereby creating an interactive interface for students. The AR based application increases their interest of learning new things by exploring the 3D Objects. This app is also designed to support the touch based interaction with the 3D Objects. This new learning environment helps the students to develop an in-depth understanding of the subject and other operational issues.

Keywords: Application, Augmented Reality, smart phones, learning environment

I. INTRODUCTION

AR is a technology where physical world merges with virtual world, creating an improvised environment for its users. AR is a great tool to visualize complex data, but to be used in applications that benefit from a merger between the digital and physical world [9]. The goal is to evaluate the use of AR in learning processes for School students. AR can be applied to Education, for the reasons listed below:

- AR supports seamless interaction between virtual and real environments.
- AR allows using a touchable interface for object manipulation.
- AR provides the ability to transit between virtual environment and reality.

Augmented Reality application can also be used as a learning tool in which students are able to build conceptual models on which, it includes both new content and consistent with what they already understand. Such that models can be improvised by integrating information with 3Dimensional representations. It includes diagrams, 2D images, audio and text annotations. AR can improvise the learning experience using traditional aids:

- The ability to understand the ideas and concepts through interaction.
- Making mistakes during the AR learning process will literally have no real consequence whereas in traditional learning, failure to follow precautions or rules would lead to serious health and safety related problems.
- AR supports discovery-based learning, which is a learning method in which students can control their own learning environment, acquire knowledge and use that in experience scenarios.[11]

II. AR IN HANDHELD DEVICES

AR systems depend on technologies that recognize and track the physical world around us with the goal to visualize and render virtual objects in it. The architecture of AR systems differs and can be categorized depending on the scene capturing, user interaction, detection/tracking method and visualization (Figure 1).

Figure 1: Mapping of different Augmented Reality systems.

The scene capturing can be done using wearables (e.g. HMD, Google Glass) or handheld devices (e.g. tablets,

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

smart phones). The detection and tracking methods includes the use of GPS, inertial tracking, compass (using accelerometers and gyroscopes), optical tracking (marker-based or marker-less) or magnetic tracking (using magnetometers). The visualization can be done using video see- through (video stream and opaque HMD), optical see-through (transparent HMD), monitor based, projector based technologies (projections onto real world objects). This proposed work focuses on Physical interaction with optical detection using handheld devices. The optical tracking and detection perceives the world through a camera, e.g. a smart phone camera, and the detection can be made using marker-based or marker-less techniques.

2.1 MARKER-BASED SYSTEM ARCHITECTURE

The Proposed work is done based on Marker-based System which includes interaction with optical detection in handheld devices. The general approach of marker-based system is illustrated in Figure 2.

Figure 2: The process of an AR marker-based system.

Preprocessing

The images that are preprocessed are taken from the camera's stream. In order to process images an image binarization is made [4]. The binarization operation makes sure that every pixel is either 0 or 1 and is performed using a thresholding algorithm. It applies one threshold to the entire image, making a pixel white or black depending on given value. This method is highly dependent upon the intensity and lighting changes. Other method is Adaptive thresholding which uses different thresholds depending on patches of image, making it robust against different lighting conditions.

Marker Detection

The detection method will depend on the design of the marker. Square markers are detected searching for contours and lines Suzuki [16] proposes one contour detection algorithm for square based markers on which the markers are four-sided quads with a black border. If the detected lines are contours, or if they belong to a quad, they are stored as marker candidates together with their corresponding corners. The detection can be done in different ways .If a candidate fulfills the requirements it is stored as a marker.

Identification

Once the marker detected, the code contained within it is extracted to check validity of the marker. The information encoded from the marker is an ID number which is used to connect the marker to certain meta-data. The square markers are divided into smaller squares. To be able to extract the code the perspective projection of the marker needs to be removed. Marker systems use Hamming distances for error correction.

Tracking

The tracking plays a main role to make the augmentation feel in a seamless way. Tracking meant to be the camera pose that is being calculated for each frame. The camera pose describes the relation between the marker and camera and used to position the virtual objects. It will return a transformation matrix which includes a rotation and translation.

Visualization

The final process is to position the virtual objects in the physical world. This is done using transformation given by the pose estimation.

2.2 DIFFERENT TYPES OF AR SDK'S -COMPARISON

The potential of AR have resulted in, companies to start developing the complete AR solutions targeting developers. An independent AR application developing organization has listed the top AR SDKs for developing mobile AR applications [2]. The various specifications can be found at the AR World Expo's website [2].

Qualcomm Vuforia: Vuforia is a software platform offering solutions for AR developers [12]. Vuforia supports both Android and iOS. The SDK is free to use and free to publish with. The SDK allows the tracking of 2D images, markers and text. Vuforia offers an extension to Unity3D, a tool used as a rendering engine to visualize the virtual objects.

Metaio SDK: Metaio SDK is a complete AR solution which is meant to handles both rendering and tracking [8]. Metaio supports both Android and iOS. It requires licensing to be used without a watermark. Metaio detects 2D images, location and 3D objects using NTF, GPS and SLAM, respectively. The SDK further allows the use of 2D barcodes and QR-codes. One special feature Metaio has implemented and patented is to add a sense of gravity to the augmented objects. Metaio does not have the large developer community that Vuforia offers. Metaio could be integrated with Unity3D for the visualization and rendering of virtual objects.

Wikitude SDK: Wikitude support detection of location and 2D images [18]. The tracking uses GPS or NTF respectively. The system runs on iOS, Android and Blackberry, but it requires licensing.

Layar SDK: Layar tracks 2D images and location using GPS or NTF respectively [7]. It runs on Android and iOS which requires licensing.

13th Lab Point Cloud: 13th Lab is a small Swedish company that is exploring SLAM to handle marker-less AR [10]. The system runs on both iOS and Android, it require

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

licensing. 13th Lab could also be integrated with Unity3D to render and visualize virtual objects.

Vuforia SDK and Unity3D

By comparing the above AR marker-based systems and SDKs, a system for the implementation would be Vuforia SDK and Unity3D. Since it satisfies the following requirements:

- Track and detect markers in real time on a mobile device;
- Allow for occlusion management during tracking;
- Extended tracking;
- Allows interaction;
- Can have small, unobtrusive markers.

Vuforia's SDK includes different recognizable real world objects, called trackables [12]. The tracking and detection algorithm uses Natural Feature Tracking and Detection, which allows the system to match elements in the image with targets in a predefined set. Different elements have different ease of being recognized. The current trackables that Vuforia handles are cylinder targets, frame markers, image targets, multi-targets and words. When the marker is detected, Vuforia returns a trackable result which includes the references to the matching target, and a status for it and the position matrix. The position matrix represents orientation and the current location of the marker with respect to the camera's coordinate system. The content rendering can be done using Unity3D. Vuforia provides an extension package to Unity that allows developers to use vision tracking and detection within the Unity IDE. Unity is originally a cross-platform 3D game engine [17]. It allows for the creation of simple geometrical objects such as cubes, spheres or rectangles, but it is essentially a tool to enable the behavior of 3D models imported from 3D programs. The behavior of the models is specified using scripts written in either C#, JavaScript or Boo.

III. PROBLEM WITH CURRENT TEACHING / LEARNING METHODOLOGY

Traditional teaching methods are used in most of the educational institutions in India on which teachers or instructors explain the concept to the students with the help of blackboard and chalks. Every important point regarding the subject is written in it and students make note of it. Even though some of the Instructors prefer graphical or contextual information like animations, PowerPoint presentation, 3d objects etc., for their presentation, they are available in classroom alone. Other than classroom, Students lack interest in learning due to the impact of Smart phones and lack of engagement with the self study material. Modern teaching methods have various advantages over traditional teaching methods [11]. These points can also be viewed as drawbacks of Traditional teaching methods-

- Modern teaching method creates more interest with the help of interesting 3d models and animations.
- Recent Survey has shown that use of visual media for learning helps the students to understand the subject better.
- Modern teaching methods are less time consuming.

3.1 SURVEY ON SCHOOL STUDENTS

To get the Students opinion or view about their learning environment, an initial level Survey was conducted. The main objective of the Survey was to compare the Traditional Teaching methods and AR –based learning approach. Figure 3 shows the results of the survey Conducted. Survey includes two sections. Section A describes about the Traditional Teaching -learning approach and Section B includes AR–based Learning which was obtained (Description of Section B was in VI Section). Section A includes the following questions.

- Q1: I learn better while experiencing a collaborative setting where I can play a role in the learning process?
- Q2: Do you understand the concept in detail in traditional teaching methodologies?
- Q3: Is the traditional teaching methodologies feels more time consuming?
- Q4: I learn better when instructor uses 3Dimensional representation or visualization technique to teach?
- Q5: Apart from classroom, I have interest in using the Study material?
- Q6: I get bored when, I use traditional learning materials.
- Q7: The use of the traditional learning materials improved my interest in this course.

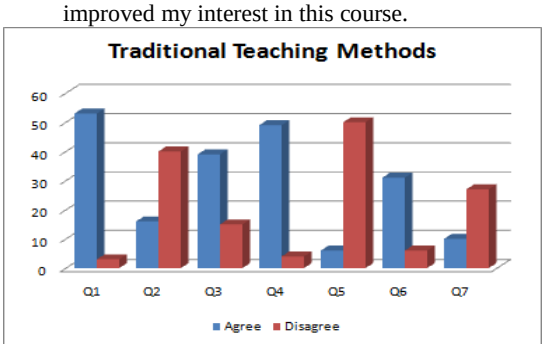


Figure 3: Survey on Traditional teaching methods

From the above results (Figure 3), it clearly shows that the concept or information delivered was less understandable in Traditional Teaching methods. Precisely, the Students opinion was, the traditional teaching method was more time consuming and 90% of them learn better when instructor uses 3D visualization or representation to teach and they feel that the practical app is more interactive. Treagust and Mills (2003) discussed that most of the students were graduating with descent knowledge of fundamental science, but they don't have exposure to apply that knowledge in practice. One among the fastest emerging technologies in education is visualization. However, none of the Traditional teaching techniques are capable of effectively conveying concept on every aspect of a subject.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

IV. INTERACTIVE LEARNING AR APP

The major issue with current teaching/learning environment is lack of engagement of students. By presenting the object in graphical or textual format, the user's view enhanced beyond the normal experience. The addition of such computer generated information (Virtual objects) can help in the performance of several engineering and scientific tasks. For this main reason, it remains to be research area for many years. AR is not as same as Virtual Reality (VR) since it completely replaces the real world. It can also be stated as the real world is supplemented with virtual data, and thus virtual and real objects coexist in an augmented surface. Major advantage of AR is that the view of the real world is used as a background for displaying superimposed virtual data.

An AR user needs to overlay and create a object that needs to be enlarged onto the real world environmental view. At the same time, by bringing the visualization onto the real world, the user will become part of the AR experience and hence, they can interact with both virtual and real objects [11]. Physical interaction in AR is different from animated work, since the virtual object is superimposed on to reality. Advancements in AR are related to tracking and detection [9], but the tangible interaction with the virtual objects in AR surface is limited to touch-screen and it remains a challenging and emerging area to have a interaction between the augmented surface and user. Initially, Image processing techniques were used for gesture recognition using a single camera. Later on it was extended to touch based direct physical interaction, but still there exists an occlusion in user's view.

4.1 SYSTEM DESIGN

The System Design describes the general AR work flow (Figure 4) to display the virtual object using an Interaction Engine. Initially for displaying virtual information over the Target image, can be made by mapping a particular object to it. When an image target is tracked or detected by the application, object that is mapped gets displayed virtually over the image target. The virtual object position and size in the target image should be distinct in such a way that object should be exactly rendered on the target. Next step is to touch, move or to rotate the virtual object; Movement of the object can be done using scripts written in C# or Java. This would control the motion or behavior of the virtual object [9]. It requires getting the current location or position of the virtual object on the scene based on the camera pose. Vision based tracking usually shows the camera image as background and superimposes the objects into the image. Therefore it is always a need to gain the location or position of the camera in relation to the object that is to be augmented. The 6 DOF of the camera have to be determined. These are all referred as extrinsic data. The parameters, which incorporate the behavior of the lens, can be referred as intrinsic parameters.

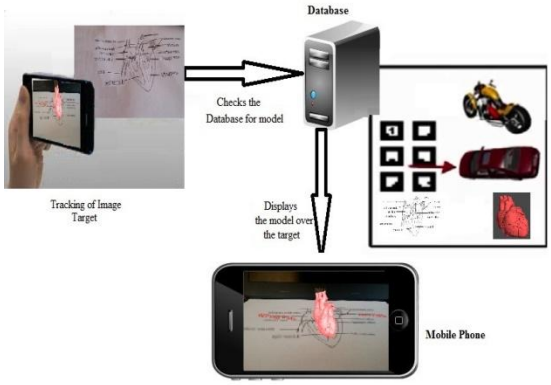


Figure 4: Working of AR

System determines the pose, and it is passed to the 3D engine, which renders the objects to be superimposed on the camera tracked image. Hence, by knowing the extrinsic data and it`s characteristics the 3D engine can virtually take the same position as the real camera preview. The coordinates of both virtual and real World have to be congruent.

V. IMPLEMENTATION

Implementation of Science based learning AR application for school students is the main objective of the paper. This proposed work focuses on Biology book of 12th standard students. Having AR based Biological Structure for learning process makes the students to learn Science in an easy and interactive way. By presenting the concept in graphical format, makes the view of user to be enhanced. Application includes three modules. Initially display virtual imaginary object over the target image. Second, Displaying object with Parts. Finally rotate the virtual object along y axis (physical interaction) when it is touched.

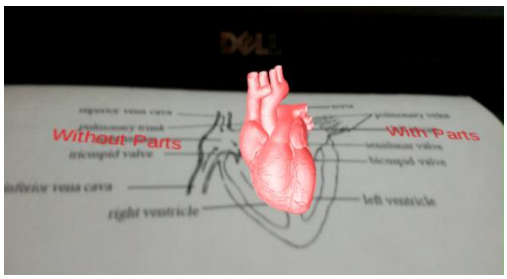


Figure 5: Displaying Human Heart (Virtual object) over the image target (Book image)

Virtual button (VB) is used for Initial Touch –based Interaction [9]. When the object is touched or occluded in the view of camera, can trigger an Interaction event with virtual object in the screen. Figure 5 shows the virtual object – human heart over the target.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

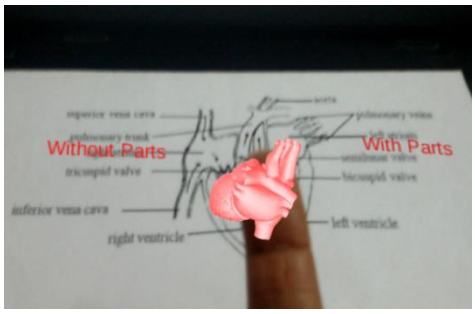


Figure 6: Displaying rotated view of Human Heart (Virtual object) on interaction

Touch- based Interaction with the object is depreciated in Figure 6. When the object is touched in camera view, it initiates an event and starts its rotation within the AR surface. Touch is being recognized and initiates its rotation along y axis.

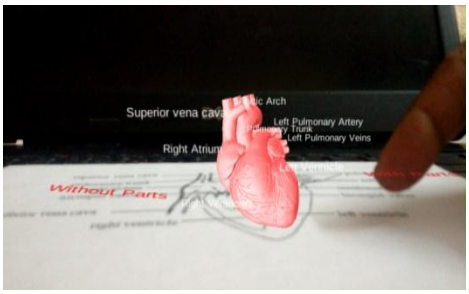


Figure 7: Displaying Human Heart (Virtual object) with parts on Clicking with Parts (Virtual Text)

Fig 7 and 8 shows the Human heart model with and without parts on clicking virtual text. Hence on clicking it, respective response is created or triggered.

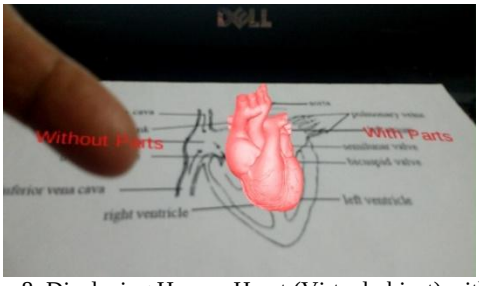


Figure 8: Displaying Human Heart (Virtual object) without parts on Clicking With-out Parts (Virtual Text)

VI. RESULTS

School Students were asked to use the Interactive based AR app and their view towards the APP was obtained through the Section B of the Survey conducted. Section B includes the following survey questions,

Q1: I prefer AR app based lessons approach over the traditional approach

Q2: I found the AR app based lessons approach to be easy and understandable.

Q3: I found the traditional presentation approach format to be easy and understandable.

Q4: I was more motivated to learn new things when using the AR app based lessons approach.

Q5: I retained concept better when the information was delivered via the traditional presentation approach.

Q6: The classroom experience was more enjoyable when AR app based lessons approach were used

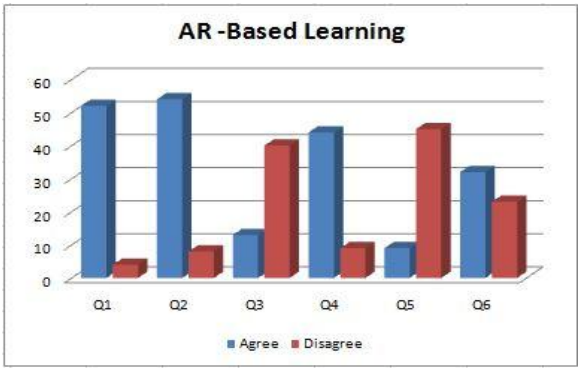


Figure 9: Survey on Augmented Reality based learning.

Figure 9 shows the results of AR – based learning approach. The results of the survey clearly conclude that students prefer AR based visualization approach to that of Traditional. Students feel that AR – based APP to be easy and they get motivated to learn new thing while using AR Science APP.

VII. CONCLUSION

Thus from the Survey of Traditional Teaching and AR based learning app conducted from the Students, it can be concluded that AR based learning will be more interactive and will be next level user experience in learning. Interaction based learning would be more effective and knowledge gaining process, since the Students are able to view and interact with things through Smart phones which they learn in books.

VIII. REFERENCES

[1]. "A framework for utilizing context-aware augmented reality visualization in engineering education" Amir H. Behzadan University of Central Florida, Orlando, FL, USA Vineet R. Kamat University of Michigan, Ann Arbor, MI, USA

[2]. Augmented World Expo, AWE 2013, "Tutorial: Top 10 augmented reality sdks for development." Http://augmentedworldexpo.com/news/ tutorial-top-10-mobile-augmented-reality-sdks-for-developers/(2014-03-30).

[3]. Computer Vision Talks, "A battle of three descriptors: Surf, freak, brisk." Http://computer-vision-talks.com/articles/2012-08-18-a-battle-of-three-descriptors-surf-freak-and-brisk/, August 2012.

[4]. D. Lélis Baggio, S. Enami, D. Escrivá Millián, K. Ledgen, N. Mahmood, J. Saragih and R. Shilkrot, Mastering opencv with Practical Computer Vision Projects. Packt Publishing, ISBN: 0521540518, first ed., 2012.

[5]. H. Bay, T. Tuytelaars, and L. V. Gool, "Surf: Speeded up robust features," in Proceedings of the ninth European Conference on Computer Vision, May 2006.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

[6]. J. Leonard and H. Durrant-Whyte, "Simultaneous map building and localization for an autonomous mobile robot," in Intelligent Robots and Systems '91. 'Intelligence for Mechanical Systems, Proceedings IROS '91. IEEE/RSJ International Workshop on, pp. 1442–1447 vol.3, Nov 1991.
[7]. Layar company information. http://www.layar.com/company/ (2011) [Online;accessed -(2014-03-26).
[8]. Metaio –Official Website, "Metaio sdk." http://www.metaio.com/sdk/(2014-03-26).
[9]. Nivedha S, Hemalatha S, "Enhancing User experience through Physical Interaction in Handheld Augmented Reality", -2015 International Conference on Computer Communication and Informatics (ICCCI -2015), Jan. 08 – 10, 2015, Coimbatore, INDIA
[10]. Official Website of 13th Lab, "13th lab sdk." http://13thlab.com/(2014-03-26).
[11]. Proceedings of the 2011 Winter Simulation Conference S. Jain, R.R. Creasey, J. Himmelspach, K.P.White, and M. Fu, eds. A Collaborative Augmented Reality Based Modeling Environment For Construction Engineering And Management Education Amir H. Behzadan , Asif Iqbal, Vineet R. Kamat
[12]. Qualcomm AR SDK – Official Website: http://www.https://developer.qualcomm.com/develop/ mobile-technologies/ augmented -reality.com/ (2011)[Online; accessed (2014-03-26).
[13]. R. Azuma, Y. Baillot, R. Behringer, S. Feiner, S. Julier, and B. Macintyre, "Recent advances in augmented reality," Computer Graphics and Applications, IEEE, vol. 21, pp. 34–47, Nov 2001.
[14]. R. Hamming, "Error detecting and error correcting codes," Bell Systems Technology Journal, vol. 29, pp. 147–160, 1950.
[15]. R. I. Hartley and A. Zisserman, Multiple View Geometry in Computer Vision. Cambridge University Press, ISBN: 1849517827, second ed., 2004.
[16]. S. Suzuki, "Topological structural analysis of digitized binary images by border following," Computer Vision, Graphics, and Image Processing, vol. 30, no. 1, pp. 32 – 46, 1985.
[17]. Unity Technologies- Official Website, "Unity game engine." https://unity3d.com/unity/ download(2014-03-26).
[18]. Wikitude –Official Website, "Wikitude sdk." http://www.wikitude.com/products/wikitude-sdk/(2014-03-26).

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Operating System Embedded Mobile Agent (EMA) and JADE: A Comparative Analysis

Oguntunde, B.O
Department of Computer Science
Redeemer's University,
Ede, Osun State, Nigeria
oguntunden@run.edu.ng

Osofisan A.O
Department of Computer Science
University of Ibadan, Ibadan,
Oyo State, Nigeria.
nikeosofisan@gmail.com

Aderounmu, G.A
Department of Computer Science and Engineering
Obafemi Awolowo university,
Ile-ife, Osun State, Nigeria
gaderoun@oauife.edu.ng

Abstract
This paper presents a comparison of an Operating System Embedded Mobile Agent (EMA) system with an existing platform based agent system, (Java Agent DEvelopment framework, JADE). The conceptual design of EMA involves a lightweight agent embedded into the kernel mode of Operating System (OS) in the form of OS service, the target OS is Windows XP. To show a proof of superiority provided by EMA over JADE, mathematical models were developed. Performance measurements tested include service delay, memory utilization, denial of service, fault tolerance and turn around time. Simulated results show that the EMA offers a superior performance compared to JADE. It offers a lower delay and turn around time, consumes less storage and has reduced percentage denial of service.

Key words: Enhanced Mobile Agent (EMA), JADE, fault tolerance, turnaround time, denial of service.

1. Introduction

Mobile agent paradigm is one of the promising approaches that have been used for building complex and robust distributed applications [1, 2, 3]. This paradigm supports connectionless processing useful for mobile applications, alleviates bandwidth limitations, achieves load balancing, it is robust and fault tolerant [4, 5, 6]. The mobile agent technology consists of the mobile agents and their execution environment, the mobile agent platform [3]. Mobile agent has been defined as a computer entity capable of reasoning, use the network infrastructure to run in another remote site, search and gather the results, cooperate with other sites and return to its home site after completing the assigned tasks [7]. The mobile agent platform also known as mobile agent system (MAS) is the execution environment for agents; it is the underlying system that provides services for running and moving the agent code and accessing management information in network nodes [3]. MAS provides common functionalities that support the migration of agents, the communication between agents, various programming languages and various forms of security [8]. There are several mobile agents' architectures [4] by different vendors; nevertheless, certain issues arose that inhibit wide acceptance of mobile agent technology they include, secure and efficient execution supports, standardization, interoperability, appropriate programming languages and coordination models [3]. The standardization issue of agents is tackled by FIPA (Foundation for Intelligent Physical Agent) [9]. The interoperability issues is handled by MASIF (Mobile Agent System Interoperability Facility) which defines standards for implementing systems within which agents could execute, that is, agent platform architecture [9].

2 Mobile Agent Paradigm

Mobile agent has been defined severally by researchers as "a persistent software entity dedicated for a specific purpose", 'a software entity to which tasks can be delegated' [7]. We adopt a broader definition of mobile agent as "a named object that contains code, persistent state, data and a set of attributes and can move about or transport itself from one host to another as required to accomplish its tasks' [11, 12]. This section presents an enhanced mobile agents system in comparison with an existing mobile agents system.

2.1 JADE: Java Agent Development framework.

JADE is a software platform that provides basic middleware-layer functionalities, it is a FIPA compliant software package for developing java agents [9], and it's platform is composed of agent containers that can be distributed over the network. Agents live in containers which are the Java processes that provide the JADE run-time and all the service needs for hosting and executing agents [9]. The set of active containers is called platform, there is a main container which is the first container to be lunched from where other containers are launched [9, 11]. For JADE to operate, it must be explicitly launched from the root directory in java environment. Once launched, other agents can

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

then be added to the existing ones on the platform and other platforms, that is, remote hosts' platforms, can be added as well.

2.2 The Proposed Embedded Mobile Agent (EMA)

The Embedded Mobile Agent proposed by [13] Oyatokun et al, 2013 presents a static agent embedded in the kernel mode of the operating system as part of the executive services provided by Windows XP. The EMA needs not be launched by the user; it is automatically launched at the boot of the computer on which it resides, it can be explicitly terminated, paused, or automatically shut down when the host computer shuts down. Figure 1 shows the conceptual model of EMA.

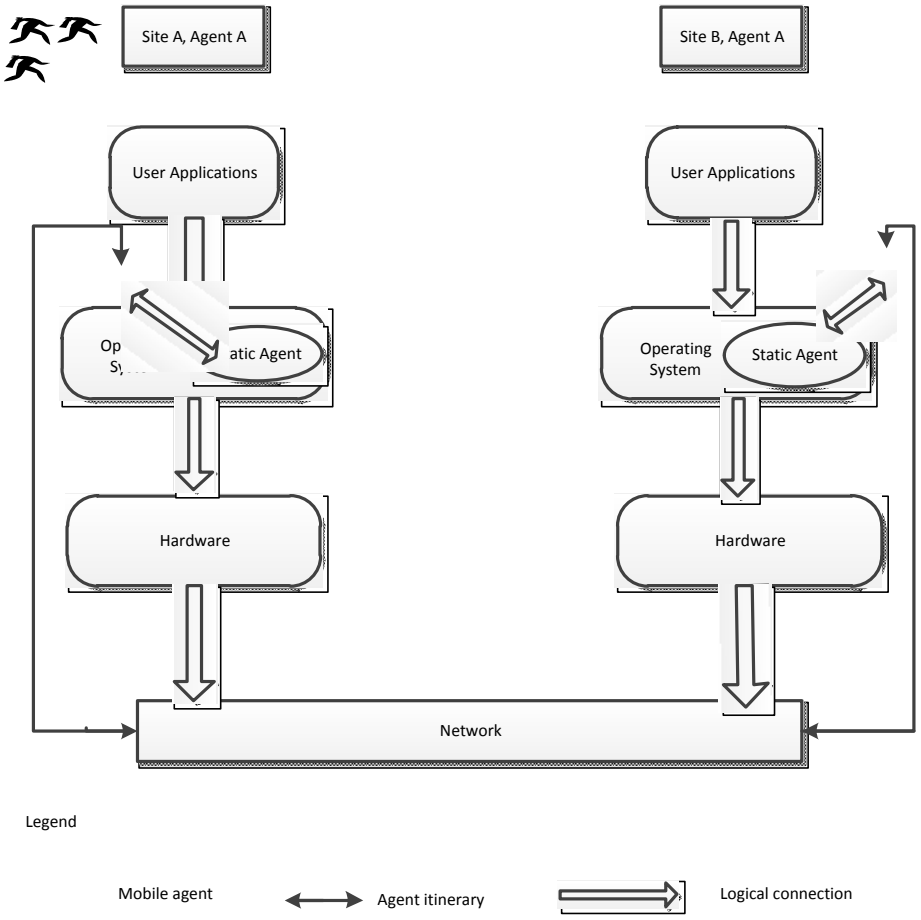


Fig. 1: The conceptual model proposed embedded mobile agent

3. ANALYSIS OF PERFORMANCE CRITERIA

The performance of the proposed mobile agent (EMA) against JADE an existing mobile agent, running on an agent platform was evaluated. JADE architecture consists of the supporting transport mechanism at the lowest level, E-mail or TCP, a server, the interpreter and the mobile agent itself at the highest level. Agents live on top of a platform that provides them with basic services such as message delivery. A JADE platform consists of agent containers that can be distributed over the network, agents live in containers that provide the JADE run-time and all the services needed for hosting and executing agents. Furthermore, each container can have zero or more agents and can be executed on different hosts to achieve distributed platform [9].

3.1 MATHEMATICAL MODEL DEVELOPMENT

The performance parameters used are service delay, memory management, fault tolerance, denial of service and turnaround time. Mathematical models were developed for:

- Service delay against the number of nodes in the network for JADE and EMA
- Memory utilization versus the number of hosts in the network
- Percentage denial of service against number of requests
- Fault tolerance in the face of power failure for various number of hosts in the network
- Turn around times for varying number of hosts visited

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

SERVICE DELAY: overall time required to execute a service, for the purpose of this study, the following components of the delay are defined.

- Waiting time: interval between the arrival of a request at the destination and the beginning of execution.
- Activation time: time to activate the mobile agent platform.
- Transfer delay: interval between the generation of the last bit of packet at the information source and the transfer of agent.
- Service time: time to complete agent's requests i.e. time interval between the beginning and end of execution of a particular service (**st**).
    - ✓ Transfer delay is suffered twice, when the agent leaves its source on request operation and when it leaves the destination on response operation. In this simulation, the transfer delay consists of two components, time to save agents internal state (**ts**) and time to sign off from agent platform (**ti**)
- Activation time is the total time it takes the agent to be triggered and it is broken down into
    - ✓ Time to accept and authenticate incoming agent (**ta**)
    - ✓ Time to provide a hierarchical name space for agent (**tp**)
    - ✓ Time to allow agent migration and communication (**tc**)
    - ✓ Time to restore agent's internal state (**tr**)
- Waiting time: the time interval between the arrival of a request at its destination and the beginning of execution (**tw**).

Assumptions

Both systems operate on the same principle for transmission, therefore, the processing delays due to packet transmission through the network is the same, thus not considered.

For the first request **tw** = 0 since there are no previous requests

For the second request **tw** is the service time of the first request i.e.

$$tw(2) = st(1) \quad \text{.....(1)}$$

and for the third request **tw** is the sum of the service times for the first and second requests i.e.

$$tw(3) = st(1) + st(2) \quad \text{.....(2)}$$

Assume the service times for all requests are equal and it is **st**, the total waiting time for **n** requests follows an arithmetic progression with a common difference **st**.

Arithmetic progression $sum = n/2(2*a + (n-1)d)$ .....(3)

Therefore

$$tw_t = n/2(2*tw_1 + n - 1)st \quad \text{.....(4)}$$

but tw(1) = 0, then

$$tw_t = n/2(n-1)st \quad \text{.....(5)}$$

Service time is the time taken to complete a request i.e time interval between the beginning and end of execution of a particular request in a service, **st**. assume each request takes equal time to execute, then,

$$st_1 = st_2 = st_3 = \text{.....} st_n = st$$

total service time will be

$$st_t = \sum_{i=1}^{n} st \quad \text{.....(6)}$$

Therefore,

$$st_t = n*st = nst \quad \text{.....(7)}$$

total service delay.

JADE operates only on hosts with the Mobile Agent System (MAS) previously installed; therefore it suffers a transfer delay equivalent to (time to save state + time to sign off the platform)

$$TD = ts + ti \quad \text{.....(8)}$$

The JADE needs to be activated on getting to its destination by the agent platform. The agent is authenticated and accepted, a hierarchical name space is provided for the agent before the agent is allowed to communicate and migrate and its internal state is restored.

Activation time of the JADE is equivalent to

$$AT = ta + tp + tc + tr \quad \text{.....(9)}$$

The service time for n requests

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

$$st_t \square nst$$

waiting time

$$tw_t \square n/2(n \square 1)st \quad \text{.....(10)}$$

JADE suffers another transfer delay on the response operation

$$TD_2 \square ts \square ti \quad \text{.....(11)}$$

The total delay

$$D_{TA} \square TD \square AT \square tw_t \square st_t \square TD_2 \quad \text{.....(12)}$$

If we assume that equal delay is suffered during request and responce operations, then

$$TD \square TD_2 \square TD$$

Therefore

$$D_{TA} \square 2TD \square AT \square tw_t \square st_t \quad \text{.....(13)}$$
$$\square 2(ts \square ti) \square ta \square tp \square tc \square tr \square n/2(n \square 1)st \quad \text{.....(14)}$$

Proposed Embedded Mobile Agent (EMA)

The proposed agent connects directly with the operating system and needs no MAS. It suffers a transfer delay that is equivalent to the time it it takes to save its internal state.

$$TD \square ts$$

Activation time

Since there is no agent platform, the mobile agent interacts directly with the operating system on the destination host. Its activation time is limited to the time taken to authenticate and accept agent and the time to restore the agent's internal state.

$$AT \square ta \square tr \quad \text{.....(15)}$$

Service time for **n** requests remains the same as for JADE.

$$st_t \square nst \quad \text{.....(16)}$$

Waiting time also remain the same

$$tw \square n/2(n \square 1)st \quad \text{.....(17)}$$

Transfer delay on response operation is

$$TD \square ts \quad \text{.....(18)}$$

The total delay for the proposed agent is equivalent to

$$D_{TB} \square TD \square tw_t \square st_t \square TD$$
$$\square 2TD \square AT \square tw_t \square st_t$$
$$\square 2(ts) \square ta \square tr \square n/2(n \square 1)st \square nst$$
$$\square 2(ts) \square ta \square tr \square n/2(n \square 1)st \quad \text{.....(19)}$$

Assuming X number of hosts are visited, the delay on X host will be $X*D_{TA}$ for JADE and $X*D_{TB}$ for EMA.

$$D_{TA} \square X(2(ts \square ti) \square ta \square tp \square tc \square tr \square n/2(n \square 1)st)$$
$$D_{TB} \square X(2ts \square ta \square tr \square n/2(n \square 1)st)$$

For simplicity, lets assume that it takes equal amount of time to save agents' internal state and sign off from agent platform i.e

$$ts \square ti$$

and let it be t_h

also, lets assume

$$ta \square tp \square tc \square tr$$

and let it be t_d, then

$$D_{TA} \square X(4t_h \square 4t_d \square n/2(n \square 1)st) \quad \square X(4(t_h \square t_d) \square n/2(n \square 1)st) \quad \text{.....(20)}$$
$$D_{TB} \square X(2t_h \square 2t_d \square n/2(n \square 1)st) \quad \square X(2(t_h \square t_d) \square n/2(n \square 1)st) \quad \text{.....(21)}$$

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

3.3 Memory Utilization

This refers to the amount of memory space requirement for each mobile agent. This performance is measured using the memory requirements for each system against the number of nodes in the network. Agents are small in size, they are not complete applications by themselves, but they work with agents and other agent platforms to form complete application.

JADE

The communicating computers in the network have the JADE mobile agent system (MAS) (JADE platform) previously installed, to be able to communicate with the mobile agent, one of them houses the main container and the others each house a container. For simplicity sake we assume all computers have MAS of size XMB.
The size of the mobile agent code is YMB, Size of request or response is Rmb
On a machine, the memory space required by architecture A will be

$$M_A = X + Y \quad (22)$$

If we assume *n* number of communicating computers

$$TM_A = nX + Y + R \quad (23)$$

and if we assume *m* number of requests and or response, then

$$TM_A = nX + Y + mR \quad (24)$$

Note that one mobile agent is assumed to be on one host at any point in time.

Proposed EMA

The proposed agent is enhanced with the capability to interact directly with the operating system on any host and needs no MAS. Assume the size of the mobile agent code is YMB, the size of the embedded lightweight static agent that runs as the OS service be ***P MB***, (P is so small compaired to the size of a MAS), each time the agent is scheduled to run it takes a part of the memory. Then, the memory space requirement for the embedded agent will be

$$M_B = Y + P + R \quad (25)$$

Since there is no need for MAS
For *m* number of requests and n communicating computers

$$TM_B = Y + nP + mR \quad (26)$$

3.4 Denial of Service

Denial of service represents the fraction of unexpectedly terminated services out of the total number of services executed during the simulation time. In this work, the node failure is simulated by a number generator with a time variant probability distribution that follows the Bernoulli Random Variable (BRV) with *p* and *q* as the variables. Bernoulli Random Variable is a discrete probability distribution which takes value 1 with success probability *p* and value 0 with failure probability $q = 1 - p$. The derivation of this performance parameter is adapted from [14].
To carry out this performance measure, we assume the probability of failure to be 0.1, i.e. one in every 10 nodes, i.e. the service has a state that is modeled after the BRV with $p = 0.9$ (90%) and $q = 0.1$ (10%).
So If *X* is a random variable with this distribution

$$\Pr(X = 1) = 1 = \Pr(X = 0) = 1 = q = p$$

The probability mass function of this distribution is

$$P_x(x) = P\{X = x\} \quad (27)$$

Where x $\Rightarrow \{0,1\}$
Generally, X can be an arbitrary real number,

$$P_x(X) = 0$$

if the random variable X never takes the value of x.
Note however that from the Normal Axiom for probabilities for any discrete random variable X with
X = { $x_1, x_2, \ldots\ldots\ldots\ldots,$ }

$$\sum_{i=1}^{\infty} P_x(x_i) = 1 \quad (28)$$

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

The cumulative distribution function ***F*** is also given by

$$F_x(a) \square \sum_{x \square a}^{\infty} P_x(x) \quad \text{.....(29)}$$

For the special case of BRV

$$\sum_{i \square 0}^{1} P_x(x_i) \square 1$$

since *i* takes on values 0 and 1. Parameters ***p*** and ***q*** are defined as follows:

$P \square P_x(1)$ is a number in the range [0,1] and *q = 1-p*, where the event {X= x_1 = 1} is called a success, or network availability and occurs with probability ***p***.

The event [X = x_2 = 0] is called a failure and occurs with probability ***q***. In the simulation, it was assumed that the network has a state that is modeled after the BRV with $p \square 0.9$ **(90%)** and $q \square 0.1$ **(10%)**.

Let

$f_A^0(t)$ be a time variate function representing denial of service at time t for architecture A

$f_A^1(t)$ be a time variate function representing successful services at time t for architecture A

Then,

$$\int_{t0}^{tf} f_A^0(t)dt$$

represents the number of denied services between simulation times t_0 and t_f for architecture A

Similarly,

$$\int_{t0}^{tf} f_A^1(t)dt$$

represents the number of total successful services between the times t_0 and t_f spent for architecture A. Hence, the total number of services during the period is given by:

$$T \square \int_{t0}^{tf} f_A^0(t)dt \square \int_{t0}^{tf} f_A^1(t)dt \square \int_{t0}^{tf} (f_A^0(t) \square f_A^1(t))dt \quad \text{.....(30)}$$

The percentage denial is thus given by

$$D_A \square \frac{\int_{t0}^{tf} f_A^0(t)dt}{\int_{t0}^{tf} f_A^0(t)dt \square \int_{t0}^{tf} f_A^1(t)dt} * 100 \quad \text{.....(31)}$$

For architecture time span t_0 and t_f .

Introducing φ, the life of an agent on each node, which is the maximum time an agent can spend on a node before moving to another. An agent may be denied services if the system is busy doing something else or the user fails to explicitly lauch the host platform.

$$\int_{tf}^{\infty} f_A^0(t)dt$$

Represents denied services due to time out, exceeding the maximum time t_f an agent can spend on a host. The percentage denied services due to time out is also randomly generated and defined as

$$\square \square \frac{\int_{tf}^{\infty} f_A^0(t)dt}{\int_{t0}^{tf} f_A^1(t)dt \square \int_{tf}^{\infty} f_A^0(t)dt} * 100 \quad \text{.....(32)}$$

The denied services due to agent time out is included in the total denial of service for both architectures, therefore, the total percentage denied services becomes

$$TD_{JADE} \square \frac{\int_{t0}^{tf} f_A^0(t)dt}{\int_{t0}^{tf} f_A^0(t)dt \square \int_{t0}^{tf} f_A^1(t)dt} * 100 + \frac{\int_{tf}^{\infty} f_A^0(t)dt}{\int_{t0}^{tf} f_A^1(t)dt \square \int_{tf}^{\infty} f_A^0(t)dt} * 100 \quad \text{.....(33)}$$

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

It is also assumed that f is directly related to the probability distribution values of p and q. However, EMA has the capability to take up part of the CPU time any time it arrives its destination, it does not need human intervention, the agent starts execution as soon as it is authenticated. Operating Systems services, being part of the Operating Systems and running in the kernel mode, have higher priorities compared to other applications on top of the operating system, the agent time out is equal to zero with EMA, thus

$$\frac{\int_{tf}^{\infty} f_A^0(t)dt}{\int_{t0}^{tf} f_A^1(t)dt + \int_{tf}^{\infty} f_A^0(t)dt} * 100 = 0 \quad \text{.....(34)}$$

thus for EMA,

$$TD_{EMA} = \frac{\int_{t0}^{tf} f_A^0(t)dt}{\int_{t0}^{tf} f_A^0(t)dt + \int_{t0}^{tf} f_A^1(t)dt} * 100 \quad \text{.....(35)}$$

3.5 Fault Tolerance

Fault tolerance is the ability of a system to respond gracefully to an unexpected hardware or software failure. Fault tolerance is a measure of robustness or adaptability of a system to breakdown [15]. A fault tolerant system degrades gracefully in the face of failure, even though at a lower level of performance [1]. Hosts, agent platforms or agents themselves can fail by crashing, other faults could occur due to programming errors or violation of security systems. Faults that occur in a platform cause all the agent on the platform to fail, fault occuring on the computer host causes the platform to fail which implies that the agents on the platform also will fail. Fault occuring in connection or network will cause loss of message or mobile agents. In cases where the network is unreliable and power supply is epileptic, once the power supply is off the computer host goes off and both the plaform and agents on it fail.

JADE

In JADE, once power fails, both the platform and agents fail, agents suffer abrupt termination, this can lead to loss of agent in which case no state is saved. Failures inherent in JADE inlude:

- Platform failure: the JADE containers distributed over the network fail, thus all agents residing in the containers also fail. When the power is restored the platforms need to be explicitly started or restarted by human user to continue operation. The platform can also fail due to natural or artificial causes like programming errors or violation of security systems.
- Host failure: the host computer on which the platform resides fails with power failure, it can also fail due to other causes like virus attack, violation of security systems and programming errors as well, which in turn causes the platform on it to fail.

Assumption

Assume there are n failed platforms, time to a restore platform $T_{p,}$ if we assume uniform recovery time for all platforms, the time to restore n platforms will be $nT_{p.}$ Let's also assume that there are L nodes that fail, and failure recovery time for each node is equal and it's T_h, then total recovery time for L nodes will be sum of LT_h and LT_p for the platforms on each node. If the time to restore an agent to continue its operation is $T_{a,}$ then, the total recovery time will be

$$T_f = L(T_h + T_p) + nT_p + nT_a \quad \text{.....(36)}$$

Let T_w be the time to restore power, then

$$T_f = L(T_h + T_p) + nT_p + nT_a + T_w \quad \text{.....(37)}$$

Where T_w is the delay equals to the total down time or total time to restore power.

Embedded Mobile Agent

The proposed agent is running as a part of the Operating System, (OS service), it takes advantage of the autosave and autorecovery facilities of Windows Operating Systems to save states. Once the power supply returns, and the host is started, the agent's state is restored automatically and the agent can continue its tasks without users' intervention, since there is no platform involved, the failure is restricted to the host alone. In case of a node failure due to other occurences, EMA throws an exception and determines alternative route to the next node in its itinerary. Mobile agents have the ability to dynamically determine alternative route in the face of failure, in both cases mobile agent could determine alternative route in the case of hosts' failure. If we assume a probability of failure to be 0.1, i.e., one out of every ten hosts fails naturally, and the node at which failure occurs is randomly generated.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Using the same notation as for JADE
T_h time to restore the host, for L nodes, total time will be LT_h
T_a is the time to restore agent

$$T_f \Box LT_h \Box T_a \quad (38)$$

It suffers a delay equivalent to the time to restore power, T_w

$$T_f \Box LT_h \Box nT_a \Box T_w \quad (39)$$

Where T_w is the delay equals to the total down time. The EMA agents are automatically restored as soon as the host is started, the time to restore the agent is therefore equal to zero, thus the total recovery time for EMA will be

$$T_f \Box LT_h \Box T_w \quad (40)$$

The total down time and host recovery time in both systems are generated by a radom number generator, unknown to the system apriori.

3.6 Turnaround Time

Turn around time is the interval between when the agent is sent form the origin to remote nodes and when it returns with the result to the origin, in other words it is the round trip migration time. The JADE agents when disparched, visits each node and suffers a delay associated with the platform activation.
Assume time to travel between node A and node B is **Tv**, if it visits **X** number nodes, it will take **X*Tv** time to visit all the X nodes, assuming the distances between the nodes are equal, and the speed of the agent is constant. Assume it takes **Rt** time to return to the origin. In jade the agent suffers a delay equivalent to the total delay measured in (equation1) above.
The total turn around time for JADE agent

$$X \Box Tv \Box D_{TA} \Box Rt \quad (41)$$

Cosidering the network traffic and the bandwidth, the speed of the agent is directly proportional to the bandwidth, speed is the distance covered per unit time, while the bandwidth is the amount of data that can be transmitted in a fixed amount of time measured in bit per second (bps), thus
Speed **S** = Distance / time = d/t . Time t to travel between a node P and Q is Tv

$$S \Box d / Tv \quad (42)$$

$S \Box B$ then, $S \Box CB \quad (43)$

where C is the constant of proportionality and equating the two equations, we have

$$S \Box d / Tv \Box CB$$
$$B \Box (d / Tv) / C \Box d / Tv \Box 1 / C \quad (44)$$

Where B is the bandwidth and **C** is the proportionality constant, for simplicity, lets assume C = 1, then

$$B \Box d / Tv \quad (45)$$

JADE
The total turn around time at varying bandwidth will be equal to

$$X \Box Tv \Box (1 / B) \Box D_{TA} \Box Rt \quad (46)$$

If $Tv \Box Rt$ and

$$D_{TA} \Box X(4(t_h \Box t_d) \Box n / 2(n \Box 1)st)$$

then

$$X \Box Tv \Box (1 / B) \Box X(4(t_h \Box t_d) \Box n / 2(n \Box 1)st) \Box Rt \quad (47)$$

If we assume that it takes equal amount of time to transport agent between nodes and on the return trip to the origin, i.e. Tv = Rt, then,

$$TAT_{JADE} \Box X \Box (Tv \Box 1) \Box (1 / B) \Box X(4(t_h \Box t_d) \Box n / 2(n \Box 1)st) \quad (48)$$

$$B \Box d / Tv$$

it follows that,

$$1 / B \Box 1 / d / Tv \Box Tv / d \text{ then}$$

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

$$TAT_{JADE} \square X \square (Tv \square 1) \square (Tv/d) \square X(4(t_h \square t_d) \square n/2(n \square 1)st) \text{.....(49)}$$

if we lump all the requests into one service, i.e n =1, thus n/2(n+1)st = st, then

$$TAT_{JADE} \square X \square (Tv \square 1) \square (Tv/d) \square X(4(t_h \square t_d)) \square st \text{.....(50)}$$

EMA

Using the same assumption as used in JADE, EMA travels to a node in time equivalent to Tv, it will visit N nodes in time X*Tv, its return trip is also eqal to Rt, the delay is equal to the total delay derived in equation (2). Considering the network bandwidth, the total turn around time for EMA will be equal to

$$X \square Tv \square 1/B \square TD_B \square Rt \text{.....(51)}$$

$$D_{TB} \square X(2t_h \square 2t_d \square n/2(n \square 1)st \quad = \quad X(2(t_h \square t_d) \square n/2(n \square 1)st)$$

$$X \square Tv \square (1/B) \square X(2(t_{h..} \square t_d) \square n/2(n \square 1)st) \square Rt \text{.....(52)}$$

Lets assume it takes same amount of time to travel from node to node and back to the origin,

$$Tv \square Rt$$

$$TAT_{EMA} \square X \square (Tv \square 1) \square (1/B) \square X(2(t_h \square t_d) \square n/2(n \square 1)st) \text{.....(53)}$$

$$TAT_{EMA} \square X \square (Tv \square 1) \square (Tv/d) \square X(2(t_h \square t_d) \square n/2(n \square 1)st) \text{.....(54)}$$

If n = 1; then

$$TAT_{EMA} \square X \square (Tv \square 1) \square (Tv/d) \square X(2(t_h \square t_d)st) \text{.....(55)}$$

4 RESULT ANALYSIS AND DISCUSSION

The authors developed a simulation program in Java programming language for the performance models presented in the previous section, the parameter used are:

1) Service delay against the number of nodes in the network for JADE and EMA
2) Memory utilization versus the number of hosts in the network
3) Percentage denial of service against number of requests
4) Fault tolerance in the face of power failure for various number of hosts in the network
5) Turn around times for varying number of hosts visited

4.1 Service Delay versus Number of hosts

We measured service delay against the number of hosts on the network for the two schemes.in our simulation. The result of our simulation (shown in fig.6.1) shows that the proposed scheme generates almost the same delay with JADE for lower number of nodes up to 40 nodes and slight differences begin to appear with increased number of nodes. This is due to the fact that both systems are agent based and the agents in the two systems are written in the same language, java.

Figure 2: service delay against number of nodes

4.2 Memory utilization versus the number of nodes

In measuring the memory utilization of the two approaches, we have compared the total memory requirements for each scheme. The total amount of memory required to store the Jade platform and the containers on all the hosts involved in the system and the memory requirement for the mobile agent at any point in time. The size of our TSR static agent running is so small compared to the size of the JADE platform. Bearing in mind that memory is an expensive resource, the increased processing speed of EMA is a prime motivator. The simulation shows that the enhanced Mobile agent scheme utilizes a smaller amount of memory compaired to JADE platform.

Figure 3: memory requirements versus number of nodes

4.3 Denial of service versus number or request per service

In this simulation,we refer to an abrupt termination of services as denial of service, we measured the adaptability of the two systems at a fixed network rate. We measured the number of failed and successful services against the total number of services to measure the percentage denial of service for the two schemes. The number of failed services was randomly generated using a random number generator that follows the Bernoulli Random Variable (BRV) with a probability of 0.1 failure. The result as shown in figure 5.3, shows a reduction in the total number of denied services with the enhanced mobile agent.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

4.4 Fault tolerance

In measuring fault tolerance, we measured the failure recovery times for various number of nodes. In cases of power failure, JADE agents suffer abrupt termination and this can lead to loss of agent in which case, no state is saved, the platform needs to be explicitly restarted. When power fails, EMA saves states and automatically recovers when power is restored this is enhanced by the auto recovery facility of windows operating systems. Our result shows that as we have more nodes on the network, there is the possibility of fault occuring which results in higher recovery times with higher number of nodes. EMA shows a superior performance which is attributed to the time JADE takes to activate the platform and restart the agents on the platforms which do not apply to EMA.

Figure 5: fault tolerance against various numbers of hosts

4.5 Turnaround Time

In measuring the agent turn around time, we measured the round trip times of mobile agent with respect to the number of nodes it has in its itinerary to complete its tasks. The speed of the agent depends largely on the network bandwidth and/or network speed. The network speed is simulated with a stochastic model while measuring the times of agent itinerary. The turnaround time increased linearly for the first three nodes, but as the agent migrates to more nodes the behaviour is affected by the network bandwidth and it becomes nonlinear. The two schemes have similar behaviour because they are both java-based agents but the enhanced agent shows an improvement in reduction in its round trip times. This is attributed to the time JADE spends activating the platform on each node. EMA agent takes considerably lower times for its round trips at varying number of hosts compared to JADE agent.

Figure 6: Turnaround times against number of nodes visited

Conclusion

In this work, we present the performance evaluation of Enhanced Mobile Agent (EMA) with the existing JADE agent for distributed information retrieval which was simulated. EMA does not need the installation of agent platforms on the hosts on the network, but a lightweight static agent embedded in the kernel of the Operating system, that runs as a windows service each time the system boots. There is a significant difference between EMA and JADE in terms of memory utilization, denial of service and greater fault tolerance in the face of failure, turnaround time and service delay. We therefore, conclude that the EMA for information storage and retrieval provides a superior, efficient and autonomous scheme with a high level of flexibility than the existing JADE scheme.

References

1. Aderounmu, G.A. (2001). Development of an intelligent mobile agent for computer network performance management. Unpublished PhD thesis, Department of Computer Science and Engineering, Obafemi Awolowo University, Ile-Ife, Nigeria.
2. Aderounmu, G.A, Oyatokun B.O. and Adigun M.O. (2006). Remote Method Invocation and Mobile Agent: a Comparative Analysis. Issues in Informing Science and Information Technology, vol 3. Available at http://informingscience.org/proceedings.INSITE2006/IISTAder188.pdf
3. Gabriel S. and Claudiu I P. 2010. A Proposal for an Enhanced Mobile Agent Architecture (EMA). *Annals of the University of Craiova, Mathematics and Computer Science Series. 37(1): 71 – 79.*
4. Lange D. B. 1998. Mobile objects and mobile agents: the future of distributed computing? Proceedings of the European Conference on Object-Oriented Programming (ECOOP'98), 1998.
5. Lange D.B and Oshima M. 1999. Seven Good Reasons for Mobile Agents. Communication of the ACM, vol.42, No.3, March 1999.
6. Bohoris C. 2003. Network Performance Management Using Mobile Software Agents. Unpublished PhD thesis, University of Surrey, Guildford, Surrey, UK.
7. Outtagarts, A. (2009). Mobile agent-based applications: A Survey. *International Journal of Science and Network Security, 331-339*
8. Syed Adnan, John Datuin and Pavana Yalamanchili 2000. A survey of mobile agent systems. Student Report, Department of Computer Science and Engineering, University of California San Diego. (Date of last access: 03 July, 2013 from cseweb.ucsd.edu/classes/sp00/cse221/reports/dat-yal-and.pdf).
9. Bellifemine, F.L, Greenwood D and Caire G 2007. Developing Multi-agent systems with JADE. John Wiley & Sons Ltd, England.
10. Milojicic D., Breugst M., Busse I., Campbell J., Covaci S., Friedman B., Kosaka K., Lange D., Ono K., Oshima M., Tham C.. Virdhagriswaran S. and While J. MASIF: The OMG Mobile agent System Interoperability Facility, personal technologies, 2(3), 117-129, December, 1999.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

11. Wenjuan W., Tong L., Weidong Z. and Weihui D. 2009. Mobile agent system for supply chain management. Proceedings of the second symposium of International Computer Science and Computational technology (ISCSCT'09), Huangshan, P.R China, 525-528.
12. Biermann E. 2004. A Framework for the Protection of Mobile Agents Against Malicious Hosts. Unpublished Ph.D thesis, University of South Africa, South Africa.
13. Oyatokun, B.O., Osofisan, A.O and Aderounmu, G.A. (2013). A framework for an Operating System-based Mobile Agent Interoperability. International Organization of Scientific Research Journal of Computer Engineering (IOSR-JCE), volume 14, issue 6, 2013.
14. Aderounmu, G.A. (2003). Performance Comparison of Remote Procedure Calling and Mobile Agent Approach to Control and Data Tranfer in Distributed Computing Environment. *A journal of Network and Computer Applications. Elsevier.*
15. Oyatokun B.O. (2004). Remote Method Invocation and Mobile Agent: A comparative Analysis. Unpublished MSC thesis, Department of Computer Science, University of Ibadan, Nigeria.

Performance Analysis of Fingerprint Reference Point Detection Techniques based on Regularized Orientation Model

Shoba Dyre [#1], C.P.Sumathi [#2]

[#] *Department of Computer Science,*
SDNB Vaishnav College for Women, Chennai, India
[1] shobales14@gmail.com
[2] drcpsumathi@gmail.com

***Abstract*—Fingerprint reference point or core point detection is an essential task for registration and classification. It is defined as the topmost point of the innermost curving ridge. This study presents a comparative analysis involving three existing approaches for core point detection. It aims to determine the optimum core point detection technique with emphasis on computational complexity and detection accuracy for fingerprint images, to use as reference point for registration and classification. Specifically, this analysis has been conducted on techniques based on Poincare index (PI) computation, Complex Filters (CF) and Multi Scale analysis of Orientation Consistency (MSOC) using Orientation Field (OF) estimate regularized by non-adaptive and adaptive neighborhood analysis. Comparative performance analysis of these techniques was conducted on standard FVC2002 fingerprint database, DB1 and DB2 datasets that contain images of various qualities and types. Experimental results demonstrate localization of reference point based on hierarchical analysis of orientation coherence using adaptive neighborhood orientation regularization is consistent with high accuracy for all classes of fingerprints.**

***Index Terms*—Reference point, Poincare index, Complex filters, maximum curvature, Multi-scale analysis**

I. Introduction

Biometrical identity authentication systems based on fingerprint analysis are the most popular alternative for a large range of applications ranging from forensics to mobile phones because of its easy accessibility, uniqueness and reliability. A fingerprint is composed of a pattern of interleaved ridges and valleys[1]. Singular points, i.e. core and delta points plays a very vital role in fingerprint alignment and classification as they are unique landmarks of fingerprints. These are the points where the ridge orientation field experiences discontinuity. As we get some partial fingerprints with the delta point outside and plain arch type fingerprints that do not have valid singular points, there is a need to define a unique reference point for all classes of fingerprints[2]. Hence, if an image does not have a core point, the reference point can be taken as the point with maximum curvature on the convex ridge[2] which is usually located at the central region of the fingerprint except for partial fingerprints. Examples of reference point are shown in Fig 1.

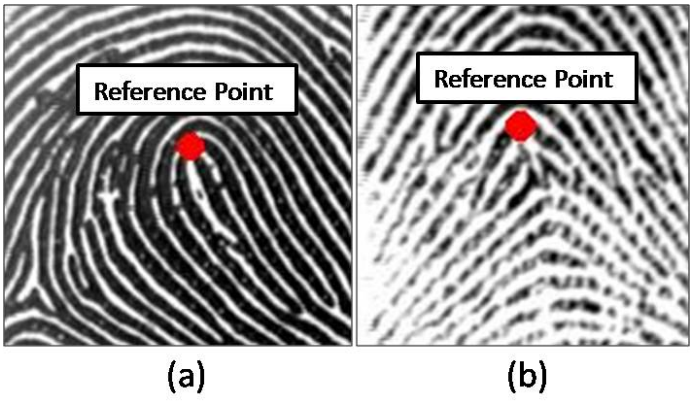


Fig. 1: Core point as reference point for a) Right loop b) Plain arch type fingerprints

An orientation image is a discrete matrix whose elements represent the local average directions of the fingerprint ridge. Hence, orientation field (OF) is an intrinsic property of fingerprint (i.e. local ridge characteristics). The fundamental idea of many existing singularity detection approaches proposed in the literature is to explore the orientation image regions, characterized by high irregularity, curvature, or symmetry[1]. It still remains a challenge to efficiently detect and extract a unique reference point for all types and qualities of fingerprints so as to classify images accurately.

Several published core point detection approaches based on local characteristics of the orientation image are available. The Local Axial Symmetry (LAS), a pixel wise feature that denotes the symmetry of the orientations inside circular regions was introduced in[3]. It is rotation invariant but requires binarization.

Many core point detection approaches based on the Poincaré Index computation had been proposed in [4] - [7]. The PI of each position in the orientation image is computed by summing of angle differences along a closed curve. If the OF estimation is not reliable for noisy images, they are prone to spurious reference point detections.

An efficient reference point detection based on orientation

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

pattern labeling was proposed in [8] but it is not rotation invariant. Multi-resolution approaches to increase robustness against noise and to reduce computational cost had been proposed by researchers. In [9], at each resolution, a curvature image whose blocks indicate the local degree of ridge curvature is derived from the orientation image. High curvature blocks are retained and analyzed at finer levels to detect singular point. Multi-resolution approach [10] is based on harmonic relationships between the orientation of a core point and its neighbors.

A model was presented in [11] to detect core points with different resolutions, where the conventional PI method is improved on the basis of the Zero-pole Model analysis. Multi-resolution analysis based on the convolution of the OF with two complex filters for detecting core point was proposed in [12].

Some existing works are based on partitioning the orientation image in regions characterized by homogeneous regions (i.e. each orientation value determines a region) that reveal the position of the core point [1],[13],[14]. The position of the core point is derived from the relational graphs modeling the orientation image in [14]. Many existing methods based on a global model of the orientation image are also available. An approach based on the zero-pole model and the Hough transform was proposed in [15]. All these reviewed techniques critically relied on orientation field of fingerprint images and hence its computation is a challenging task especially when dealing with poor quality fingerprints to avoid spurious detections.

This comparative study involves three existing computationally less expensive core point detection approaches, (i) based on computation of Poincaré Index (PI)[11], (ii) using Complex Filter (CF) tuned to detect core point based on multi-resolution analysis [12], and (iii) Multi Scale analysis of Orientation Consistency (MSOC)[2]. As these techniques are based on fingerprint orientation field, gradient squared averaging method[4] is used to compute the orientation field of an image block. The orientation fields are smoothed using non-adaptive[18] and adaptive neighbourhood analysis[20] approaches discussed in subsections II-A and II-B. The impact of core point detection approaches based on the two orientation regularization approaches have been experimentally analyzed. A detailed performance analysis has been made with emphasis on detection accuracy. Experimental evaluation conducted on standard FVC2002 fingerprint database demonstrate localization of reference point based on Multi scale analysis of orientation consistency using adaptive neighborhood orientation regularization is consistent with high accuracy for all classes and qualities of fingerprints.

This article is organized as follows. Section II describes the fingerprint OF estimation and smoothing approaches. The reference point techniques used in this study are presented in section III. The experimental results of the comparative analysis conducted on a set of fingerprints are provided in section IV. Section V concludes the study.

II. Orientation Field Computation

The fingerprint image consists of a foreground region of interest (ridges and valleys of fingerprint impressions). This foreground region is segmented to avoid extraction of features from noisy background area of the fingerprint. Mean and variance based method for segmenting the fingerprint area[17] is used in this work.

Most of the techniques for reliable detection of fingerprint core point are based on orientation field estimation. As gradient based least mean square method of orientation estimation is most widely used because of its high resolution and efficiency, it is employed in this work to estimate the orientation of each block[4]. The processing steps are as follows:[4]

1) Divide the segmented fingerprint image into non overlapping blocks of size w x w . The size of the block should be sufficient enough to obtain a good estimate of the local ridge flow. As the average size of the ridges are 5 to 9 pixels, the block size of w=8 is used in this work.
2) Compute the gradients $G_x(u,v)$ and $G_y(u,v)$ of each pixel with respect to the horizontal and vertical directions respectively. The Sobel operator is used in this work to determine the components of the gradient.
3) Compute the orientation field of each block (i,j) by averaging the squared gradients as follows:

$$\theta(i,j) = \frac{1}{2} tan^{-1}\left(\frac{\sum_{u=1}^{w}\sum_{v=1}^{w}(2G_x(u,v)G_y(u,v))}{\sum_{u=1}^{w}\sum_{v=1}^{w}(G_x^2(u,v)G_y^2(u,v))}\right) + \frac{\pi}{2} \quad (1)$$

where $\theta(i,j)$ is the least square estimate of the local ridge estimation at the block centered at (i,j).

The orientation field $\theta(i,j)$ estimated by (1) may contain several unreliable elements due to heavy noise such as creases, scars and ridge breaks. In regions with poor ridge structure or poor ridge contrast, the orientation estimate will also be unreliable that has an adverse effect on computing an accurate reference point in fingerprint images for further classification. Fig. 2 shows the unreliable directional field computed for such a region. Hence, the orientation smoothing stage is implemented to further attenuate noise of the OF to compute a reliable orientation image. The following subsections II-A and II-B present non adaptive and adaptive neighborhood orientation regularization approaches respectively used in this work.

A. Non adaptive Orientation Smoothing

In this method, the orientation field estimate discussed in a local neighborhood of fixed size is smoothed using a Gaussian low-pass filter G of size w_ϕ x w_ϕ. The Gaussian function is given by

$$g(x,y) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}}$$

where σ is the scale of the Gaussian function and x and y are the distances in blocks in the vertical and horizontal directions from the central block. The non-adaptive neighbourhood orientation smoothing approach is summarized below [18]:

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

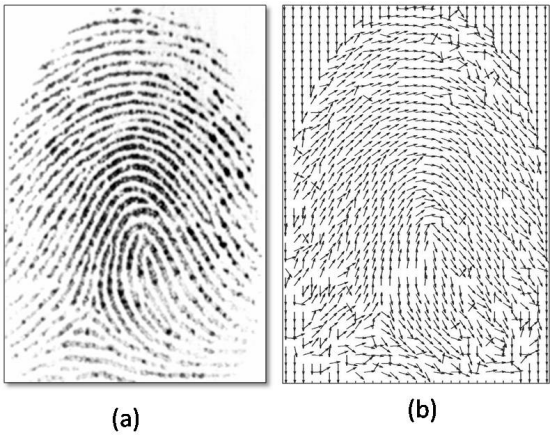


Fig. 2: (a)Low-quality original fingerprint image from FVC2002 database (b) unreliable orientation estimate of the image using (1)

1) Convert the orientation field image into a continuous vector field which is defined as follows:

$$\phi_x(i,j) = cos(2\theta(i,j)) \quad (2)$$

$$\phi_y(i,j) = sin(2\theta(i,j)) \quad (3)$$

where ϕ_x and ϕ_y are the x and y components of the vector field respectively.

2) Perform low pass filtering using with the resulting vector field as follows:

$$\phi_x^{'}(i,j) = \sum_{p=-\frac{W_\phi}{2}}^{\frac{W_\phi}{2}} \sum_{q=-\frac{W_\phi}{2}}^{\frac{W_\phi}{2}} G(p,q)\phi_x(i-pw, j-qw) \quad (4)$$

$$\phi_y^{'}(i,j) = \sum_{p=-\frac{W_\phi}{2}}^{\frac{W_\phi}{2}} \sum_{q=-\frac{W_\phi}{2}}^{\frac{W_\phi}{2}} G(p,q)\phi_y(i-pw, j-qw) \quad (5)$$

3) The smoothed orientation field $\theta^{'}(i,j)$ centered at (i,j) is computed as:

$$\theta^{'}(i,j) = \frac{1}{2} tan^{-1}\left(\frac{\phi_y^{'}(i,j)}{\phi_x^{'}(i,j)}\right) \quad (6)$$

B. Orientation Smoothing based on adaptive neighborhood analysis

This approach is based on adaptively varying the smoothing neighborhood size after analyzing the orientation consistency of neighboring blocks for regularizing the orientation field. It attenuates noise of corrupted orientation field while maintaining high curvature areas around the core point. The orientation coherence for a point (x,y) is given as[21]

$$OC(s) = G(x,y)\frac{\sum_{(i,j)\in w(s)} ||G(x_i,y_i)cos(\theta(x,y) - \theta(x_i,y_i))||}{\sum_{(i,j)\in w(s)} G(x_i,y_i)} \quad (7)$$

where $w(s)$ is the neighborhood of each block to be considered.

The orientation consistency $OC(s)$ gives a highest value of 1 if all the orientations in w(s) is directed in the same direction and approaches 0 when orientation discordance increases[2]. The size of the smoothing neighbourhood for a block is determined based on the orientation consistency of outside surrounding $(2s+1)$ x $(2s+1)$ blocks consisting of $8*s$ elements starting with $s=1$ to a maximum neighborhood size of 4. The processing steps of the adaptive neighborhood orientation smoothing method as proposed in [20] are summarized below and illustrated using flowchart (Fig. 3).

1) Initially set $s=1$ and maximum value of s to be equal to be 4. Convert the orientation field image into a continuous vector field using (2) and (3).
2) Compute the orientation coherence using (7), for the outside $8*s$ blocks of $(2s+1)$ x $(2s+1)$ in w(s).
3) Set $s = s+1$ and compute the orientation coherence using (7).
4) If the orientation consistency is greater than a threshold (0.3 in this work) and also greater than $OC(s-1)$, go to step 6, else if s is smaller than the maximum value of 4, go to step 3.
5) When s reaches its maximum value of 4, reset $s=1$ so that $w(s)$ represents the neighborhood of size 3 x 3 blocks.
6) Gaussian smoothing is performed on the vector fields

$$\phi_x^{'} = \sum G * \phi_x \quad (8)$$

$$\phi_y^{'} = \sum G * \phi_y \quad (9)$$

where the summation is taken over the local adaptive smoothing neighborhood size $(2s+1)$ x $(2s+1)$, G represents a Gaussian low pass kernel of adaptive size $(2s+1)$ x $(2s+1)$.
7) The final smoothed orientation $\theta^{'}(i,j)$ is computed using (6), (8) and (9).

If $OC(s)$ is greater than the threshold and $OC(s-1)$, it indicates that the estimated orientation based on $w(s)$ is reliable. The smoothing neighborhood $w(s)$ is reduced to $w(1)$ when all scales of $s=1,2,3,4$ is smaller than the threshold t, as it is most likely a high curvature area.

III. Reference point detection Techniques

Determining a unique Reference Point (RP) is an important task for subsequent fingerprint analysis and classification steps. Three existing less computationally complex RP detection approaches based on Orientation Field estimate are discussed in the following subsections and analyzed experimentally to determine the method that has high detection accuracy for all types and qualities of fingerprints

A. Poincaré Index (PI)

The Poincaré index is computed for each position (i,j) in the orientation field image by considering some elements around the internal point as proposed in[11]. Let θ_{ij} be the element of (i,j) position in an orientation field image $O^{'}$. In this work, the 8-neighborhood elements of the current

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

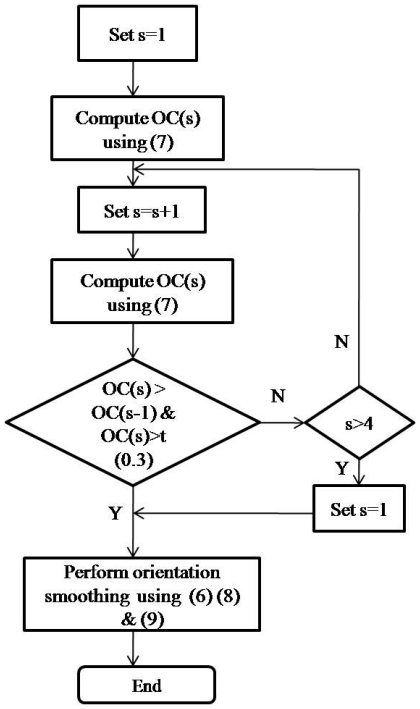


Fig. 3: (a)Flowchart of the adaptive orientation smoothing method[20].

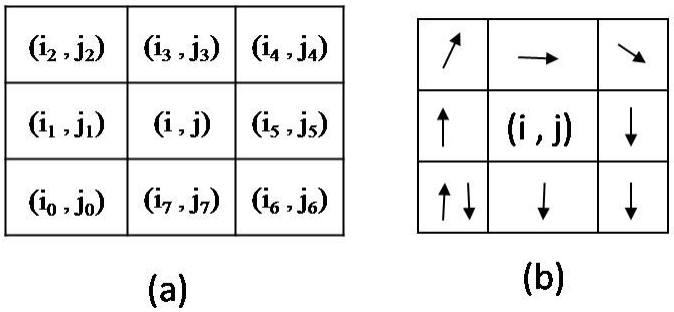


Fig. 4: (a) The eight positions considered for the Poincare index computation (b) the directional elements for detecting a core point

processing point (i, j) are considered as shown in fig. 4. The PI at position(i, j) is computed as

$$Poincare(i,j) = \frac{1}{2\pi}\sum_{k=0}^{7}\Delta_k(i,j) \tag{10}$$

where

$$\Delta_k(i,j) = \left\{ \begin{array}{ll} \delta_k(i,j) & \text{if } |\delta_k(i,j)| < \frac{\pi}{2} \\ \pi + \delta_k(i,j) & \text{if } \delta_k(i,j) \leq -\frac{\pi}{2} \\ \delta_k(i,j) - \pi & \text{otherwise} \end{array} \right\} \tag{11}$$

and

$$\delta_k(i,j) = \theta(i_{(k+1)mod\ 8}, j_{(k+1)mod\ 8}) - \theta(i_k, j_k) \tag{12}$$

The PI has values -0.5, 0, 0.5 or 1. The third part of (11) has been improved from the traditional PI computation to capture the sudden change of orientation and extract core point more reliably.

The steps in core point detection using Poincaré technique are as follows:

1) Initialize a label image A , which is used to indicate the core points.
2) The Poincaré index for each position (i, j) in $O^{'}$ is computed by algebraically summing the orientation differences between adjacent elements in the neighborhood.
3) Assign the corresponding position in A, a value 1 if the Poincaré index is 0.5.
4) If the area of each connected component in A with pixel values 1 is larger than 3, the centroid of the connected component is taken as the core point[19].

B. Complex Filters (CF)

The complex filter method detects symmetry parts in the complex orientation field by applying a complex filter to detect the reference point. Fig. 5 shows the complex filter h that detects the core-type symmetry[12]. The detection of reference point with the complex filtering method is summarized below[12]:

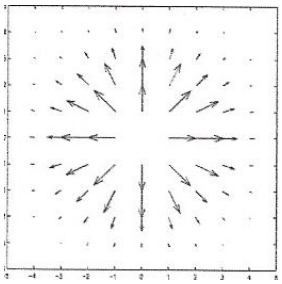


Fig. 5: Complex filter h that detects core-type symmetry

1) Complex valued orientation field image is obtained from the input fingerprint image by

$$z(x,y) = (f_x + if_y)^2 \tag{13}$$

where f_x and f_y are the derivative of the original image in the x- and y-direction respectively and i is the imaginary unit.
2) Apply the complex filter for core point $h = (x + iy)^m g(x, y)$ centered at the pixel (x, y) in the orientation image, where m is the filter order and g is a Gaussian function defined as

$$g(x,y) = exp\left\{-\frac{x^2+y^2}{2\sigma^2}\right\}$$

with variance σ
3) The convolution of the complex orientation field image with the complex field is computed and the maximum response of the complex filter is taken as the reference point.

The time complexity of this method is $O(n^2 logn)$

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

C. Multi-scale Analysis of Orientation Coherence (MSOC)

This reference point localization approach is based on the hierarchical analysis of orientation coherences on varying neighborhood[2]. The point with maximum curvature on the convex ridge, which is usually at the central area of the fingerprint, is taken as the reference point. The orientation consistency is low in high curvature and noisy areas than in smooth areas[2]. The block with local minimum coherence is searched from large scale to fine scale (s) [2] based on the outside surrounding blocks of its neighborhood as shown in Fig 6. The initial value of s is set to 4 in this work. The

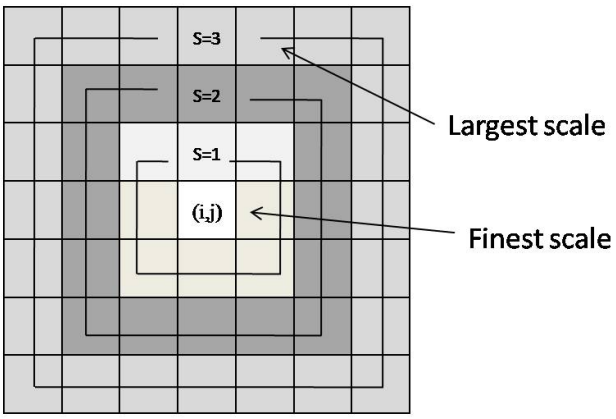


Fig. 6: Multiscale analysis of orientation consistency

unique reference point is determined according to the direction of curvature.
In the $(2s+1)$ x $(2s+1)$ neighborhood of $\theta(i,j)$

$$dx(s) = \sum_{j=-s}^{s} cos(2\theta(i-s,j)) - \sum_{j=-s}^{s} cos(2\theta(i+s,j)) \quad (14)$$

$$dy(s) = \sum_{i=-s}^{s} sin(2\theta(i,j-s)) - \sum_{i=-s}^{s} sin(2\theta(i,j+s)) \quad (15)$$

The processing steps for the localization of reference point based on the multiscale analysis of orientation consistency are summarized below[2]:

1) Compute the orientation consistency $Cons(s)$ of each position (i,j) in the orientation field image for the outside $8*s$ surrounding blocks of its $(2s+1)$ x $(2s+1)$ neighborhood using (7).
2) Find the minimum orientation consistency and select those blocks whose consistency is less than a threshold T, where T=minimum consistency+0.5(used in this work).
3) Compute $dx(s)$ and $dy(s)$ as in (14) and (15) respectively. Select the blocks with both $dx(s)$ and $dy(s)$ larger than 0 as the candidate blocks in the next finer scale.
4) Repeat steps 1, 2 and 3 in the selected candidate blocks with $s = s-1$ until $s = 1$.
5) The unique reference point is localized with minimum orientation consistency $Cons(1)$ from the selected finest scale blocks.

IV. Experimental Results and Discussion

This section reports the experimental results of the comparative analysis of three existing core detection techniques based on non-adaptive and adaptive orientation smoothing methods presented in subsections II-A and II-B using MATLAB. 550 Fingerprint images of diverse qualities from the standard FVC2002 fingerprint databases Db1 (Set A) and Db2 (Set A) were used for this analysis. The images' size of Db1_a and Db2_a are 388 x 374 and 296 x 560 pixels respectively and they are all gray scale images with a resolution of 500dpi. Sample classes of fingerprints from these datasets are shown in Fig. 7 and their corresponding orientation field images regularized by fixed size (non-adaptive) neighborhood size smoothing[18] and adaptive neighborhood analysis are illustrated in Fig. 8(a) and (b) respectively. The Region of

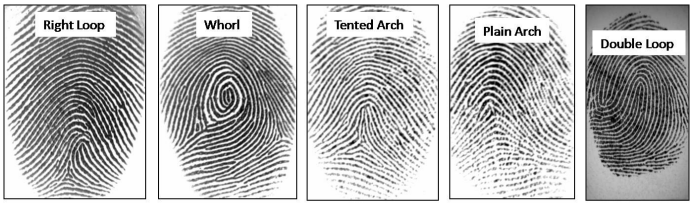


Fig. 7: Fingerprint samples from FVC2002 database

Interest (ROI), which has the potential for core point, is annotated with square. A block size of 8 x 8 is used to estimate the OF using gradient squared averaging method.
More than 90% of fingerprints belong to three classes namely left loop or Radial loop, right loop or Ulnar and whorl according to statistics and the arch type fingerprint proportion is very small. Five categories of fingerprints that constitute left loop (27%), right loop (29%), whorl (24%), arch(plain and tented arch) (7%) and double loop (11%) have been considered for this extensive analysis. The arch and tented arch have been combined into one category as they have a substantial overlap[19].

The threshold value T for choosing the blocks for probable reference point is chosen as minimum consistency + 0.5 in step 2 of subsection III-C as 0.15 proposed in [2] does not detect reference point in arch type fingerprints.
The results of the reference point(RP) detected using the techniques, PI[11] (in red), CF[12](in cyan) and MSOC[2] (in green) based on the above mentioned Orientation regularization approaches are shown in fig. 9.

For good and medium quality fingerprints, visual inspection of the results of the extraction exhibit acceptable reference point for most classes of fingerprints except plain arch fingerprint patterns where technique based on PI does not detect the reference point. More spurious points are detected by PI in poor quality and inclined fingerprint images using fixed neighborhood size smoothing, but there is significant reduction in spurious points using adaptive neighborhood smoothing as shown in Fig. 10 and Fig. 11. Moreover, according to the observation from experiments, reference point detection

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

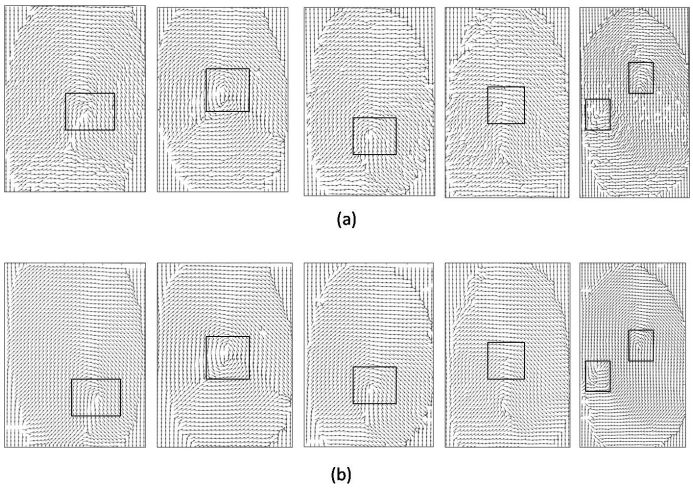


Fig. 8: Block OF estimate with size 8x8 regularized by (a) non-adaptive or fixed neighborhood smoothing[18] (b) adaptive neighborhood analysis[20]

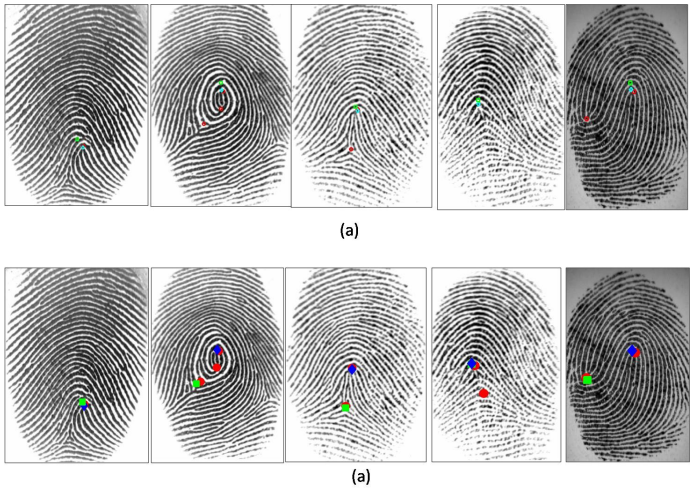


Fig. 9: Reference point extractions using techniques PI(in red), CF(in blue) and MR(in green) based on (a) non-adaptive fixed neighborhood size[18] (b) adaptive neighborhood size smoothing[20]

using Complex filter in inclined and poor quality images with cuts and creases are not consistent as seen in Fig. 10 and Fig. 11. The accepted number of reference points (ARP), false number of reference points (FRP) and number of fingerprints where reference points goes undetected(UD) are observed for the three core detection techniques based on orientation field estimate smoothed using the methods discussed in subsections II-A and II-B. The accepted number is measured as the number of images in which the RP has been correctly detected to the total accessed images. Tables I and II provide the results of the comparative analysis for the above mentioned techniques. The ARP along with FRP and UD number of fingerprints are graphically represented in Fig. 12. This depicts that the consistency of reference points detected and extracted

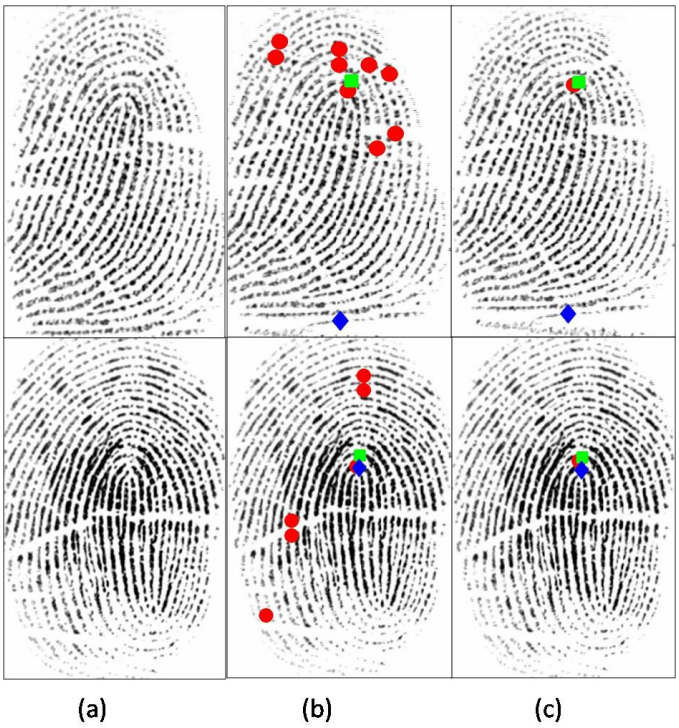


Fig. 10: (a) Poor quality fingerprint image and reference point extraction based on OF smoothed using (b) fixed neighborhood size[18] and (c) adaptive neighborhood[20]

by multi-scale analysis of orientation consistency based on adaptive neighborhood approach yields better results than other techniques used in this study.

TABLE I: Comparison results of the RF detection techniques based on non-adaptive neighborhood OF smoothing[18]

Method	ARP (No)	ARP (%)	FRP (No)	FRP (%)	UD (No)	UD (%)
PI[11]	490	88.97	23	4.28	37	6.72
CF[12]	487	88.54	57	10.36	6	1.09
MAOC[2]	483	87.81	55	10	12	2.18

TABLE II: Comparison results of the RF detection techniques based on adaptive neighborhood size OF smoothing[20]

Method	ARP (No)	ARP (%)	FRP (No)	FRP (%)	UD (No)	UD (%)
PI[11]	506	92	19	3.45	25	4.54
CF[12]	489	88.90	55	10	6	1.09
MAOC[2]	513	93.27	29	5.27	8	1.45

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

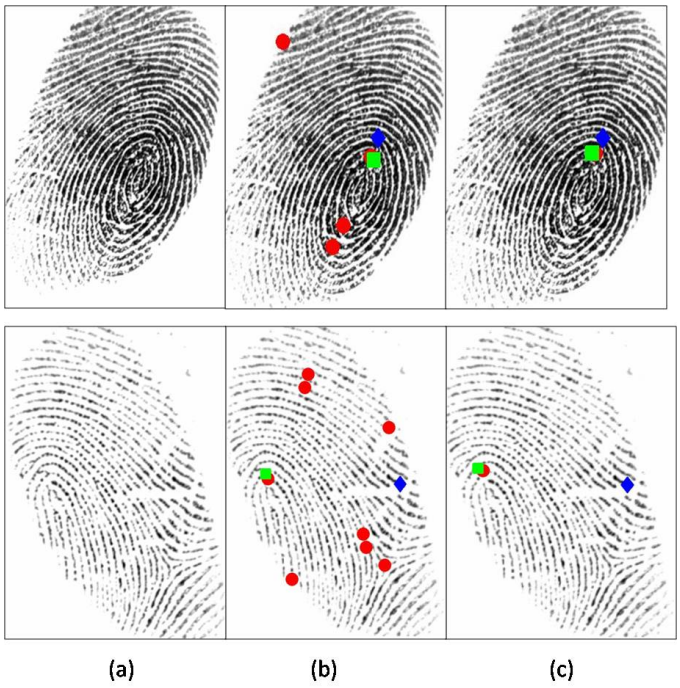


Fig. 11: (a) Poor quality inclined fingerprint image and RP extracted based on OF smoothed using (b) fixed neighborhood[18] and (c) adaptive neighborhood size[20]

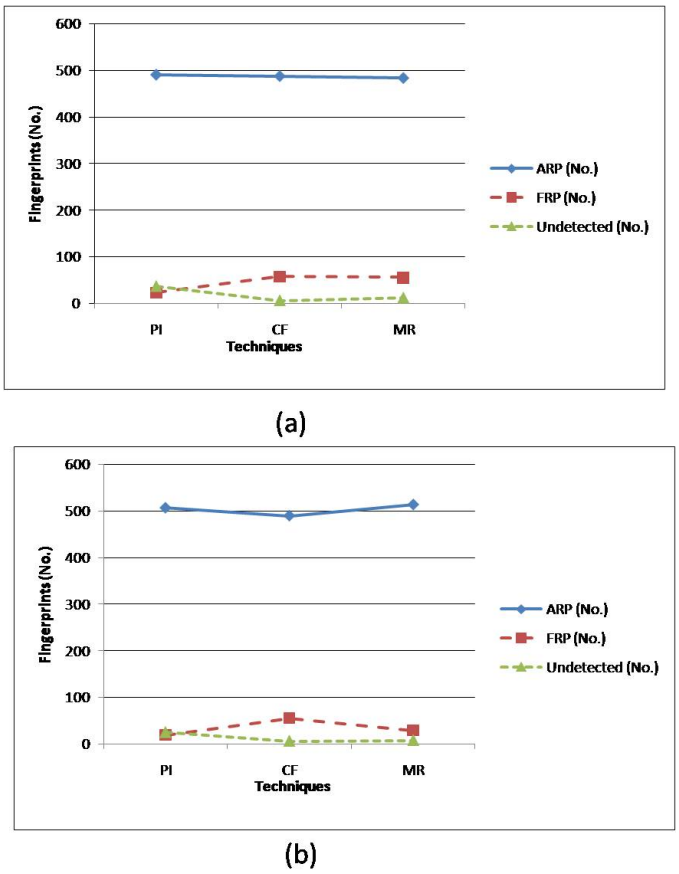


Fig. 12: The graphical analysis of the reference point detection techniques based on (a) non-adaptive neighborhood[18] and (b) adaptive neighborhood smoothing[20].

V. Conclusion

The performance of three existing fingerprint core point detection techniques PI, CF and MR based on non-adaptive and adaptive neighborhood orientation field regularization methods is presented in this paper. It is with the aim to detect the optimum RP detection technique with emphasis on computational complexity and detection accuracy. Obtained results from the experimental study indicate that, localization of reference point based on hierarchical analysis of orientation coherence using adaptive neighborhood orientation regularization is consistent with high accuracy for all classes and qualities of fingerprints. The reference point detected can be used for subsequent alignment and classification steps in automatic fingerprint recognition systems.

References

[1] Davide Maltoni, Dario Maio, Anil K.Jain, Salil Prabhakar. Handbook of Fingerprint Recognition. 2nd edn. New York:Springer-Verlag, 2009.

[2] Manhua Liu, Xudong Jiang, Alex Chichung Kot,"Fingerprint reference-point detection". EURASIP J. Appl. Signal Process, vol.4, pp. 498-509, 2005.

[3] Tong Liu, Chao Zhang and Pengwei Hao, "Fingerprint Reference Point Detection Based on Local Axial Symmetry", In Proceedings of the 18th International Conference on Pattern Recognition, USA, 2006, pp. 1050-1053.

[4] Asker M. Bazen, Sabih H. Gerez, "Systematic methods for the computation of the directional fields and singular points of fingerprints", IEEE Transactions on Pattern Analysis and Machine Intelligence. 2002, vol.24, pp. 905-919.

[5] Jie Zhou, Jinwei Gu, and David Zhang, "Singular Points Analysis in Fingerprints Based on Topological Structure and Orientation Field", International Conference on Biometrics, Springer Berlin Heidelber, pp. 261 - 270, August 2007.

[6] R. Anwar, M.U.Akram, R. Arshad, "A Modified Singular Point Detection Algorithm", International Conference on Image Analysis and Recognition, Portugal, Springer Berlin Heidelberg, 905-914, 2008.

[7] Jie Zhou, Fanglin Chen, Jinwei Gu, "A Novel Algorithm for Detecting Singular Points", IEEE transactions on pattern analysis and machine intelligence. vol.31, pp. 1239 - 1240.

[8] Park CH, Oh SK, Kwak DM, Kim BS, Song YC, Park KH, "A new reference point detection algorithm based on orientation pattern labeling in fingerprint images", In Proceedings of Iberian Conference on Pattern Recognition and Image Analysis, Springer Berlin Heidelberg, June 2003, pp. 697-703.

[9] W.M. Koo, A. Kot, "Curvature-based singular points detection", In Proceedings of 3rd International Conference on Audio- and Video-Based Biometric Person Authentication, Halmstad, pp.229-234, 2001.

[10] Wang X., Li J., Niu Y, "Definition and extraction of stable points from fingerprint images", Pattern Recognition, vol.40, pp.1804-1815, June 2007.

[11] Dawei Weng, Yilong Yin, Dong Yang, "Singular points detection based on multi-resolution in fingerprint images", Neurocomputing, vol.74, pp. 3376-88, Oct 2011.

[12] Kenneth Nilsson, Josef Bigun, "Localization of corresponding points in fingerprints by complex filtering", Pattern Recognition Letters, vol.24, pp. 2135-2144, September 2003.

[13] Raffaele Cappelli, Alessandra Lumini, Dario Maio, and Davide Maltoni, "IEEE Transactions on Pattern Analysis And Machine Intelligence", vol.21, pp. 402-421, May 1999.

[14] Tomohiko Ohtsuka, Daisuke Watanabe, Hiroyuki Aoki, "Fingerprint Core and Delta Detection by Candidate Analysis", In Proceedings of IAPR, Japan, 2007 May, pp. 130-133.

[15] Fan L., Wang S., Wang H., and Guo T, "Singular points detection based

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

on zero-pole model in fingerprint Images", IEEE Transactions on Pattern Analysis Machine Intelligence, vol.30, pp.929-940, 2008.
[16] Anil Jain, Salil Prabhakar, and Lin Hong,"A multichannel approach to fingerprint classification",IEEE transactions on pattern analysis and machine intelligence, vol.21, pp. 348-59, April 1999.
[17] Nalini K. Ratha, Shaoyun Chen and Anil K. Jain, "Adaptive Flow Orientation-Based Feature Extraction in Fingerprint Images", Pattern Recognition, vol. 28, pp. 1657 - 1672, 1995.
[18] Michael Kaas and Andrew Witkin, "Analyzing Oriented pattern", Computer vision, graphics and image processing, vol.37, pp. 362-385, 1987.
[19] L. Hong and A. K. Jain, Classification of fingerprint images", In Proceedings of 11th Scandinavian Conference in Image Analysis, Greenland, June 1999.
[20] Shoba Dyre and C.P.Sumathi,"Reliable orientation field estimation of fingerprint based on adaptive neighbourhood analysis", ICTACT Journal on Image and Video Processing, Vol. 07, pp. 1456-1462, February 2017.
[21] Ravishankar Rao and Brian G. Schunck, Computing Oriented Texture fields, Graphical Models and Image Processing, Vol. 53, pp. 157-185, 1991.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Enabling Software Factory with Job Workflow Automation.

Dzulkafli Jalil
School of Computing
Universiti Utara Malaysia, 06010 UUM Sintok,
Kedah, Malaysia
jay@smartlab.com

Muhamad Shahbani Abu Bakar
School of Computing
Universiti Utara Malaysia, 06010 UUM Sintok,
Kedah, Malaysia
shahbani@uum.edu.my

Abstract— **The growth of the Enterprise Application system in the last few decades has justified the need to industrialize the software development industry. Software Factory approach has been initiated a few decades ago with the intention to provide a solution that can transform software development project into a more systematic approach imitating factory manufacturing concept. Among the challenges in implementing Software Factory model is the availability of the tools that mimic manufacturing process machine. The key machinery in this approach is the job planning and process routing capability feature. This paper presents a job workflow management model that can serve as a planning and process routing tool in the software factory environment. Our proposed model consists of five elements which are System Inputs, Work Centers, Jobs and Tasks, Work Order Routing and System Output. With a design guideline, the model is able to be presented as a system which will be able to help standardize the overall software production with semi or fully autonomous workflow routing based on the services provided by the intended Work Centers. The system can help to govern and monitor the jobs and tasks scheduled to be carried out in a software production environment. The model is expected to be a complement to other Software Factory element model presented in other research to enable software factory environment setup.**

Keywords- Workflow Management; Software Factory; Job Management System; Process Flow; Cloud ERP Production

I. INTRODUCTION

Software development processes are still very much a project based event whereby a team member coordinates and plans through meetings [1], [2]. This is fine with small scale software by a team of talented software programmers. The problem exists with a large software development effort such as continuous Enterprise Software development and deployment that seems to take up a huge amount of resources and rely heavily on team member's competency [3]. In general, typical view of a good software development practice is a well-documented procedures of development life cycle which is project based in nature [4]. This problem has been acknowledged by the software industry company with the fact that there were numerous attempts to revolutionize the software industry into an industrialized model [5]. One of the efforts was the Eureka Software Factory (ESF) Project which was initiated in 1987 [6]. These projects acknowledge the need for the industrialization of software development which can be achieved through Software Factory approach. However, it was also recognized that the Software Factory approach in a bigger scope is more of a vision than standard practice due to the challenges such as weak associated models [7]. One of the paradigm shift proposed by Software Factory is to change from the perception of project based view to a discreet process dimension. One way to promote the use of process dimension is by automating the planning and distribution of software development jobs into process oriented work centers [8]. It is like dividing jobs into specific processes that are managed similar to the conventional factory manufacturing processes. In this paper, we refer the division of jobs as job workflow management. To define it further, job workflow management can also be equated to production planning work in a manufacturing factory environment.

Although the vision to shift the paradigm in software production was clearly identified, most subsequent research after the introduction of Software Factory has claimed that it is difficult to demonstrate the applicability of software factory approach due to the insufficient strength of the corresponding models and concepts associated with it [9]. This indicates how software production behaves in the software industry as most still follows the same project based life cycle model, ad-hoc methods in managing day to day activities [5]. Cloud ERP production environment in particular is very dynamic and different from the conventional software production but sadly enough still operate in a similar fashion.

II. RESEARCH MOTIVATION

The main motivation of this research is based on the fact that enterprise system deployment such as Enterprise Resource Planning (ERP) system over the years have shifted its focus, anticipating the necessary variables and ensuring that their solution is able to adapt to changes [10]. However, this shift coupled with the emergence of Cloud Computing has increased the workload required to be completed making the system more and more complex behind the scene [8]. In our previous research, workflow management has been identified as one of the key components of Software Factory model along with

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Software Product Line (SPL), Product Control, Platform and Knowledge Management [8]. In this paper, we are extending the research in a more in depth focus on the workflow model that can be used as Software Factory enabler or tool and complement the Cloud ERP Factory model that has been published earlier.

With the inclusion of dynamic customization requests, ad hoc and uncontrolled task management in a project based approach, most managers are claiming is its relatively impossible to predict or even gauge the actual time frame for the completion of tasks in a software production environment [11].

To understand the need for a more process dimension outlook, we have to understand the basic concept of a typical software production lifecycle model. Most of the time, a software production would go through a cascading type of work process or more commonly known as a Waterfall Model whereby each process is the precedence of another. This model works well considering the scope of the project as well as the complexity of the software being produced. As the software grows more complex, this model is no longer effective in providing a cost-effective solution. There has been numerous research that applied Software Factory approach and it has yielded results allowing the development of software to go through a specific set of processes [12], [13]. This has promoted the innovation of reusability and thus cutting the time allocated in rewriting codes for each new system development. Each successful adaptation of Software Factory focusses on the shift of using specific processes which can be replicated for every software development [14], [15].

As most research looks at production environment solely as the development of software, we believe that an overview perception is required to understand the overall business and technical aspects in a software production environment and combined with the concepts in Software Factory, we would be able to generate a model that provides specific process dimension approach for software production environment.

III. Proposed Solution

In developing the solution of Job Workflow Model that can automate the planning and development of software production processes, we employ design science methodology with mix qualitative and quantitative approach. Three research phases those are theoretical Analysis, Model development and Model Evaluation were used to complete the research cycle as shown in Fig. 1 below.

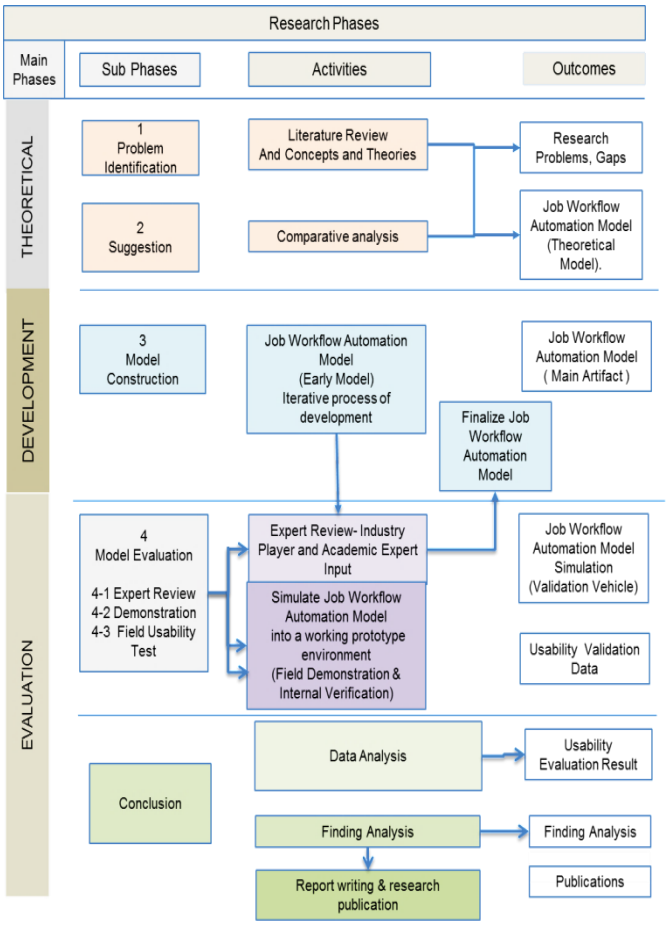


Figure 1. Research Methodology and Phases

Based on the research gap analysis as well as problems faced by many software production environments, we propose a Job Workflow Automation model to allow for the ability of an organization to standardize its workflow for the whole product or service lifecycle. We refer the lifecycle as the whole complete range of activities from pre-sales to after-sales support rather than just the software development lifecycle.

Several concepts and methodologies were referred to in determining the overview of the Job Automation Workflow model. We have incorporated the concepts explained in Manufacturing System Model, Resource Based Theory, Software Factory, Work System Theory and Mass Customization Theory to derive the model as illustrated in Fig. 2 below.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

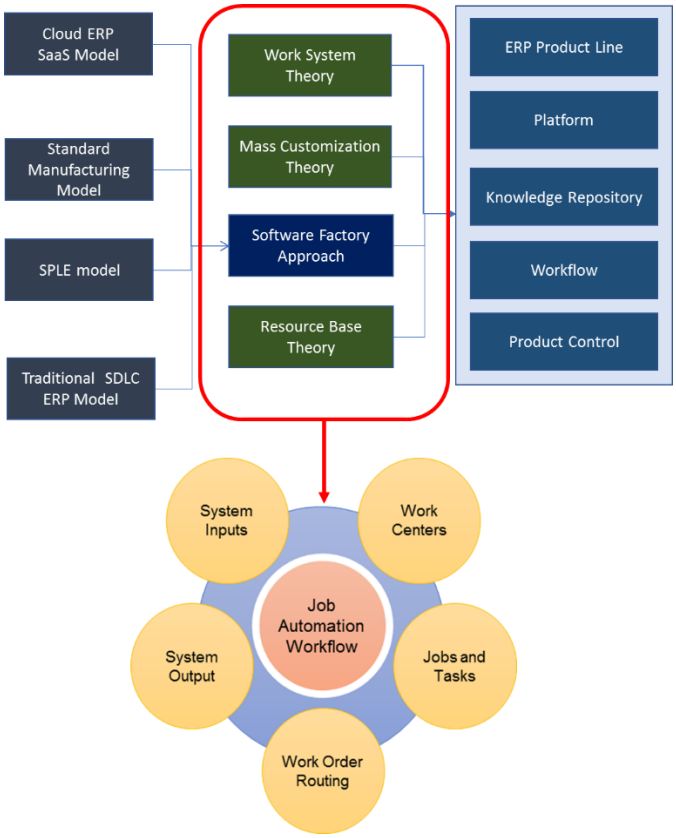


Figure 2. Concepts and Theories Derivation

To identify the component elements for the Job Workflow Automation model, we have compared several workflow management system current concepts shown in Table I below.

TABLE I. WORKFLOW SYSTEM COMPARISON TABLE

Author/Journal	System Inputs	Work Centers	Jobs and Task	Work Order Routing	System Output
Dartflow: A workflow management system web using transportable agents [16]			√	√	
An Overview of Workflow Management: From Process Modeling to Workflow Automation Infrastructure [17]	√	√	√	√	
Petri-net-based workflow management software Petri-net-based Workflow Management Software [18]		√	√		
A simulation of a workflow management system [19]		√	√	√	√
Dynamic Guidance Enhancement in Workflow Management Systems [20]			√	√	

By comparing the existing journals on workflow management, we were able to identify that to generate the Job Workflow Automation, there are five distinct core elements which are System Input, Work Centers, Jobs and Task Identification, Work Order Routing Table and System Output as illustrated in Fig. 3 below. The model is then subjected to expert review consisting of six reviewers from the industry and academia. With Likert Scale questionnaires, the feedback was utilized to add a guideline for the model which can be used to translate the model into a system. Each of the core elements will be explained further in the prototype development of the model.

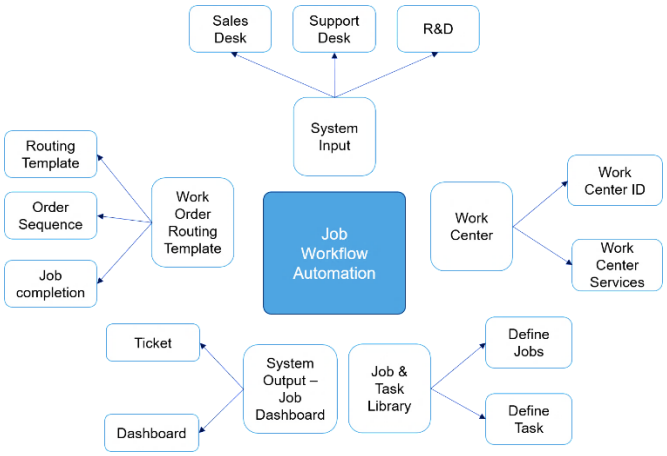


Figure 3. Job Automation Workflow Overview

IV. JOB WORKFLOW AUTOMATION MODEL

A. System Inputs

In our model, system input is a very important element as it identifies the type of input accepted software production environment as shown in Table II. Each system input has its own priority level and is tracked by a request number. The request number is used throughout the whole process as a point of reference until it is solved or completed. The Fig. 4 below shows an example of a system input flow chart in a Cloud ERP Production floor.

TABLE II. SYSTEM INPUTS DEFINITION

Sales Desk	Support Desk	Other Input Request
New sales request/New sales order request	After-sales support contract	Internal request and R&D activities

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

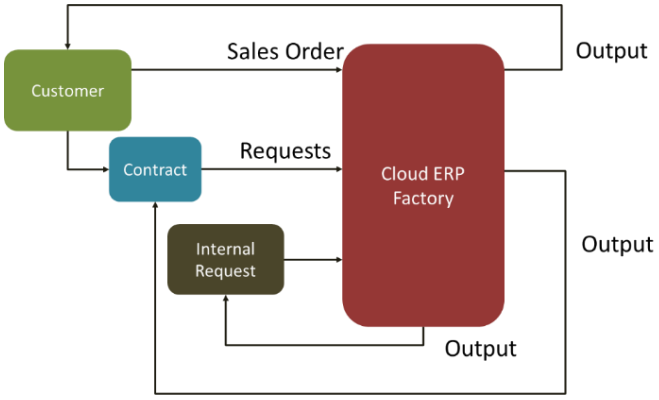


Figure 4. System Inputs Flow

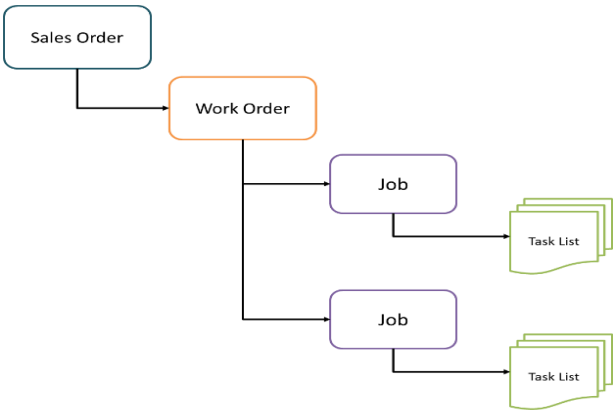


Figure 6. **FIGURE 6**. Job and Tasks Hierarchy Model

B. *Work Centers*

Each work center represents specific tasks with specific skills required to execute the designated job. In our Job Workflow Automation model, work center is primarily a department providing a specific set of services which is then defined in a task library. Fig. 5 below illustrates an example of Work Centers in a typical Cloud ERP software production. Each department provides different set of tasks and services according to the recipe decided for a specified product. The definition of each department can be varied according to the organization.

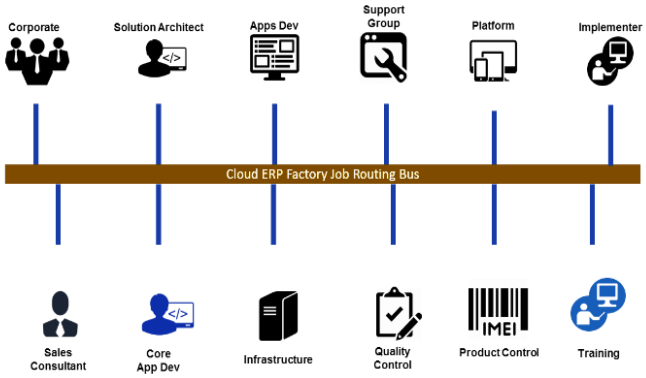


Figure 5. **FIGURE 5**. Work Center Defined for a Software Production environment

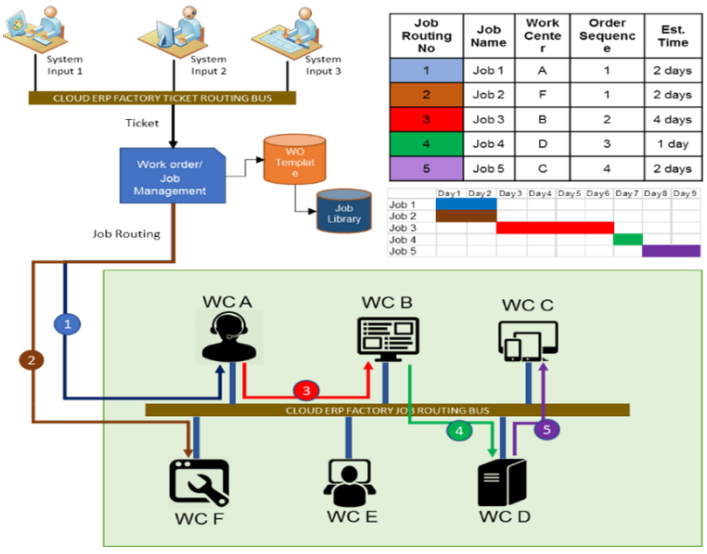
C. *Job and Task Library*

Every single job and task in the Job Workflow Automation must be clearly defined with the specific tasks required to be executed. A job may have many tasks in order to complete that specific job as shown in Fig. 6. All of this information would then be stored in a Task Library.

D. *Work Order Routing / WO Template*

As with conventional manufacturing processes, the Job Workflow Automation is defined by Work Order routing. In manufacturing convention, product process routing is a process flow involved to build a particular product with BOM as material required. In our model, the term Work Order routing refers to processes required to complete a particular Work Order. Routing template is used to pre-define the processes involved and their routing or sequence in completing a particular Work Order. Basically, a routing template consists of a list of processes and their sequence to be executed. When we use any routing template, the system will assign the required processes to the respective Work Centers or departments and each process will be referred to as a job.

Based on Fig. 7 below, an example of how an actual model is shown. The ticket generated from one of the system input is converted into a Work Order which contains a Work Order template complete with its defined job routing table. Each job is then distributed to the assigned Work Center according to the order sequence. Once every single job is completed, the ticket will be updated and closed.



Job Routing No	Job Name	Work Center	Order Sequence	Est. Time
1	Job 1	A	1	2 days
2	Job 2	F	1	2 days
3	Job 3	B	2	4 days
4	Job 4	D	3	1 day
5	Job 5	C	4	2 days

Figure 7. Job Workflow Automation Process Flow Designation

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

The Job Workflow Automation can be configured to be either fully automated or semi-automated by these methods described below:

- Semi-automated – In this mode, from the Work Order template which contains list of jobs, each job will be routed or assigned to the particular Work Center. The Work Center administrator or Head of Department has the option to delegate to job to the member attached to the Work Center. In this mode, the CEF time block is recommended to be set up in day block.
- Fully automated – In order to enable this mode, we are required to set up the time block with more accuracy. It is basically the most refined time scale in a 24 hours' period. Typically, we can assign 30 minutes as the time block which means that the scheduling of jobs for a particular Work Center will be in the 30-minute scale. Here, the estimated time to complete the job will be used by the system to slot the particular job to the available workers with the right competency who are attached to the Work Center. In summary, in fully automated mode, jobs will be assigned directly to the staff based on the availability and skill level. A few other parameters such as time between job and working hours' pattern can be configured in order to achieve optimum productivity level.

Fig. 8 below illustrates a typical Work Order Routing flow in a Cloud ERP Production environment that would support the model.

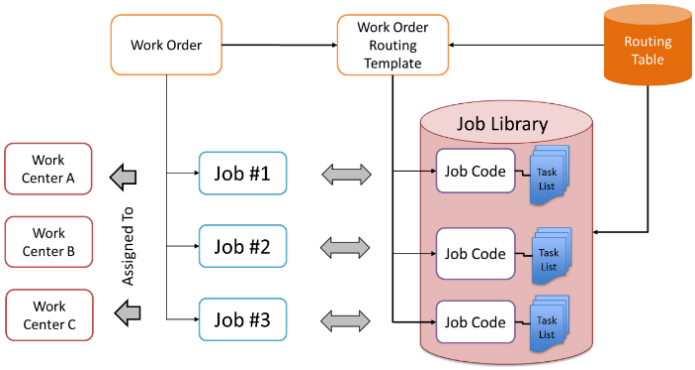


Figure 8. Work Order Routing Flow

E. System Output - Job Dashboard

The Job Dashboard can be considered as the planning output of the system and serves as a planner in the manufacturing plant. In a manufacturing plant, the production planner will plan for the optimum capacity to achieve maximum productivity. Here, the system can be configured to automatically take the system input requests and translates them into multiple jobs displayed in the Job Dashboard of the respective assignees.

Fig. 9 below explains how the employee is assigned with several jobs. Using a Job dashboard, the employee is able to refer to a specific set of job checklist on how the task should be executed which cross references it with the knowledge management or LMS system.

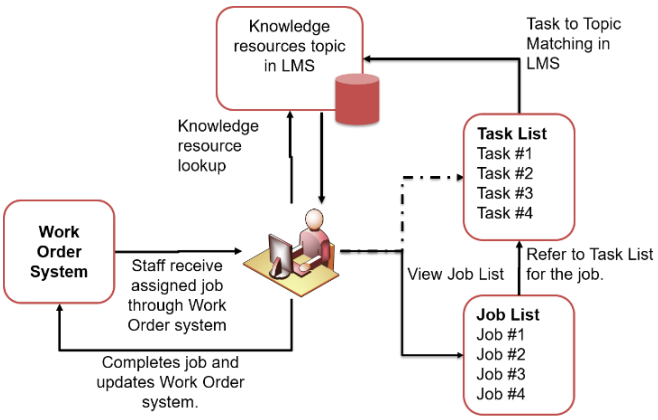


Figure 9. Job Dashboard

Design Guidelines

Each of the elements in the Job Workflow Automation model is connected which can then be used to develop a system. The system is able to combine all the elements, producing a semi-automated engine to manage the type of jobs done in a software production environment as shown in Table III below.

TABLE III. DESIGN GUIDELINE FOR JOB WORKFLOW AUTOMATION

No.	Guidelines Description	Model Element
1	Define Work Centers to provide specialized services within the factory process. It can also be referred to as Departments.	Work Center
2	Define system inputs into the CEF Workflow model.	System Input
3	Define work order, job and task library into a library of services.	Job and Task Library
4	Define time block to represent the minimum time scale for the job allocation slot.	Job and Task Library
5	Define competency skills required for each job.	Job and Task Library
6	Define the task list for all specified jobs.	Job and Task Library
7	Define Work Order template to represent specific routing for all common input types.	Work Order Routing Template
8	Define priority level for each Work Order template.	Work Order Routing Template
9	Create a system as per the Job Workflow Automation model requirement	NA

V. SYSTEM PROTOTYPE DEVELOPMENT

As the engine of our model, we have created a Job Management System complete with a Dashboard view. Then, each business process for each department has been defined to

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

better suit a software production environment. Each department have listed their own specific task list and been entered into the Job Management System. The Job Management system acts as a task repository to be used in the Work Order routing workflow in the Job Management System. Below are the steps which we have completed prior to the development of the Job Management System.

A. *Define system inputs into the Job Workflow Automation model.*

The definition of system inputs for the Job Workflow Automation Model implementation has been defined as Sales Desk, Support Desk and Other Input Request. Sales Desk refers to any request requested during sales activity. This may include the request to create a new version of an application module for a specific customer, a new installation request for platform and core ERP products. Support Desk requests are mainly requests during and after a Cloud ERP product or project has been implemented for the client. The Other Input Request was defined as any request for the purpose of research and development. Each system input is designated by its own ticketing request ID number which is used throughout the whole workflow implementation as a reference point.

B. *Define Work Centers*

Next, we have defined Work Centers which provided specialized services within the factory process. It can also be referred to as Departments. For this company, we have defined twelve Work Centers as shown in Table IV below. Each Work Center is specialized in their roles within the Job Workflow Automation Model.

TABLE IV. WORK CENTER DEFINED BASED ON ORGANIZATION

No.	Name	Role	WCID
1	Platform	Maintain and upgrade the platform environment	
2	Apps Developer	Maintain, configure, customize, improve	
3	Infrastructure	Build, maintain and manage the Server and network Infra.	
4	Quality Control	Enforce and audit QA procedure	
5	Support Group	Maintain and support post implementation job	
6	Implementer	Plan and deploy new implementation order	
7	Solution Architect	Business Consultation and Product and Solution Architect	
8	Sales Consultant	Manage CRM scope, quotation and invoicing	
9	Core Apps Developer	Maintain and Upgrade standard product, develop new products	
10	Product Control	Manage product management policy and server	
11	Training	Manage Product training	
12	Corporate	Finance, HR and CEO office role	

C. *Define work order, job and task library into a library of services.*

Each of the Work Centers defined have their own type of jobs. Each job defined will have its own set of task list. This information is then stored in a central database which we have defined as Job Library. Table V below is a sample of jobs and task for each Work Center.

TABLE V. JOB AND TASK LIBRARY IDENTIFICATION

No	Work Center	Sample Jobs
1	Sales Consultant	a) Presale Meeting b) Register Customer and Project in CAMS
2	Solution Architect	a) Verify new application features
3	Core Apps Developer	a) Release new module development b) Register new application modules
4	Application Developer	a) Customize client application b) Support client request for bug fix
5	Support Team	a) Prepare technical request document b) Verify apps functionality
6	Quality Assurance	a) System testing and buyoff b) Prepare customer satisfaction survey
7	Corporate	a) Create/update LMS record b) Run monthly payroll
8	Training	a) Prepare training materials for application training b) Prepare and set training agenda
9	Implementer	a) Test and buyoff system using UAT b) Conduct User Requirement Study
10	Platform	a) Update Platform features b) Create new platform interface
11	Infrastructure	a) Set Up system server b) Upgrade Networking Hardware
12	Product Control	a) Release activation key b) Provide part number and serial number

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

D. Define competency skills required for each job.

We have defined the competency skills required for the job defined for each Work Centers. The Table VI below is a list of sample competency skills for crucial jobs.

TABLE VI. COMPETENCY SKILLS LIST SAMPLE

No	Job Name	Sample Competency Skills
1	Set Up system server	Server Set up knowledge
2	Support client request for bug fix	ASP programming knowledge Application troubleshooting knowledge
3	Verify new application features	Database Design Application Design Software Engineering

E. Define the task list for all specified jobs.

We have clarified that each job defined in the Job Library contained its own Task List. A sample of Jobs complete with its own task list is shown below in Table VII.

TABLE VII. SAMPLE TASK LIST FOR DEFINED JOBS

No	Job Name	Sample Task List
1	Documentation and Training	Prepare training material Set training session Setup system / module for training Train users
2	Conduct User Requirement Study (URS)	Prepare meeting for URS buyoff Create test data Test system functionalities Test system usability Release test report Make decision no -no go
3	Kickoff Meeting	Schedule Meeting Meeting attendance report Introduce team members Brief project overview to clients Review project schedule Overview requirement study Review project expectation Generate and publish meeting report Set baseline Gantt Chart Set next meeting date

F. Define Work Order template to represent specific routing for all common input types.

We have defined that the Work Order template contained several jobs across Work Centers. These jobs were provided with their own order sequence. In Fig. 10 below, we have defined that each Work Order have its own routing table which flows through the Job Routing Bus.

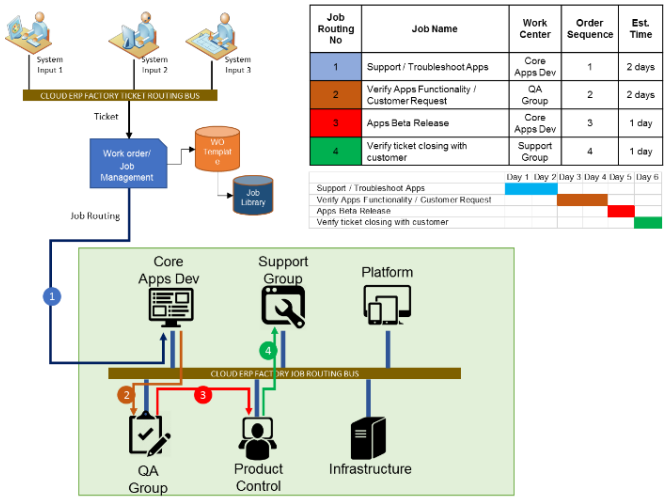


Figure 10. Sample Work Order Routing Flow

With the combination of all the elements described, we are able to provide the necessary blueprint to replicate the model into a system.

Based on the elements gathered and defined in the prototype phase, we were able to create a system which will be able to manage and control the job processes in a software production environment. Each job will contain its own specific tasks defined based on the Work Center or Department the job belongs to. The Fig 11 – 14 shows the snapshots of the prototype system for the Job Workflow Automation which we named it as Job Management System.

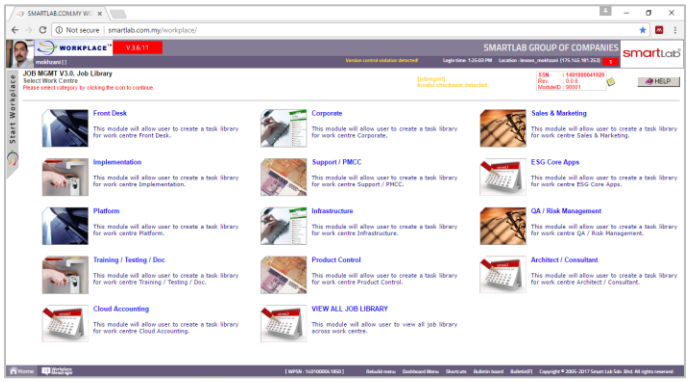


Figure 11. Work Centers/Departments Job List Settings

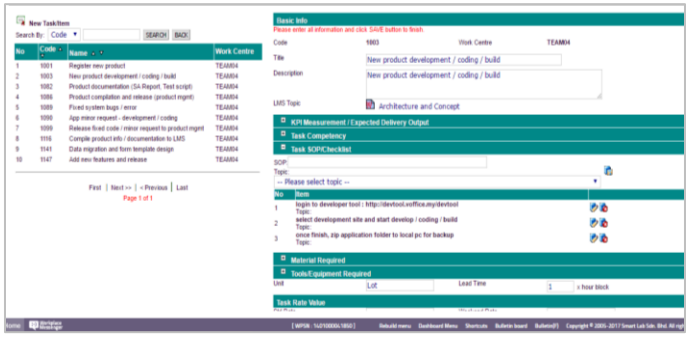


Figure 12. Work Center Specific Job Listing and Tasks List

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

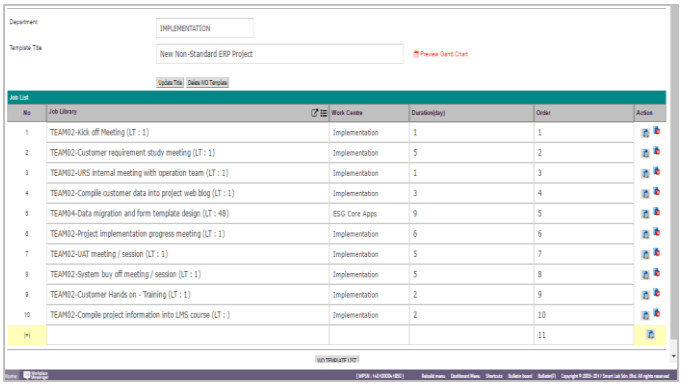


Figure 13. Sample Work Order Routing Flow

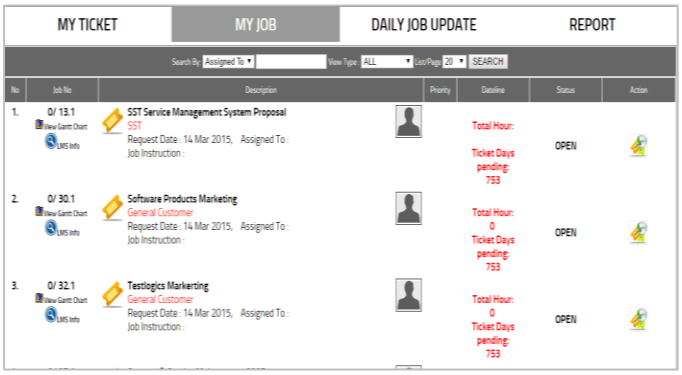


Figure 14. Job Workflow Automation Dashboard

VI. System Evaluation

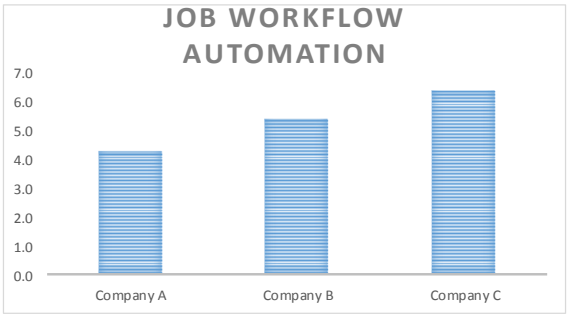


Figure 15. Job Workflow Automation Dashboard

To evaluate the system developed based on the proposed model, we have conducted three separate field demonstrations. The field demonstration focuses on the usability test of the system by utilizing Perceived Usefulness and Ease of Use (PUEU) Validation Instrument with a Likert Scale of 7 rating points. From the Fig.15 shown above, we have verified that with each implementation of the Job Automation Workflow in a software development environment, the overall usability of the model has increased thus proving that the model is able to increase productivity by reducing the workload for developers.

VII. Conclusion

In summary, the Job Workflow Automation has been demonstrated to meet the objective of solving the software development workload and complexity in the commercial software production environment. The model can be represented as one of the enabler component of software factory environment. The five elements within the model provide the necessary tools to achieve a semi-automated or fully autonomous environment in a software production environment such as Cloud ERP production. The research evaluation result has shown that model environment can promote the reduction of workload as well as maintaining a quality standard as each job is defined with precise process flows and maximizing the capacity of the resources available. It is interesting to note that future research can be applied to any relevant industry to achieve similar result.

References

[1] [1] R. W. Jensen, "Why Do We Still Have Software Development Problems?," 2014.

[2] [2] G. E. Bryan, "Not all programmers are created equal #x2014; Redux #x00A9;," *Aerosp. Conf. 2012 IEEE*, no. March 1980, pp. 1–10, 2012.

[3] [3] M. Khan and M. Sayed, "A Simple Software Engineering Environment for Coming Decades," no. January, pp. 46–53, 2017.

[4] [4] H. Bratman and T. Court, "The Software Factory," *Computer (Long. Beach. Calif).*, vol. 8, 1975.

[5] [5] J. Greenfield and K. Short, "Software Factories Assembling Applications with Patterns, Models, Frameworks and Tools," *Management*, pp. 16–27, 2003.

[6] [6] R. Rockwell and M. H. Gera, "The Eureka Software Factory CoRe: A Conceptual Reference Model for Software Factories," *Proc. Softw. Eng. Environ. Conf.*, p. 240, 1993.

[7] [7] D. Helton, "The Pontential of Software Factories," vol. 3, no. 7, pp. 260–266, 2010.

[8] [8] D. Jalil, "Adapting Software Factory Approach into Cloud ERP Production Model," *Int. J. Comput. Sci. Inf. Secur.*, vol. 15, no. 1, 2017.

[9] [9] V. Canuel and M. Robert, "Toward A Better Software Factory," 2012.

[10] [10] B. Johansson, A. Alajbegovic, and V. Alexopoulos, "Cloud ERP Adoption Opportunities and Concerns : A Comparison between SME S and Large Companies," *Pre-ECIS 2014 Work. "IT Oper. Manag.*, 2014.

[11] [11] Y. Zhao and Y. S. Fan, "Implementation approach of ERP with mass customization," *Int. J. Comput. Integr. Manuf.*, vol. 20, no. 2–3, pp. 160–168, 2007.

[12] [12] J. D. Tvedt, R. Tesoriero, and K. A. Gary, "The Software Factory : Combining Undergraduate Computer Science and Software Engineering Education," *Proc. 23rd Int. Conf. Softw. Eng. (ICSE01=*, pp. 633–642, 2001.

[13] [13] M. O. Ahmad, K. Liukkunen, and J. Markkula, "Student perceptions and attitudes towards the software factory as a learning environment," *IEEE Glob. Eng. Educ. Conf. EDUCON*, no. April, pp. 422–428, 2014.

[14] [14] P. H. Comitz and A. Pinto, "A software factory for air traffic data," *AIAA/IEEE Digit. Avion. Syst. Conf. - Proc.*, pp. 1–7, 2006.

[15] [15] J. Chao and M. Randles, "Agile software factory for student service learning," *Proc. - 22nd Conf. Softw. Eng. Educ. Training, CSEET 2009*, pp. 34–40, 2009.

[16] [16] T. Cai, P. A. Gloor, and S. Nog, "Dartflow : A workflow management system web using transportable a gents," *Tech. Rep. Dartmouth Coll. Comput. Sci. Hanover, NH*, pp. 1–18, 1996.

[17] [17] D. Georgakopoulos, M. Hornick, and A. Sheth, "An Overview of Workflow Management: From Process Modeling to Work ow Automation Infrastructure," *Work*, vol. 153, pp. 119–152, 1995.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

[18] [18] A. Technische and U. Eindhoven, "Petri-net-based workflow management software Petri-net-based Workflow Management Software," no. August, pp. 1–6, 2016.

[19] [19] A. Greasley, "A simulation of a workflow management system," *Work Study*, vol. 52, no. 5, pp. 256–261, 2003.

[20] [20] C. Günther, S. Schönig, and S. Jablonski, "Dynamic Guidance Enhancement in Workflow Management Systems," *Proc. 27th Annu. ACM Symp. Appl. Comput. (SAC 2012)*, p. 1717, 2012.

AUTHORS PROFILE

Dzulkafli Jalil has 25 years' experience in Electronics Design and developing Enterprise Resource Planning (ERP) solution and is currently the CEO at Smart Lab Sdn Bhd Malaysia. He received BSC Electrical Engineering from Purdue University, Indiana, USA in 1993 and MSc IT from USM, Malaysia 2002. He is currently a Ph.D candidate and researcher at School of Computing, Universiti Utara Malaysia. His research interests are on Cloud ERP Software, Internet of Things (IoT) and Business Intelligence.

Muhamad Shahbani Abu Bakar received the Ph.D Computer Science, M.Sc (Information Technology) and BSc. Computer Science in 1990 and 1999, respectively. Currently, he is a Deputy Director University Teaching and Learning Center, Universiti Utara Malaysia. After working as an analyst programmer and system analyst (from 1990-2000) in private and government sector and a lecturer (from 2000 - 2009), he has been a senior lecturer in School of Computing, Universiti Utara Malaysia since 2009. His research interest includes Software Engineering, Web Application, Cloud Computing, Enterprise Resource Planning, Big Data, Data Warehouse, Business Intelligence,andEducational Technology.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Analysis of Boneh-Shaw Finger Printing Codes under Randomized Bits Collusion Attacks

Alok Tripathi
IT Division
NIELIT
Patna, India
gkp.alok@gmail.com

Rajiv Pandey
IT Department
Amity University
Lucknow, India
rajivpandeylko@gmail.com

***Abstract*—Lot of research has been done in the previous years to deal with threat of collusion attacks on finger printing codes. Digital fingerprints are code inserted in the media contents before distribution. Each fingerprinting code is assigned to an intended recipient. This fingerprinting code is used to track the culprit in case of illegal distribution of media contents by users. It is now possible for a group of users with different printing codes of the same content to collude together and collectively mount attack against fingerprints. Thus collusion attack poses a real challenge to protect the copyright of digital media. This paper presents an analysis of Boneh-Shaw finger printing codes under randomized bits collusion attacks.**

Keywords-Digital Water Marking,Digital Fingerprinting,Collusion Attack,Boneh-Shaw Finger printing Codes

I. INTRODUCTION

A. Digital Water Marking

Digital water marking is a technique that enables for the enforcement of the copyright protection of the digital media. It is a technique that is applied to provide security, authentication and copy right protection of the digital media. In digital watermarking a secret message called watermark is embedded inside the digital media. If some problem occurs this secret message is recovered to check the authentication or the real owner of the digital media. The technique is described diagrammatically as follows.

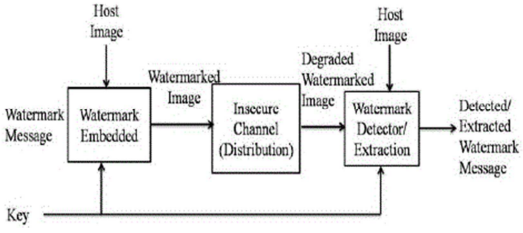


Figure 1. Digital Water Marking

B. Digital Finger Printing Codes

In digital fingerprinting unique codes are generated for each digital media file and these unique codes are embedded in their corresponding digital media file. The database mapping of fingerprinting code is done with their corresponding digital files. If after distribution some user makes an illegal copy of its digital media file and redistributes it the illegal copy is traced and the fingerprinting code is extracted. This extracted code is searched in database mapping of fingerprinting codes with digital media file and digital media file is found which is illegally distributed. Now from this database the corresponding user who has distributed the illegal copy is caught. This digital fingerprinting codes help in copyright protection of digital media files. The process is shown diagrammatically as follows:

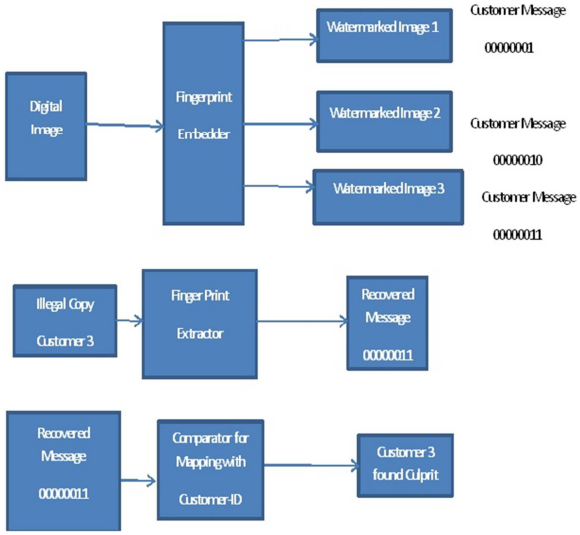


Figure 2. Digital Finger Printing

C. Collusion Attack on Digital Fingerprinting Codes

A collusion attack is one in which a group of customers having the illegal copies of same digital media may

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

collaborate and try to manipulate the fingerprints embedded in their data. These users collaborating to generate the manipulated code are known as colluders. These users do the manipulation by comparing their data and then they manipulate the data at the positions where they saw the differences. The UNIX command diff may be used for this purpose. By doing the manipulation the colluders try to generate the digital media copy with destroyed or altered watermark. For e.g. in the diagram the customers 2 and 6 are the colluders and they collaborate to generate a modified media file in such a way that the generated media file contains watermark message allocated to customer 10.

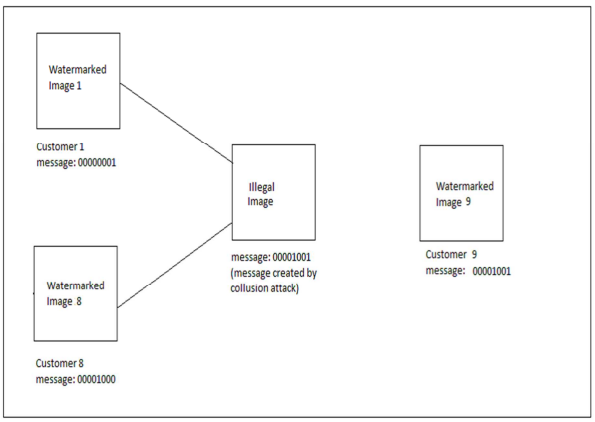


Figure 3. Collusion Attack

D. Boneh & Shaw Fingerprinting codes

Boneh & Shaw have tried to solve the problem caused by collusion attack. They have given a secure fingerprinting code that has the length of $O(n^3\log(n/\varepsilon))$ with an ε error rate.

1) Code Construction

In Boneh & Shaw code for code construction the code constructor will first require the number of users n and the error rate ε, the constructor will generate a code matrix which has n rows and number of columns equal to the length of fingerprinting code. Let Y_m be a column of height n in which the first m bits are 1 and the rest are 0.Let us construct the following matrix

$$Y(n,d)=(\underbrace{Y_1Y_1Y1Y_1}_{d\text{ times}})(\underbrace{Y_2Y_2Y_2}_{d\text{ times}})\ldots(\underbrace{Y_{n-1}Y_{n-1}\ldots\ldots\ldots Y_{n-1}}_{d\text{ times}})$$

we define $\Gamma_0(n,d)$ as an (n(d-1),n) code whose code words are the rows of the matrix Y(n,d).The amount of duplication d determines the error probability ε. For e.g. Γ_0 (4, 3) for users A, B, C, D is defined by

$$Y(4,3)=\begin{matrix}1&1&1&1&1&1&1&1&1&A\\0&0&0&1&1&1&1&1&1&B\\0&0&0&0&0&0&1&1&1&C\\0&0&0&0&0&0&0&0&0&D\end{matrix}$$

Before using this code the distributor applies to the columns of Y (n,d) random permutation π.The same permutation π is used for all the users. Let B_m is the set of positions where columns Y_m are mapped by π,$|B_m|$=d.In other words if $\pi=(\pi_1,\pi_2\ldots\ldots\ldots\ldots\pi_{dn-1})$ then

$B_m=\{\pi_1|(m-1)d+1 \le 1 \le md\}$

Note that

$\{1,2,\ldots\ldots\ldots d(n-1)\}=B_1 \upsilon B_2 \upsilon\ldots\ldots\ldots\ldots\ldots\ldots\upsilon B_{n-1}$

In fact the permutations of columns of Y(n,d) is defined only by partition of $\{1,2,\ldots\ldots\ldots..,d_{n-1}\}$ in to $B_1,B_2,\ldots\ldots\ldots\ldots\ldots B_{n-1}$ because of repetitive columns. Therefore there are only

$$\binom{d(n-1}{d,d,--d}=(d(n-1)\lrcorner$$

really different permutations of Y(n,d) for $2\le s\le n-1$ define $R_s=B_{s-1}U\ B_s$

For instance suppose for Y(4,3) we use the following permutation

π = (7, 3, 2, 4, 9, 5, 1, 6, 8) then

$$\pi(Y(4,3))=\begin{bmatrix}1&1&1&1&1&1&1&1&1\\1&0&0&1&1&1&0&1&1\\1&0&0&0&0&1&0&1&0\\0&0&0&0&0&0&0&0&0\end{bmatrix}$$

$B_{1=}\{2,3,7\}$ $B_2=\{4,5,9\}$ $B_3=\{1,6,8\}$

$R_2=\{2,3,4,5,7,9\}$

$R_{3=}\{1,4,5,6,8,9\}$

2) Tracing Algorithm for Boneh & Shaw Code

Given $x\varepsilon\{0,1\}^{d(n-1)}$ find a subset of the coalition that produced x.

1. Set all bits to 0
2. If $w(X|B_1) > 0$ then output user 1 is guilty.
3. If $w(X|B_{n-1}) <$d then output user n as guilty
4. For S=2,3,……n-1 do
   Let $k=W(X|R_s)$ if
   $W(X|B_{s-1}) < k/2-\sqrt{\left(\frac{k}{2}\right)\log n/\varepsilon}$

   Then output user S is guilty.

E. Random bits Collusion Attacks

In Random bits collusion attack the colluders compare their codes bit by bit. If codes agree then in the pirated copy the same bit is copied but if the bits of the code disagree then in the pirated copy that bit position is

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

filled randomly with either 0 or 1.The colluders generally use a random bit generator in this case.

II. RELATED WORK

[1].This paper reviewed the basic model of digital image watermarking for embedding along with some latest research work done on digital image watermarking. Next, it mentioned the requirements of any digital image watermarking System .Then it listed some of the applications of digital image watermarking. Next, it showed the classification based on different categories. Next it highlighted the evaluation system of watermarking technologies by comparing their advantages and disadvantages. Finally it presents some work done on improving watermark as a copyright protection method.

[2].In this paper it is discussed that Watermarking is most popularly used approach for providing security on images. Under many circumstance watermarking approach is not possible for providing the security. Because of the visibility of the security message, the hackers can create the watermarking on the original image as like the sender sent and then send the modified image to the receiver. Everyone can read the copyright information. To solve the problems in watermarking approach the unique intrinsic fingerprint of the image source coders are taken as the evidence for security. Based on the intrinsic fingerprint of image source encoders, forensic detector is developed. This detector identifies which source encoder is applied, what the coding parameters are along with confidence measures of the result.

[3].There is various types' watermarks and these have uses and applications. It depends upon which application area one is looking for according to that watermark type is chosen. There are mix and match of techniques, applications and documents on which watermarking are categorized and studied. This paper shows an overview of various kinds of watermark and its implementation area.

[4].This paper incorporate the detail survey about watermarking, it starts with overview, classification, features, techniques, application, challenges, and limitations of watermarking.

[5].The large need of networked multimedia system has created the need of "COPYRIGHT PROTECTION". It is very important to protect intellectual properties of digital media. Internet playing an important role of digital data transfer. Digital watermarking is the great solution of the problem of how to protect copyright. This paper emphasizes that Digital watermarking is the solution for the protection of legal rights of digital content owner and customer with the help of fingerprinting.

[6]. Digital watermarking is not a new name in the technology world but there are different techniques in data hiding which are similar to watermarking. In this paper authors compare digital watermarking with other techniques of data hiding. Steganography, Fingerprinting, cryptography and Digital signature techniques are compared with watermarking. They emphasizes that people need water-marking for digital data security .It provides ownership assertion, authentication and integrity verification, usage control and con-tent labeling.

[7]In this work they show how an existing fingerprint code can be optimized with respect to code length in order to collaborate with a watermarking algorithm to provide a maximum of reliability with a minimum of payload.

[8].The Internet presents opportunities for individuals to dispatch information in various forms, such as through blogs that are not part of the content distribution routes used by content providers. At the same time, problems must be addressed when copyrighted content is distributed without authorization. To deter these illegal activities, authors say that fingerprinting is attracting attention as a promising content copyrights protection technology.

[9] Digital fingerprinting protects multimedia content from illegal redistribution by uniquely marking copies of the content distributed to users. Most existing multimedia fingerprinting schemes consider a user set on the scale of thousands. However, in such real-world applications as video-on-demand distribution, the number of potential users can be as many as 10–100 million. This large user size demands not only strong collusion resistance but also high efficiency in fingerprint construction, and detection, which makes most existing schemes incapable of being applied to these applications. A recently proposed joint coding and embedding fingerprinting framework provides a promising balance between collusion resistance, efficient construction, and detection, but several issues remain unsolved for applications involving a large group of users. In this paper, authors explore how to employ the joint coding and embedding framework and develop practical algorithms to fingerprint video in such challenging settings as to accommodate more than ten million users and resist hundreds of users' collusion. They investigate the proper code structure for large-scale fingerprinting and propose a trimming detection technique that can reduce the decoding

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

computational complexity by more than three orders of magnitude at the cost of less than 0.5% loss in detection probability under moderate to high watermark-to-noise ratios. Both analytic and experimental results show a high potential of joint coding and embedding to meet the needs of real-world large-scale fingerprinting applications.

[10].With a digital fingerprinting scheme a vendor of digital copies of copyrighted material marks each individual copy with a unique fingerprint. If an illegal copy appears, it can be traced back to one or more guilty pirates, due to this fingerprint. Boneh and Shaw [18] have devised a classic fingerprinting scheme, and several recent papers have designed improvements. In the present paper authors make a new error analysis of Boneh and Shaw's original scheme,[18] and they prove that it is far better than assumed and in fact better than the improvements in some respects.

[11]. Authors have shown that an efficient collusion-secure code with error-correction can be built based on the Boneh-Shaw code [18]. The error-correction helps to build a complete watermarking/fingerprinting scheme resistant to attacks on the watermarking layer. They show that impact of errors on the information rate is surprisingly low.

[12].The work presented in this paper consists in the development of a portable platform to protect the copyright and distribution rights of digital contents, and empirically demonstrate the capacity of several marking and tracing algorithms. This platform is used to verify, at a practical level, the strength properties of digital watermarking and fingerprinting marks. Initially, two watermarking algorithms, one based on spread-spectrum techniques and the other based on QIM (Quantization Index Modulation), have been implemented. Moreover, authors use these watermarking algorithms to embed a fingerprinting code, based on code concatenation, equipped with an efficient tracing algorithm. In this paper they focus on the implementation issues of the Java based platform that consists of three main packages that are fully described.

[13].A pirate is a person who buys a legal copy of a copyrighted work and who reproduces it to sell illegal copies. Artists and authors are worried as they do not get the income which is legally theirs. It has been suggested to mark every copy sold with a unique fingerprint, so that any unauthorized copy may be traced back to the source and the pirate who bought it. The fingerprint must be embedded in such a way that it cannot be destroyed. Two pirates, who cooperate, can compare their copies and they will and some bits which differ. These bits must be part of the fingerprint, and when the pirates can see and change these bits, they get an illegal copy with neither of their fingerprints. Collusion secure fingerprinting schemes are designed to trace at least one of the pirates in such collusion. In this paper authors prove that so called (2, 2)-separating codes often are collusion-secure against two pirates. In particular, they consider the best known explicit asymptotic construction of such codes, and prove that it is collusion-secure with better rate than any previously known constructions.

[14].Collusion-secure fingerprinting codes are an important primitive used by many digital watermarking schemes. Boneh and Shaw [18] define a model for these types of codes and present an explicit construction. Boneh and Shaw [18] also present a lower bound on the length of any collusion-secure code. Authors give new lower bounds on the length of collusion-secure codes by analyzing a weighted coin-flipping strategy for the coalition. As an illustration of their methods, they give a simple proof that the Boneh- Shaw [18] construction cannot be asymptotically improved. Next, they prove a general lower bound.

[15].A construction is presented to obtain 3-secure fingerprinting codes for copyright protection. Resistance against collusions of up to three buyers is achieved with a code word length dramatically shorter than the one required by the general Boneh-Shaw construction [18]. Thus the proposed fingerprints require much less embedding capacity. Due to their very clandestine nature, collusions tend to involve a small number of buyers, so that there is plenty of use for codes providing cost-effective protection against collusions of size up to 3.

[16]Authors examine the problem of Collusion-Secure Fingerprinting in the case when marks are binary and coalitions are of size 2. They are motivated by two considerations, the pirates' probability of success (which must be non-zero, as was shown by Boneh and Shaw [18]) on one hand, and decoding complexity on the other. They show how to minimize the pirates' probability of success: but the associated decoding complexity is O(M 2), where M is the number of users. Next they analyze the Boneh and Shaw [18] replication strategy which features a higher probability of success for the pirates but a lower decoding complexity. There are two variations. In the case when the fingerprinting code is linear they show that the best codes are linear intersecting codes and that the decoding complexity drops to O(log2 M). In the case when the fingerprinting code is allowed to be

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

nonlinear, finding the best code amounts to finding the largest B 2-sequence of binary vectors, an old combinatorial problem. In that case decoding complexity is intermediate, namely O(M).

[17].Electronic copyright protection is increasingly dependent on fingerprinting and watermarking techniques. In this paper the properties of dual binary Hamming codes are exploited to obtain a fingerprinting scheme secure against collusion of two buyers. The advantage over previous proposals is that collusion security is obtained using well-known and shorter length error correcting codes.

[18].This paper discusses methods for assigning code words for the purpose of fingerprinting digital data, e.g., software, documents, music, and video. Fingerprinting consists of uniquely marking and registering each copy of the data. This marking allows a distributor to detect any unauthorized copy and trace it back to the user. This threat of detection will deter users from releasing unauthorized copies. A problem arises when users collude: for digital data, two different fingerprinted objects can be compared and the differences between them detected. Hence, a set of users can collude to detect the location of the fingerprint. They can then alter the fingerprint to mask their identities. Authors present a general fingerprinting solution which is secure in the context of collusion. In addition, they discuss methods for distributing fingerprinted data.

[19]. This white paper provides a high level overview of digital watermarking and fingerprinting and examines how these two technologies can be integrated into workflows for automatically tracking, protecting and monetizing content.

[20].This Paper examines some early examples of steganography and the general principles behind its usage. It then looks at why it has become such an important issue in recent years. Then there is a discussion of some specific techniques for hiding information in a variety of files and the attacks that may be used to bypass steganography.

This paper analyses the Boneh & Shaw code under Random bit collusion attack. The analysis is done using a simulator coded in Java. The experimental results are presented and detailed analysis of performance of Boneh & Shaw code under random bits collusion attack is shown.

III. PROPOSED WORK

The work done has been summarized as follows

- Construction of Boneh & Shaw code has been simulated by developing a simulator in Java
- Accusation algorithm of Boneh & Shaw code has been simulated by developing a simulator in Java.
- Random bit collusion attack has been simulated by developing a simulator in Java.
- Accusation algorithm simulated using Java has been used to detect the pirates who have colluded to launch the attack.

The comparison of present work with exiting works is as follows:

a) Practical Simulation of Construction of finger printing codes (Boneh & Shaw) has been performed.

b) The Collusion attack (Random Bit Collusion Attack) has been launched practically on finger printing codes constructed in step (i).

c) The Accusation algorithm (Boneh & Shaw code) has been practically implemented to detect the colluders who have performed the collusion attack in step (ii).

d) The analysis has been performed by using different combination of colluders, different collusion sizes, different coding lengths; different error rate, different number of users practically and results have been summarized in experimental result section.

e) The present work practically analyses the performance of Boneh& Shaw code under random bit collusion attack by creating different scenarios of different colluders, different collusion sizes, different coding lengths, different number of users & different error rate.

Thus this paper serves as a base for practically analyzing the Boneh & Shaw code with attacks other than Random Bit Collusion attacks and compare with the results obtained here.

IV. EXPERIMENTAL RESULTS

The following experimental results have been deduced after performing the above proposed work. The evaluation has been shown for 30 users.

No of Users	Size of Collusion	Error Rate %	Length of finger printing Code	% False Positive
30	2	1	454111	0
30	3	1	454111	0
30	5	1	454111	0
30	10	1	454111	0
30	15	1	454111	0
30	20	1	454111	0
30	25	1	454111	0

TABLE-I EXPERIMENTAL RESULTS AT 1 % ERROR RATE

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	5	370098	0
30	3	5	370098	0
30	5	5	370098	0
30	10	5	370098	0
30	15	5	370098	0
30	20	5	370098	0
30	25	5	370098	0

TABLE-II EXPERIMENTAL RESULTS AT 5 % ERROR RATE

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	10	333906	0
30	3	10	333906	0
30	5	10	333906	0
30	10	10	333906	0
30	15	10	333906	0
30	20	10	333906	0
30	25	10	333906	0

TABLE-III EXPERIMENTAL RESULTS AT 10 % ERROR RATE

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	15	312736	0
30	3	15	312736	0
30	5	15	312736	0
30	10	15	312736	0
30	15	15	312736	0
30	20	15	312736	0
30	25	15	312736	0

TABLE-IV EXPERIMENTAL RESULTS AT 15 % ERROR RATE

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	20	297714	0
30	3	20	297714	0
30	5	20	297714	0
30	10	20	297714	0
30	15	20	297714	0
30	20	20	297714	0
30	25	20	297714	0

TABLE-V EXPERIMENTAL RESULTS AT 20 % ERROR RATE

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	25	286085	0
30	3	25	286085	0
30	5	25	286085	0
30	10	25	286085	0
30	15	25	286085	0
30	20	25	286085	0
30	25	25	286085	0

TABLE –VI EXPERIMENTAL RESULTS AT 25 % ERROR RATE

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	30	276544	0
30	3	30	276544	0
30	5	30	276544	0
30	10	30	276544	0
30	15	30	276544	0
30	20	30	276544	0
30	25	30	276544	0

TABLE-VII EXPERIMENTAL RESULTS AT 30 % ERROR RATE

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	35	268511	0
30	3	35	268511	0
30	5	35	268511	0
30	10	35	268511	0
30	15	35	268511	0
30	20	35	268511	0
30	25	35	268511	0

TABLE-VIII EXPERIMENTAL RESULTS AT 35 % ERROR RATE

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	40	261551	0
30	3	40	261551	0
30	5	40	261551	0
30	10	40	261551	0
30	15	40	261551	0
30	20	40	261551	0
30	25	40	261551	0

TABLE –IX EXPERIMENTAL RESULTS AT 40 % ERROR RATE

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	45	255403	0
30	3	45	255403	0
30	5	45	255403	0
30	10	45	255403	0
30	15	45	255403	0
30	20	45	255403	0
30	25	45	255403	0

TABLE-X EXPERIMENTAL RESULTS AT 45% ERROR RATE

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	50	249893	0
30	3	50	249893	0
30	5	50	249893	0
30	10	50	249893	0
30	15	50	249893	0
30	20	50	249893	0
30	25	50	249893	0

TABLE XI EXPERIMENTAL RESULTS AT 50 % ERROR RATE

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	60	240381	0
30	3	60	240381	0
30	5	60	240381	0
30	10	60	240381	0
30	15	60	240381	0
30	20	60	240381	0
30	25	60	240381	0

TABLE-XII EXPERIMENTAL RESULTS AT 60% ERROR RATE

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	70	232319	0
30	3	70	232319	0
30	5	70	232319	0
30	10	70	232319	0
30	15	70	232319	0
30	20	70	232319	0
30	25	70	232319	0

TABLE-XIII EXPERIMENTAL RESULTS AT 70% ERROR RATE

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	80	225359	0
30	3	80	225359	0
30	5	80	225359	0
30	10	80	225359	0
30	15	80	225359	0
30	20	80	225359	0
30	25	80	225359	0

TABLE –XIV EXPERIMENTAL RESULTS AT 80% ERROR RATE

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	90	219211	0
30	3	90	219211	0
30	5	90	219211	0
30	10	90	219211	0
30	15	90	219211	0
30	20	90	219211	0
30	25	90	219211	0

TABLE-XV EXPERIMENTAL RESULTS AT 90% ERROR RATE

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	95	216398	0
30	3	95	216398	0
30	5	95	216398	0
30	10	95	216398	0
30	15	95	216398	0
30	20	95	216398	0
30	25	95	216398	0

TABLE-XVI EXPERIMENTAL RESULTS AT 95% ERROR RATE

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	99	214223	0
30	3	99	214223	0
30	5	99	214223	0
30	10	99	214223	0
30	15	99	214223	0
30	20	99	214223	0
30	25	99	214223	0

TABLE-XVII EXPERIMENTAL RESULTS AT 99% ERROR RATE

No of Users	Size of Collusion	Error rate %	Length of Finger Printing Codes	% of False Positive
30	2	100	213701	0
30	3	100	213701	0
30	5	100	213701	0
30	10	100	213701	0
30	15	100	213701	0
30	20	100	213701	0
30	25	100	213701	0

TABLE-XVIII EXPERIMENTAL RESULTS AT 100 % ERROR RATE

Also it has been observed that as the number of users increases Java Starts showing heap space error. The solution to above problem is that powerful servers of high configuration should be deployed for using Boneh& Shaw code for fingerprinting for copyright protection with practical applications also with very large users we may require supercomputers for using Boneh & Shaw code for practical applications.

Also from simulation results it is observed that for Boneh & Shaw code implementation the number of users should be known at the beginning of implementation it is not possible to dynamically add users.

From the simulation results it is observed that no false positives are there for Boneh & Shaw code even at error 1 hence Boneh & Shaw code is foolproof against the random bit collusion attack.

V. CONCLUSION

From the simulation performed in this paper it is clear that Boneh & Shaw code are foolproof against the random bit collusion attacks. Also powerful servers should be deployed for practical application of Boneh & Shaw code. The number of users should be known in advance for practical application of Boneh & Shaw code. Also our next effort will be to simulate Boneh & Shaw code with more attacks like majority value attack and compare the results obtained with this work.

REFERENCES

[1] S Sahar Afshan Andrabi, Sheenam. A Review: Information Hiding Using Watermarking Techniques. SSRG International Journal of Computer Science and Engineering (SSRG-IJCSE) – EFES April 2015.

[2] V A. Sudha, K. Vanitha, A. NooralShaba. Efficient Analysis And Secure Client Side Image Using Fingerprint Embedding

International Journal of Scientific & technology Research Volume 3, Issue 1, January 2014 ISSN 2277-8616.

[3] Sharbani Bhattacharya et al. Survey on Digital Watermarking – A Digital Forensics & Security Application International Journal of Advanced Research in Computer Science and Software Engineering Volume 4, Issue 11, November 2014.

[4] Kusuma Kumari A Survey of Digital Watermarking Techniques and it Applications Karnataka, India International Journal of Science and Research (IJSR)ISSN (Online): 2319-7064 Volume 2 Issue 12, December 2013.

[5] Miss. Nupoor M. Yawale1, Prof. V. B. Gadicha2. Digital Watermarking and fingerprinting:A good idea for security. International Journal of Application or Innovation in Engineering & Management (IJAIEM) Volume 2, Issue 2, February 2013 ISSN 2319 – 4847.

[6] Gurpreet Kaur, Kamaljeet Kaur Digital Watermarking and Other Data Hiding Techniques International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-2, Issue-5, April 2013.

[7] Marcel Schäfer, Waldemar Berchtold, Margareta Heilmann, Sascha Zmudzinski, Martin Steinebach, Stefan Katzenbeisser. Collusion Secure Fingerprint Watermarking for Real World Applications Proc. of GI-Sicherheit 2010.

[8] Satoshi Fujitsu. Fingerprinting. Broadcasting Systems. Series: Challenges: "Information Security Technology in the Digital ... Broadcast Technology No.36, Spring 2009. NHK STRL. C. 21. Challenge. CAS technology overview. Broadcasting.

[9] Shan He and Min Wu. Collusion-Resistant Video Fingerprinting for Large User Group. IEEE Transactions on Information Forensics and Security, Vol. 2, No. 4, December 2007.

[10] Hans Georg Schaathun. The Boneh–Shaw Fingerprinting Scheme is Better Than We Thought. IEEE Transactions on Information Forensics and Security, Vol. 1, No. 2, JUNE 2006.

[11] Schaathun, H.G. . On watermarking/fingerprinting for copyright protection. Proceedings of the 1st International Conference on Innovative Computing, Information and Control, Volume 3, August 30-September 1, 2006, Beijing, China, pp: 50-53.

[12] Miguel Soriano, Marcel Fernandez, Elisa Sayrol, Joan Tomas,Joan Casanellas,Josep Pegueroles, and Juan Hernández-Serrano. Multimedia Copyright Protection Platform Demonstrator. P. Herrmann et al. (Eds.): iTrust 2005, LNCS 3477, pp. 411-414, 2005.

[13] Hans Georg Schaathun. Fighting two pirates. Chapter Applied Algebra, Algebraic Algorithms and Error-Correcting Codes Volume 2643 of the series Lecture Notes in Computer Science pp 71-78, April 2003.

[14] Chris Peikert abhi shelat Adam Smith. Lower Bounds for Collusion-Secure Fingerprinting. Proceeding SODA '03 Proceedings of the fourteenth annual ACM-SIAM symposium on Discrete algorithms Pages 472-479,2003.

[15] Francesc Seb´e and Josep Domingo-Ferrer. Short 3-Secure Fingerprinting Codes for Copyright Protection.Chapter Information Security and Privacy Volume 2384 of the series Lecture Notes in Computer Science pp 316-327 , 2002.

[16] Gérard Cohen, Simon Litsyn, Gilles Zémor. Binary Codes for Collusion-Secure Fingerprinting Inforrmation Security and Cryptology — ICISC 2001Volume 2288 of the series Lecture Notes in Computer Science pp 178-185 Date: 23 April 2002.

[17] J. Domingo-Ferrer and J. Herrera-Joancomarti. Short collusion-secure fingerprints based on dual binary Hamming codes. Electronics Letters 28th September 2000 Vol. 36 No. 20.

[18] Dan Boneh and James Shaw .Collusion-Secure Fingerprinting for Digital Data. IEEE Transactions on Information Theory, Vol. 44, N0. 5, September 1998.

[19] Content Control: Digital Watermarking and Fingerprinting by Dominic Milano Rhozet http://www.carbonserver.com/whitepapers/Fingerprinting_Watermarking.pdf.

[20] Steganography And Digital Watermark http://www.gnu.org/copyleft/fdl.html

AUTHORS PROFILE

Mr Alok Tripathi Member IEEE is Director-in-Charge at NIELIT Patna, Bihar, India. He possesses a diverse back ground experience of around 20 years of Academic experience. His research interests include the contemporary technologies as Information Security, Cloud computing and Database systems. He has been on technical Committees of Various Government and Private Universities. He is intellectually involved in supervising Post graduate Students. He has been the Principal Investigator of 3 National Level Information Security Projects.

Dr. Rajiv Pandey Senior Member IEEE is a Faculty at Amity Institute of Information Technology, Amity University, Uttar Pradesh, Lucknow Campus, India. He possesses a diverse back ground experience of around 30 years to include 15 years of Industry and 15 years of academic. His research interests include the contemporary technologies as Semantic Web Provenance, Cloud computing, Big-Data, and Data Analytics. He has been on technical Committees of Various Government and Private Universities. He is intellectually involved in supervising Doctorate Research Scholars and Post graduate Students. He is also an active contributor in professional bodies like IEEE, IET and LMA. He is a member of Machine Intelligence Labs.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Overview of Broadband Connectivity for Rural Areas-Tanzania as a Case Study

Mastidia Byanyuma & Zaipuna O. Yonah, *Nelson Mandela African Institution of Science and Technology (NM-AIST) Arusha, Tanzania*

Fatuma Simba
University of Dar es Salaam, Tanzania.

Lena Trojer
Blekinge Institute of Technology, Sweden

Abstract—**Broadband connectivity is a necessary service required not only in urban areas but more so in rural areas where most of the basic services are inadequate or do not exist at all. Broadband services can enable many services to be offered through information and communication technologies (ICTs) to the extent that rural people can get a chance to enjoy quality communication and other services as in urban areas and be part of the socio-economic development of a given community. Currently, there is a number of technologies and initiatives to connect rural and urban-underserved areas at a reasonable cost but most of the rural users are yet to be connected. This paper gives an overview and a discussion on technologies, broadband connectivity models, infrastructure and policy readiness, and initiatives towards achieving connectivity and bridging the digital divide. The context of this paper is rural areas in Tanzania.**

***Index Terms*—Broadband connectivity, WiMAX, Optic Fibre Cable, rural and urban-underserved, broadband technologies, digital divide.**

I. Introduction

In recent years, broadband connectivity has been a necessity for provision of real-time applications to subsidize the lack of basic services in most areas of developing countries. However, last mile broadband connectivity (i.e. extending the available infrastructure to reach rural users) has been taking a slow speed. Despite its importance to national economies and the personal lives of users, its availability and adoption are not diffusing in rural and urban areas at the same rates [1]. The main reason to this remains the lack of purchasing power to attract investments. This is evident from various governments' initiatives to subsidize the same through Universal Communications Services Access Funds like UCSAF in Tanzania, Universal Service Fund (USF)-Kenya and Universal Service and Access Fund (USAF)-South Africa.

Most of these rural areas are without or have poor basic facilities such as hospitals, schools, road and other social services [2, 3]. In Tanzania, for example, there are many schools in rural areas with very few teachers, with no laboratories, books and other learning tools [4, 5]. These areas are also the ones inhabited by more than 70% [6] of the population despite the lack of basic needs. Reasons behind the poor or inadequate provision of services in rural areas include among others; perceived business risk attributed to unpredictable revenue streams, high investment cost attributed to infrastructural and cost demands of the current technology, unstable policies in some countries and weak business models [7]. These and other problems have slowed down development in these areas because traditionally investors perceive rural and urban underserved areas as low revenue, high costs, and high-risk areas.

The Tanzania government has embarked on connecting the last mile in rural and urban-underserved areas through various initiatives. The last phase (5th Phase) of the National Information and Communication Technologies (ICT) Broadband Backbone (NICTBB) project is to extend the broadband connectivity to the last mile in rural and urban-underserved areas. Mobile Operators through the UCSAF subsidization initiative and Halotel have collectively covered more than 90% of the geographical area of the country in which case every ward has at least a 2G cellular network coverage.

However, according to the National ICT policy of 2016 (NICTP2016), most citizens still cannot access broadband services [8]. This is in line with Kwigizile *et al* who contends that, the lack of ICTs is a lower barrier than affordability [9]. These facts suggests that, there is more to just bringing broadband connectivity to rural and urban underserved areas and these are discussed in this paper.

Despite the stated inadequacy of broadband services to rural areas, the engagement of rural communities is crucial for economic development and social transformation through e-governance [10] and other programs. Broadband service, in particular, is an important contributor to increased country's Gross Domestic Product (GDP), job creation, broadening of education opportunities, public service delivery, and rural development if the reach, availability, and affordability are guaranteed and the demand and supply side skills to exploit the economic and innovative potential of broadband are developed [11].

This paper gives an overview and a discussion on technologies, broadband connectivity models, infrastructure and policy readiness, and initiatives towards achieving

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

connectivity and bridging the digital divide. The context of this paper is rural areas in Tanzania.

The paper is organized as follows: Sections II to V discusses broadband and associated services, an overview of broadband technologies, broadband models and initiatives available for providing connectivity in rural areas, respectively; while Sections VI to VII present the infrastructure and policy readiness respectively. Section VIII concludes the paper.

II. Why Broadband?

Broadband is the transmission capacity that is faster than the primary rate Integrated Services Digital Network (ISDN) of at least 2.0 Megabits per second (Mbps). With this capacity, end users can browse the internet, transfer information (multimedia) more freely and possibly on real time speed. In areas with challenging transport and other socio-economic infrastructure, telecommunications infrastructure in terms of both voice, data, and video plays a greater role in balancing the socio-economic activities of such areas. Broadband technology in particular is termed as general purpose technology because adoption of the same results in improved lives in a given area as seen from minimized depopulation caused by poor living conditions in rural areas in the Bavaria State in German; and indicating that an improved broadband coverage makes these municipalities more valuable places to live [12]. Taking an example of mobile money innovation in East Africa [13], through telecoms infrastructure, financial services are everywhere regardless of the geographical situation of an area as long as mobile coverage is there. This is why Donner [14] confirm that a mobile phone is a vehicle that could be utilized efficiently to generate profits and reduce costs in business enterprises [15], a fact any entrepreneur will capitalize on.

On the other hand, broadband connectivity has made it possible for social networking applications such as WhatsApp, twitter, and Facebook which continue to bring people closer in space such that distance is no longer an issue. Some users have benefited from sharing useful information on farming, health, educational and news on what is happening worldwide. Others have used them to promote their businesses, product, and services close to free of charge. All these have been possible through broadband media in particular mobile broadband through the cellular network, which has comparatively wider coverage in rural areas.

The cellular network coverage is increasing yearly along with improvement in value-added services and applications (mobile apps), which comes with associated benefits to users. From Fig. 1, the mobile cellular penetration rate worldwide is 97% (7 billion mobile cellular subscriptions) which has increased from 738 million subscriptions in 2000 whereas the mobile broadband technology had a penetration of about 47.2% in 2015 that increased about 12 times since 2007. The global internet penetration in terms of individual using the internet was 43.4% in 2015 [16].

On the other hand, Fig. 2 shows the trend of internet use in Tanzania where the mobile wireless has shown an increasing rate from 2011 to 2016. The internet penetration including both wired and wireless (fixed and mobile) were 40% in 2016 which had increased from 12% in 2011 also indicating a tremendous growth in a very short time. The combination of growth in mobile broadband penetration and the emerging cost-effective technologies are likely to impact communities since currently, mobile technology is the only technology that can reach most of the areas easily, a fact that promises more investment in the sector hence increased associated benefits to the society.

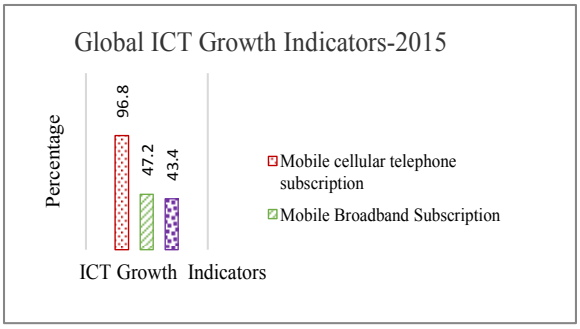


Fig 1: Global ICT Indicators (Source: [17]).

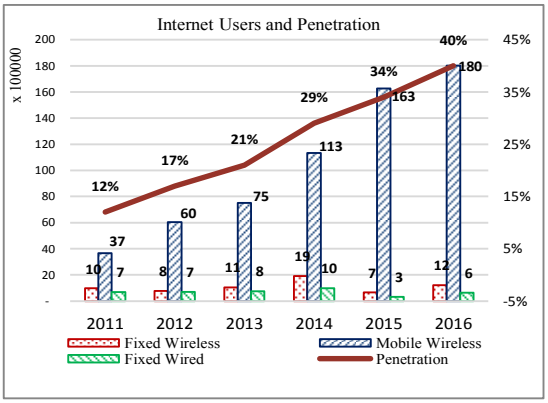


Fig 2: Internet Users by Technology Type and Penetration in Tanzania (Source:[18]).

Users regardless of their geographical area need affordable and reliable broadband access, which is vital for the provision of sophisticated ICT applications [17] such as telemedicine, e-learning and other innovations that may come up in the cause of science and technology advancement to improve livelihood.

In this study, we find that broadband connectivity is currently not an issue to worry about but the issue is adoption, availability, and usage and user experience of broadband services.

III. Overview Of Broadband Technologies

There are many different types of broadband technologies which may be wired or wireless technologies. Most of the wired technologies such as dial-up, Advanced Digital Subscriber line (ADSL), Cable, leased line (T1), Broadband over Powerline (BPL) and fiber optic cable have for a long time been expensive means to reach rural areas where in most cases the population density is very low. On the other hand, wireless technologies such as fixed wireless, Wi-Fi, Satellite, Television White Space (TVWS) [18–20], GPRS/EDGE, (Worldwide Interoperability for Microwave

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Access (WiMAX)[21–24] and Long Term Evolution (LTE) are available and can be used to connect the rural users. Other fixed wireless technologies are such as the Local Multipoint Distribution Service (LMDS) and Multichannel Multipoint Distribution Service (MMDS) [26], [27]. Among all these technologies, only a few can be used cost effectively to provide rural and urban-underserved areas broadband connectivity due to various reasons. For instance, the wired technologies need comparatively higher investment cost to reach rural areas making them non-feasible for rural last mile connectivity. The wireless technology in rural and urban-underserved areas of Tanzania are dominated by GPRS, EDGE and VSAT network services which offer limited throughput unsuitable for real-time applications. UMTS, HSPA, and LTE are deployed in urban areas where population density justifies investment leaving rural areas uncovered by these high capacity technologies [28]. The possible reasons for deployment of UMTS, HSPA, and LTE only in city centers are coverage limitation that would require significant investment costs to cover all rural areas.

However, some of these technologies can be used as first or middle mile in combination with other wireless technologies. Various initiatives have proposed or implemented a combination of the above technologies to achieve reach, capacity, and quality of service. In some of these, both wired and wireless technologies have been recommended to be used together to achieve the required throughput and convenience. Example, in some areas fiber optic technology [28] has been proposed to be combined with MMDS as the access network to reach rural and urban-underserved areas. Alternatively, UMTS operating at 900MHz is used to extend the capacity and coverage of UMTS at 2100MHz to rural areas where the available technology is GSM/EDGE with low data rate [29].

Various technologies are available to date to achieve broadband connectivity and these are either implemented in different areas or are proposed to be implemented. Most of these are a combination of one or two technologies with the aim of lowering capital expenditure (CAPEX) and operational expenditure (OPEX) while achieving the desired goal in terms of quality of service, reach, sustainability and affordability. In this section, both used and proposed technology set-ups for broadband connectivity for rural areas are presented.

A combination of different technologies has been recommended to be a good option to reach rural areas cost effectively with required throughput. This is because some of the technologies despite their high capacity and QoS are not viable to use to extend the same as the access network. For instance, combining Optic Fibre technology with WiMAX (FiWi) is one of the hybrid technology where WiMAX is used to extend the reach of Fibre Optic connectivity to the users [29]. Such set up are Passive Optical Network (PON) with WiMAX integration and Optical Fibre with WiMAX integration as shown in Figs. 3 and 4, respectively:

IV. Broadband Connectivity Model Trends For Rural Areas

Various models are proposed by various researchers for Tanzania environment taking into consideration of technology, network set up, management and other factors to achieve the desired service. Examples of rural and urban underserved areas models are Mesh networks, Broadband Island, Nokia Siemens Networks and Rural Netco shared broadband model. These are presented in the next paragraphs. These models aim at connecting the rural areas in its totality. While these models are prospective general technology especially proposed for the rural areas, currently Tanzania has a cellular coverage of about 90% as stated previously and fiber optic network coverage of almost 25600 km (government 7600 km and Halotel 18,000km).

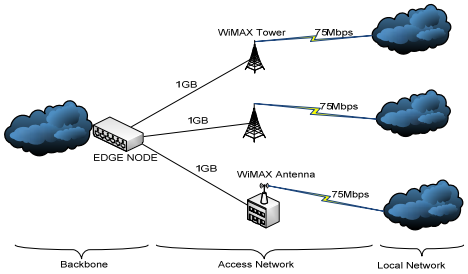


Fig 3: PON and WiMAX Integration **[29]**.

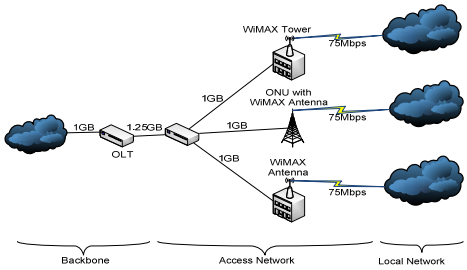


Fig 4: Optical Fibre with WiMAX **[29]**.

A. *Mesh Networks*

A WiMAX mesh network that lowers the subscriber's cost and helps to bridge the digital divide through the elimination of the middleman (i.e. ISPs) is proposed in [30]. WiMAX mesh network is based on Wireless Mesh Network (WMN), a special kind of Mobile Ad Hoc Network (MANET) with the WiMAX technology as a wireless part of the network.

WMNs have special characteristics such as dynamic self-organization, self-configuring, self-healing, high scalability and reliable services and are able to balance traffic and provide support to drop connections to fixed or mobile clients [31]. These are convenient characteristics for a network in rural areas where constant network management may make the business unprofitable. The basic topology of an IEEE 802.16 mesh network consists of two parts namely; Base Station (BS), a coordinating node and Subscriber Station (SS).

B. *Broadband Island*

As a move to address further the access gap, Nungu *et al* [32] developed an Island model to make use of unutilized TANESCO fiber optic network that existed between Bunda and Serengeti districts in Mara Region, Tanzania. In this model, only local communication among government offices, education, healthcare, and other entrepreneurs were considered. This broadband island had a narrowband VSAT connection to the Internet but the main focus was local connectivity. In similar set ups, unutilized networks can be used to provide not only voice but also broadband services

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

to users around that network. Promotion and mainstreaming the broadband island model can benefit many at a reasonable cost.

C. Nokia Siemens Village Network

The Nokia Siemens Village Connection (NSVC) system is PC based, using IP (Internet Protocol), with backhauling delivered mainly by satellite. Each Access Point is supported by a regional Access Centre which can support up to 200 Access Points with each Access Centre providing network coverage for up to 14,000 subscribers [33]. The NSVC uses a different business model in which all the village internal calls are connected locally and only rest of the world calls go out of the village network as shown in Fig.5. This significantly lowers CAPEX and OPEX costs by avoiding unnecessary use of bandwidth and hence the reduction in connection cost. The other cost serving technique is through the use of antenna on village buildings instead of installing masts which normally add cost. This cost effective network has been successful in India where the rural population has started to enjoy the services just like in urban centers. Because of lack of power in rural areas the village connection network make use of low capacity solar panels on the customer's house.

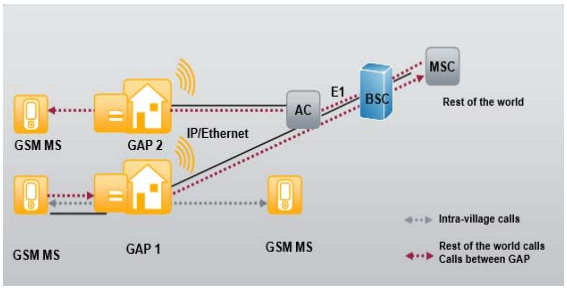


Fig 5: Nokia Siemens Village Network **[33]**.

In Tanzania, Nokia Siemens Networks and Vodacom Tanzania Limited entered into an agreement to implement the Nokia Siemens Networks Village Connection Solution [15], as an innovative and unique solution to resolve the challenge of rural coverage to deliver cost effective network capacity (i.e. low capital expenditure, CAPEX) at a low operating cost (OPEX). The solution was set to start in 2008 with a trial implementation and later be extended elsewhere in the country.

This arrangement has a promising future but at the time of writing this paper, there was no progress report on the project in Tanzania. The implementation ended only on trial stage. Although the reasons are unknown, it can be attributed to lack of customers interested in the service due to the fact that they were not involved in project planning as noted in [34] and [35].

D. Rural Netco Shared Broadband Model

The Rural Netco Broadband Model is a wholesale model operating in Tanzania from which the operators buy the capacity to provide services to their customers. The company launched their services commercially with Vodacom, the largest in Tanzania in September 2013 with market share of 37% compared to Airtel (32%), Tigo (23%), Zantel (7%)TTCL (1%) and Benson (0.002%) as indicated on TCRA website [36].

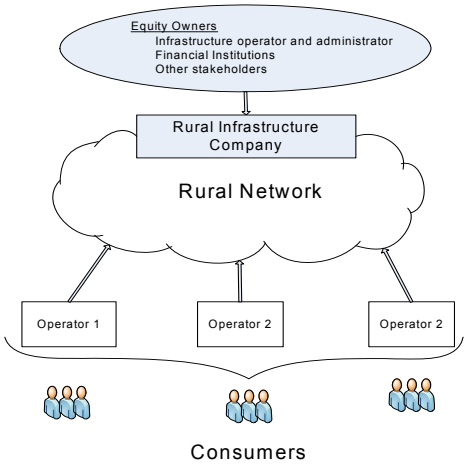


Fig 6: Rural Netco Shared Broadband Model.

According to the BE Weekly magazine [37], Rural Netco is currently providing coverage to 23 regions in Tanzania. This is a huge coverage if the remaining operators can enter into an agreement and cover those areas with value added services. The Rural Netco covers a given area and lets the operators use their network to provide services to users as shown in Fig. 6. This model is attractive in a way that it allows the company to benefit from economies of scale while contributing to the realization of co-location and sharing of resources that is stipulated in the Electronic and Postal Communications Act (EPOCA).

E. Television White Spaces (TVWS)

Television White Space (TVWS) is the recent technology that uses the unoccupied television (TV) frequency band for non-broadcasting services such as broadband services. TVWSs exist in the spectrum primarily used for digital terrestrial TV broadcasting, that is, 470 MHz to 694 MHz.

Recently, TVWS was recommended for use in rural areas due to associated low cost of operation and a substantial amount of bandwidth for broadband services., they can provide broadband connectivity of up to 14Mbps (Ref). A typical example of the implementation of TVWS is the project that has connected 5 schools in the rural Mankweng Township at a distance of around 10 km around the University of Limpopo in South Africa [38]. In this particular project, each of the five schools received a donation of 31 tablets, an overhead projector, and smartphone to enable eLearning delivery. There is another good example in Tanzania whereby Microsoft in collaboration with The Commission for Science and Technology (COSTECH) and UhuruOne, a Tanzanian ISP organized a project to provide affordable wireless broadband access to university students and faculty in Dar es Salaam using TVWS radios from 6Harmonics. In this project, 4 higher leaning institutions are involved and this partnership will enable UhuruOne to offer a laptop or tablet, wireless broadband connectivity, and applications and services to cover a student population of about 50,000 at four universities: the Institute of Financial Management, the Dar es Salaam School of Journalism, the Institute of Social Work and The Open University of Tanzania.[39].

Apart from providing broadband connectivity in rural and underserved areas, TVWS can effectively improve spectrum utilization and alleviate spectrum scarcity and

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

when compared with Log Term Evolution (LTE) for rural broadband, TVWS is more cost effective. However, very few countries have fully regulated and adopted TVWS for broadband services. In countries like Tanzania, Ghana, Kenya, Botswana, Namibia and South Africa, trial projects have been implemented by Microsoft in collaboration with local Service Provider to support various media protocols, such as streaming videos, emails, FTP, Skype voice and video conferencing, and high-speed VPN services[39].

Fig.7 shows a TVWS network architecture which comprises of the 802.11 b/g/n/ac Wi-Fi access points (APs), which connect directly to the TVWS customer premise equipment, or CPE using standard Cat5 or Cat6 cable. The CPE communicates with the TVWS base stations (BS) through a TVWS air interface protocol, e.g. IEEE 802.11af, which can be located within several hundred meters of the CPE or kilometers away. The TVWS radio attaches behind the antenna to the same pipe mount and an RF jumper connects to the antenna while Cat5 cable drops to the Wi-Fi AP or Ethernet switch [39], [40].

When it comes to what technology to be used in connecting a specific area in rural areas, a number of factors need to be considered to come up with the right one for the area: type of services, ownership and purchasing power of the people in that area.

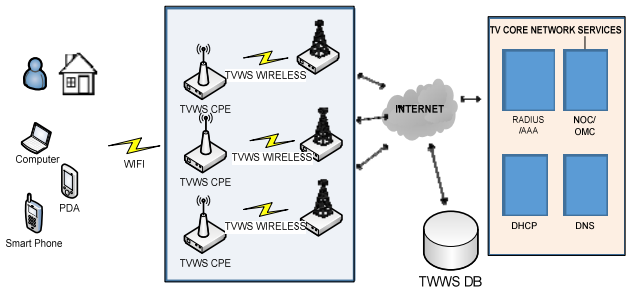


Fig 7: TVWS network Architecture.

V. Initiatives to Achieve Broadband Connectivity

A number of initiatives to achieve the goals of Tanzania Vision 2025 and the objectives of NICTP-2003/2016 have been implemented and together have helped in some ways to reduce the digital divide. Some of these initiatives are the telecentres, the NICTBB project and the Universal Communication Service Access Fund (UCSAF). Initially, when the telecentres were first instituted the main service considered was the voice service. However, the current telecentre model considers broadband connectivity because the technologies to facilitate that are available. This is why the ITU/UNESCO report of 2013 [41] recommends telecentres as a means to address broadband access barriers in areas with low population density and low purchasing power. In this section, each of the initiatives is briefly presented and discussed.

A. Telecentres

Telecentres are places where shared access to ICT and enabled services are available and are used to bridge the digital divides between rural and urban areas [42]. Telecentres were initially introduced in 1998 for developing countries as a means to achieve universal access and hence socio-economic development. In Tanzania, Sengerema pilot telecentre was implemented in Mwanza region in 2000. It was expected that installation of such centers would increase with time but ten (10) years later only 22 telecentres are reported to exist [43] which is a very small number compared to a number of areas in need of such services. This means the expected impact of telecentres are yet to be realized [44]. Looking at the investment structure of such initiatives most of which were donor-funded and at the end of the funding duration most of these telecentres failed to operate despite the inclusion of secretarial and other services as part of the diversification strategy to sustain the centers. Fig. 8 is the Sengerema Telecentre in Mwanza, Tanzania, which shows the presence of a radio service, Radio Sengerema (98.8 FM), as part of the center's services [44].

Although the inception of telecentres in Tanzania was well before the institution of the National ICT Policies (NICTP-2003 and NICTP 2016), telecentres have always been recommended for shared access and means for aggregating traffic in areas where customers are sparsely populated and purchasing power on an individual basis is low, as such then, achieving the universal access remains a challenge.

Fig 8: Sengerema, Mwanza Telecentre. Source **[44]**.

At the time the Tanzania telecentre initiative was being introduced for rural and remote areas in 1998, the access technologies were mainly VSATs due to their being located far from the reach of wired and other networks. With VSATs, the main challenge was annual satellite charges even when the link is not used. With the positive changes in technology coupled with high capacity, affordable and reliable networks, telecentres of today are expected to perform even better. This is why to date the International Telecommunication Union (ITU) recognizes telecentres as one of the strategies to overcome access barriers to universalizing broadband in low population and places with low purchasing power [41]. This means countries such as Tanzania need to consider mainstreaming the telecentre model for low purchasing power users if it has to achieve broadband connectivity for all.

B. The Tanzania National ICT Broadband Backbone (NICTBB)

In order to realize the vision of the NICTP-2003 "Tanzania becoming a hub of ICT Infrastructure and ICT solutions that enhance sustainable socio-economic development and accelerated poverty reduction both nationally and globally", the government through the

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

NICTBB project set itself to connect all its regions and districts to create a high capacity and reliable national and international broadband infrastructure so that they have an access to a national and regional broadband infrastructure as well as the sea cables landing on its shores [40]. This alone is enough to allow other initiatives to be undertaken once the relevant infrastructure is in place. The project was set to be implemented in 5 phases.

At the end of its 2nd phase, The NICTBB had an OFC route length of 7560 km connecting 24 Region centers in Tanzania Mainland, also connecting Pemba through TANESCO cable between Tanga and Pemba. Telecommunication operators and ISPs are able to connect to the network, which has drastically reduced the connection cost of most services from voice to the internet and other services.

In its 3rd phase, the NICTBB centred on four main components which are [40]: (i) construction of additional OFC links to achieve a mesh OFC transmission networks; (ii)construction of regional and district OFC transmission networks; (iii) construction of an IP-layer of the NICTBB and a national Internet Data Centre (IDC) facility of high standard; and (iv) Implementation of additional Internet-based connectivity systems for the government to extend the ongoing e-Government project such as ERNET, e-Schools Network, e-HealthNet and Community Information Centres (CICs) to local governments [45]. It was reported that the service charges per Gigabyte (GB) had dropped by 75% from TZS 36,000 in 2009 to TZS 9,000 in 2013. A similar drop in charges was achieved in mobile phone calls per minute charges from TZS 147 to TZS 62 [45]. This makes communication affordable to most of the people where this connectivity is available.

During our research work, it was discovered that some users (businesses and institutions) in remote, rural and urban-underserved areas are connected to the fiber network with huge capacity terminated within the vicinity of the rural and urban-underserved unconnected users. This suggests that it is possible to tap from such connectivity as a means to utilize the links at the same time serving the users who would never bring that connectivity to their areas on their own due to the associated costs. It is so because the main cost of bringing the connectivity is already paid for. An example is the 14 km fiber link from Arusha town to the Nelson Mandela Institution of Science and Technology (NM-AIST), Arusha campus carrying 1Gbps capacity while the schools and other organizations around NM-AIST are not connected. This connectivity can be extended to surrounding users using wireless technologies such as MMDS, WiMAX [4], [46].

C. The Universal Communication Services Access Fund (UCSAF)

UCSAF is one of the initiatives that was created in Tanzania to address the access gap existing in the country between rural and urban areas. It is a follow up on the World Summit on Information Society (WSIS) agenda. The idea is to subsidize investments to unprofitable rural and urban-underserved areas, which lack incentives to investors. Through members of parliament (MPs), it was possible to identify 2175 villages in Tanzania for which the fund needed to consider.

Between 2012 and 2013, the fund issued two subsidy tender bids for the provision of basic voice telecommunications services under contracts: (UCAF-2012-1 and UCAF-2013-1) covering a total of 223 wards and 1284 villages [47]. In Tanzania, a ward is an administrative structure consisting of several villages in rural areas or streets in urban areas. Universal Access plan is expected to cover a total of 340 wards with about 2500 villages in total. It can be noted that both tender bids require operators to provide basic voice services to these rural areas. Although the voice service is one way to development but yet still, broadband connectivity is as important considering real-time applications that require more than just mobile voice services. Fortunately, with the availability of Fibre Network coverage to the district level and the wireless coverage that is being established, it is now possible to extend the broadband connectivity through a combination of various technologies that are already available in the market. For instance, the recent launch of 3G and LTE mobile broadband services can easily build on the coverage already in place.

From the report by UCSAF on "Coverage, Population and Land Scan Data for Selected Wards, some ward villages were without telecommunication services. Fig. 9 shows some of the selected wards with a bigger percentage of the geographical area uncovered, most of which 100% were not covered by any network which means even the population was uncovered with more or less percentage as shown. These villages were selected based on the total areas uncovered by any telecommunication service at the time of research as presented in the report. This is a serious situation for a Tanzania that wants to graduate from a Lower Income Country to a Middle-Income country by the year 2025, which is expected to be achieved through ICTs [48].

However, through strategies put forward by UCSAF and the government the situation as far as universal access in rural and urban-underserved areas is concerned, has improved a lot. It is reported that currently 90 % of the geographical areas is covered by mobile operators. Additionally, Vietell Company limited since 2010 has built an 18,000 km OFC (mostly as access) network all over the country to reach those areas which were not reached. This is adding to the 7600 km fiber built by NICTBB project.

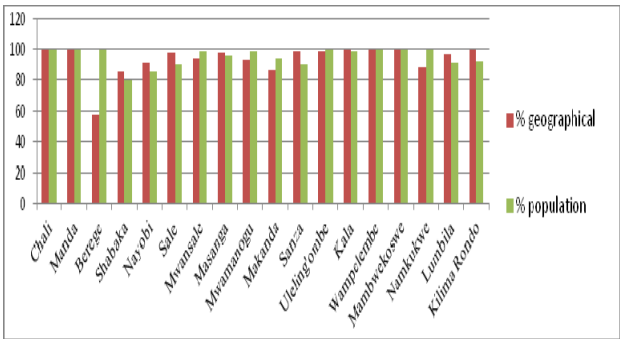


Fig 9: Geographical and population uncovered percentages for selected wards [29].

VI. Infrastructure Readiness

It is generally understood that infrastructure is what drives information society such that lack of it makes the goal of achieving an information society as stipulated in the

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

NICTP-2016 [8] a daydream. One of the policy statement states on ICT infrastructure that:

> "*The Government will ensure that a reliable state of the art ICT infrastructure, of adequate capacity, high-speed and countrywide coverage is developed*".

This policy statement has been a motivation for the Government of Tanzania to construct the OFC traced NICTBB. Building such advanced network with high-speed capacity has been described by many as "the great infrastructure challenge of the 21st century" [45]. Therefore, Tanzania is one of the countries that has addressed that challenge by building the state of art NICTBB with Points of Presence (PoPs) at all regional and district headquarters. This network provides connectivity to the international infrastructure through the four International submarine cables: SEACOM, EASSy, SEAs and TEAMS providing an abundant bandwidth, fast and affordable broadband connectivity to the country [11].

In addition to the OFC infrastructure covering the whole country at district level, there are other private mobile and fibre networks available in the county owned by telecommunications operators and various organisations such as the Tanzania Electric Supply Company (TANESCO) and Ministry of Water (MoW), which are currently being used in combination with the public networks in various socio-economic development projects. Example: the Bunda-Mugumu access network is being provided through an OFC installed by TANESCO with the fibres carried in the ground wire known as optical power ground wire (OPGW) along the 33 kV power line (for supervision, control and data acquisition purposes) and the Wami-Chalinze network project through the MoW optic fibre network (a water flow monitoring and accounting systems) [14, 22, 23].

Additionally, the Government of Tanzania through its Ministry of Communication, Science, and Technology (MCST) envisions a knowledge-based Tanzanian society with the capacity and capability to harness Science, Technology, and Innovation for the transformation of the economy that is sustainable and globally competitive. With this vision, it is clear that ICTs can facilitate reaching the majority (about 75%) of Tanzanians living in rural areas to be part of this vision. This is why the Government charged the Ministry to construct the NICTBB as a means to solve the issue of telecommunication infrastructure [40].

In line with this, the NICTP-2016 emphasizes ensuring all installed ICT infrastructure and capacity is utilized effectively and contributes to resilience and redundancy. Therefore there is a need for a plan on how to utilize all installed capacity such as the NICTBB and the UCSAF projects to achieve the learned society as stipulated in Tanzania Vision 2025, in which case digital divide in different geographical locations is minimized if not eliminated.

However, the ICT Infrastructure is associated with the availability of other essential services/ infrastructure such as electricity supply, roads and other basic economic services and social necessities; meaning that any solution to achieve connectivity in such areas needs to consider presence or absence of such services.

Even after all necessary ICT infrastructure has been in place still willingness and readiness, leadership and ownership will be a holdup of service provision to users in the urban-underserved and rural areas. However, with the Public Private People's Partnership (PPPP) model proposed in [49] as an implementation strategy for sustainable broadband rural connectivity solution, it is possible to mitigate such challenges due to the fact that from the very beginning all the parties are involved so that each of the member/parties is interested to see the projects to the end and play part in each step where involved.

VII. Policy Readiness

Various Tanzania policies, regulations, and national strategic plans recognize the importance of broadband connectivity either through, set regulations and frameworks, encouraging best ways for broadband connectivity or encouraging ICTs in various sectors in the country. Tanzania does not have a Broadband policy which should be a vital part of broader ICT policy strategies [50], like its neighboring country Kenya and the rest of developed countries. However, the available policies, regulations, strategies and frameworks are sufficient to allow broadband connectivity reach every citizen. For instance, the National ICT policy of 2016 (NICTP-2016) envisions:

> *"Tanzania with economically, socially and culturally enriched people in ICT-enabled knowledge society".*

This policy targets specifically broadband connectivity through policy statements:

The government will [8]*:*

i. *Ensure conducive environment for collaboration of public and private sector in exploring various means of financing access to broadband services;*

ii. *Ensure availability and accessibility of reliable and affordable broadband services countrywide.*

All of these focus on bridging the digital divide through the Universal Communication Services Access Fund (UCSAF) which has started with the provision of voice services to rural and urban-underserved areas.

Notably, the Electronic and Postal Communications Act (EPOCA) of 2010 regulates the co-location and sharing of network facilities as a means to bring down the access charges among providers so that many people can access the services. This has allowed for the successful implementation of spectrum sharing as means to effectively utilize the scarce resource.

In the ITU/UNESCO broadband report of 2013, Tanzania is listed among the countries that have broadband plans [41]. This is due to the implementation of the National ICT Broadband Backbone that is intended to provide high-speed connectivity to the whole country.

Therefore, Tanzania is ready to provide and promote the provision of universal access to broadband services countrywide through both private mobile broadband projects (Mobile operators), Private-Public Projects (PPP) and other initiatives as the policy environment is in support of the same.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

VIII. CONCLUSIONS

In this paper, we have discussed models available for last mile connectivity, infrastructure, policy readiness and initiatives focusing on rural connectivity in Tanzania. It has been noted that, although Tanzania has no specific broadband policy, the current national strategies and ICT policy and other frameworks are sufficient to bring broadband services to rural and urban-underserved areas. We find that the infrastructure is to some extent satisfactory if utilization of available private and public networks are extended to rural and urban-underserved areas. Other factors such as ownership and public-private people's partnership programs need to be considered.

Therefore, to achieve the universal access in Tanzania in terms of broadband connectivity we recommend the establishment of business models that will allow small scale entrepreneurs available in rural areas to provide services at a scale sufficient for the area and for the capital available.

REFERENCES

[1] J. E. Prieger, "The broadband digital divide and the economic benefits of mobile broadband for rural areas," *Telecommun. Policy*, vol. 37, no. 6–7, pp. 483–502, 2013.

[2] A. Joyce-Gibbons, D. Galloway, A. Mollel, S. Mgoma, M. Pima, and E. Deogratias, "Mobile phone use in two secondary schools in Tanzania," *Educ. Inf. Technol.*, pp. 1–20, 2017.

[3] Z. Isamuyo, "Open access ICT infrastructure in rural Tanzania: prototype design," no. November, 2006.

[4] S. I. M. Byanyuma S. Kalolo C.Nyakyi, A.Sam, M., "Affordable Broadband Connectivity for Rural Areas -A Case Study of NM-AIST neighborhood," *PACT13*, 2013.

[5] D. Z. Machuve, I. Zlotnikova, and D. Nyambo, "Monitoring and evaluation of the e-readers project in rural Tanzania," in *Science, Computing and Telecommunications (PACT), 2014 Pan African Conference on*, 2014, pp. 62–67.

[6] NBS, "Tanzania in Figures 2015," Tanzania National Bureau of Statistics, Jun. 2016.

[7] G. Naik, "Designing a sustainable business model for e-governance embedded rural telecentres (EGERT) in India," *IIMB Manag. Rev.*, vol. 23, no. 2, pp. 110–121, 2011.

[8] United Republic of Tanzania, "The National Information and Communications Technology Policy," no. May, 2016.

[9] E. Kwigizile, J. Chilongola, and J. Msuya, "The impact of road accessibility of rural villages on recognition of poverty reduction opportunities," *Afr. J. Mark. Manag.*, vol. 3, no. 2, pp. 22–31, 2011.

[10] K. Chaudhari, "E-Governance in Rural India: Need of Broadband Connectivity Using Wireless Technology," *Wirel. Eng. Technol.*, vol. 02, no. 03, pp. 212–220, 2011.

[11] RSA, "South Africa Connect: Creating Opportunities, ensuring inclusion. CREATING OPPORTUNITIES, ENSURING INCLUSION, South Africa's Broadband Policy," Department of Communications, Republic of South Africa, 2013.

[12] W. Briglauer, N. Dürr, O. Falck, and K. Hüschelrath, "Does state aid for broadband deployment in rural areas close the digital and economic divide?," 2016.

[13] N. Economides, "Mobile Money in Tanzania ∗," pp. 1–57, 2015.

[14] J. Donner, "Research approaches to mobile use in the developing world: A review of the literature," *Inf. Soc.*, vol. 24, no. 3, pp. 140–159, 2008.

[15] M. Komunte, "Usage of Mobile Technology in Women Entrepreneurs: a case study of Uganda," *Afr. Jounral Inf. Syst.*, vol. 7, no. 3, 2015.

[16] B. SANOU, "ICT Facts & Figures. The world in 2015.," *Itu 150 Años 1865 - 2015*, pp. 6–6, 2015.

[17] ITU, "Measuring the Information Society," 2016.

[18] TCRA, "Quarterly Communications Statistics Report, October-December Quarter," 2016.

[19] K. Patil, K. E. Skouby, and R. Prasad, "Cognitive access to TVWS in India: TV spectrum occupancy and wireless broadband for rural areas," in *Wireless Personal Multimedia Communications (WPMC), 2013 16th International Symposium on*, 2013, pp. 1–5.

[20] M. T. Masonta, L. M. Kola, A. A. Lysko, L. Pieterse, and M. Velempini, "Network performance analysis of the Limpopo TV white space (TVWS) trial network," in *AFRICON, 2015*, 2015, pp. 1–5.

[21] M. T. Masonta, A. Kliks, and M. Mzyece, "Television White Space (TVWS) Access Framework for Developing Regions," in *IEEE AFRICON 2013 WORKSHOP: Cognitive radio and Opportunistic TVWS Broadband Wireless Networks for sustainable broadband provision in Emerging Economies*, 2013.

[22] A. Thesis, "A Framework for Multimedia Streaming over WiMAX in an Emerging Market Scenario," no. June, 2007.

[23] S. Ahmadi, "An overview of next-generation mobile WiMAX technology," *Commun. Mag. IEEE*, vol. 47, no. 6, pp. 84–98, 2009.

[24] M. T. Mandioma, G. S. V. R. Krishna Rao, A. Terzoli, and H. Muyingi, "A Study on WiMax Implementation at Dwesa-Cwebe Rural Areas of Eastern Cape of South Africa," in *TENCON 2006. 2006 IEEE Region 10 Conference*, 2006, pp. 1–3.

[25] J. Rakesh and U. Dalal, "A Survey of Mobile WiMAX IEEE 802.16 m Standard," *ArXiv Prepr. ArXiv10050976*, 2010.

[26] E. Armanious, "Adaptive Modulation , Adaptive Coding , and Power Control for Fixed Cellular Broadband Wireless Systems," 2001.

[27] P. Soma, D. S. Baum, V. Erceg, R. Krishnamoorthy, and A. J. Paulraj, "Analysis and Modeling of Multiple-Input Multiple-Output (MIMO) Radio Channel Based on Outdoor Measurements Conducted at 2 . 5GHz for Fixed BWA Applications," pp. 272–276, 2002.

[28] M. Byanyuma S. Kalolo, S. I. Mrutu, C. Nyakyi, A. Sam, "Affordable Broadband Connectivity for Rural Areas -A Case Study of NM-AIST neighborhood," *PACT13*. LUsaka, Zambia, 2013.

[29] F. Simba, B. M. Mwinyiwiwa, E. M. Mjema, L. Trojer, and N. H. Mvungi, "Broadband Access Technologies for Rural Connectivity in Developing Countries," *Int. J. Res. Rev. Comput. Sci. IJRRCS*, vol. 2, no. 2, pp. 312–319, 2011.

[30] E. Sedoyeka and Z. Hunaiti, "Low cost broadband network model using WiMAX technology," *Gov. Inf. Q.*, vol. 28, no. 3, pp. 400–408, 2011.

[31] I. F. Akyildiz and X. Wang, "A survey on wireless mesh networks," *IEEE Commun. Mag.*, vol. 43, no. 9, pp. S23–S30, 2005.

[32] A. M. Nungu, B. Pehrson, and N. Genesis, "Serengeti broadband," *Proc. Second ACM SIGCOMM Workshop Networked Syst. Dev. Reg. - NSDR 08*, pp. 37–37, 2008.

[33] NSN, "NSN. (2008). 'Nokia Siemens Networks Village Connection - affordable voice and internet con- nectivity for rural villages'. Nokia Siemens Networks White Paper," Nokia Siemens Networks, White paper, 2008.

[34] Fatuma Simba (Bleking Institute of Technology) and Intergovernmental Panel on Climate Change, "Determination of Viable Connectivity Technology for e-Learning in Tanzania: Case Study of Rural Secondary Schools," Bleking Institute of Technology, Cambridge, 2012.

[35] A. Nungu, T. Brown, and B. Pehrson, "Challenges in sustaining municipal broadband networks in the developing world," *Commun. Comput. Inf. Sci.*, vol. 171 CCIS, pp. 26–40, 2011.

[36] TCRA, "Quarterly Telecom Statistics-Quarter 1 (September 2013)," 2013.

[37] Daynes, W and Boyle, J, "Connecting the Dots," 2016.

[38] M. T. Masonta, T. M. Ramoroka, and A. A. Lysko, "Using TV white spaces and e-Learning in South African rural schools," in *IST-Africa Conference, 2015*, 2015, pp. 1–12.

[39] S. Roberts, P. Garnett, and R. Chandra, "Connecting Africa Using the TV White Spaces: from Research to Real World Deployments," in *Local and Metropolitan Area Networks (LANMAN), 2015 IEEE International Workshop on*, 2015, pp. 1–6.

[40] MCST/CITCC, "The National ICT Broadband Backbone Infrastructure Development -Technical Proposal for Phase III." United Republic of Tanzania - Ministry of Communication Science and Technology, 2010.

[41] ITU/UNESCO, "The State of Broadband 2013: Universalizing Broadband," 2013.

[42] S. K. Kapondera and G. Hart, "The use of multipurpose community telecentres and their services in Malawi: the case of Lupaso Community Telecentre," *South Afr. J. Libr. Inf. Sci.*, vol. 82, no. 1, pp. 13–25, 2016.
[43] TCRA/BIID/TTN, "Reaching to Rural (R2R): Connecting the Rural Tanzania Through Telecentres," 2011.
[44] E. Ngowi, A. Mwakalobo, and D. Mwamfupe, "Making ICTs work for Agro-pastoral Livelihood: Using the Telecentre as Learning Tool for Agro-pastoralists Communities in Tanzania," *J. Sustain. Dev.*, vol. 8, no. 2, p. 89, 2015.
[45] MCST, "Ministry of Communication, Science and Technology (MCST) website," 2013.
[46] I. Frank, J. Orunta, and I. Dike, "Broadband Wireless Access Deployment Approach to Rural Communities," *J. Comput. Netw.*, vol. 1, no. 3, pp. 38–45, 2013.
[47] UCSAF, "Welcome Note from CEO, Universal Communications Service Access Fund (UCSAF)." .
[48] TDV2025, "The Tanzania Development Vision 2025."
[49] F. Simba, "Determination of Viable Connectivity Technology for e-Learning in Tanzania: Case Study of Rural Secondary Schools," Blekinge Institute of Technology, 2012.
[50] OECD, *Broadband Growth and Policies in OECD Countries*. 2008.

QSearch: A QUESTION BANK DECISION SUPPORT SYSTEM USING QUERY EXPANSION ALGORITHM

Anna Liza A. Ramos
Saint Michael's College of Laguna
Old National Road, City of Biñan,
Laguna 4024, Philippines
(+639) 27-432 9716
annakingramos@yahoo.com.ph

Jennica C. Corpuz
Saint Michael's College of Laguna
Old National Road, City of Biñan,
Laguna 4024, Philippines
(+639) 95 342 0466
jennica.corpuz@gapps.smcl.edu.ph

Baby Joy B. Lacampuenga
Saint Michael's College of Laguna
Old National Road, City of Biñan,
Laguna 4024, Philippines
(+639) 21 314 1840
baby.joy.lacampuenga@gapps.smcl.edu.ph

John Mark D. Lozanta
Saint Michael's College of Laguna
Old National Road, City of Biñan,
Laguna 4024, Philippines
(+639) 35 196 4351
john.mark.lozanta@gapps.smcl.edu.ph

Manilyn A Sausal
Saint Michael's College of Laguna
Old National Road, City of Biñan,
Laguna 4024, Philippines
(+639) 35 056 9851
manilyn.sausal@gapps.smcl.edu.ph

Adrian D. Evanculla
Saint Michael's College of Laguna
Old National Road, City of Biñan,
Laguna 4024, Philippines
(+639) 06 191 4029
adrian.evanculla@gmail.com

Cathy P. Alzona
Saint Michael's College of Laguna
Old National Road, City of Biñan,
Laguna 4024, Philippines
(+639) 75 936 7171
cathy.alzona@gapps.smcl.edu.ph

ABSTRACT

The study aims to develop a Question Bank Decision Support System using Query Expansion Algorithm to address the need of the schools on checking the validity and reliability of test questions, creation and storing of questions. The study applied the Rapid Application Development (RAD) method to ensure the early visibility and acceptability of the system being developed supported with the ISO 9126 Software Evaluation Testing to ensure the compliance of the system. As a result of this study, the system marked 4.25 weighted mean on Functionality, 4.18 weighted men on Reliability, 4.33 weighted mean on Efficiency, 4.33 weighted mean on Usability and 4.2 weighted mean on Maintainability and 3.75 weighted mean on Portability with an overall result of 4.17 weighted mean interpreted as "Satisfactory" which shows that the developed system adhere the minimum requirements thus provide accessibility, reliability, accuracy and systematic, question bank.

Keywords

QSearch, Question Bank, Query Expansion Algorithm, Decision Support System (DSS),

1. INTRODUCTION

Technology is considered as a vital factor that serves to improve lives [31]. As well as in the educational institution which embraced technology [43] for their educational activities such as creation of examination [8] and storing of questions electronically [50]. This will also enhance the learning processes [39] like the visual representation of lessons became more appealing to the learners through the use of audio-visual media and the resource materials is accessible and available online by using different mobile devices which makes the learners learns faster [15].

One of the major concerns of the schools nowadays is to check the validity and reliability of questions created by the teachers [34] that improves the quality of teachings because it encourage and increase learners participation and at the same time assess what they have learned [4], it also promotes higher-order competencies and increase the intellectual capacity of learners for questioning create challenges that make learners learn [14]. Question is an essential tool to measure the learner's level of understanding [10] because it is an effective device in teaching [25].

These questions should be analyze to improve the validity of a test by improving its reliability [48]. According to Oshkosh, 2012 [35], the question items should be measured based on its difficulty, discrimination and effectiveness to improve the quality of those items and of the test as a whole by eliminating ambiguous items [44].The result of the analysis produced will be the basis for educational stakeholders and academicians to make effective decision making and quality education [28]. With the new innovation of technology, a decision support system is created that will help to analyze data with graphical representation of data [42].

1.1 Project Context

Many large companies before are using management information systems that focused on providing managers with structured, periodic reports, however, the systems did not provide interactive support to assist managers in decision making, this led the pioneers to develop a Decision Support System [37]. The concept of decision support systems (DSS) can be defined as computer information systems that provide information in a specific problem using analytical decision models and techniques, as well as access to databases, in order to support a decision maker in making decisions [17].

As technology evolved, decision support systems were developed to access and manipulate data [16]. Decision support systems are a

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

major category of tools that an organization utilizes to support and enhance its decision-making activities [3]. Many organizations have integrated decision support system into day-to-day operating activities, like performance monitoring. The goal of DSS is to create and use better information. Today, there is a pressing need to use decision support system to help make important decisions [36]. Nowadays, decision-making is more difficult; the need for decision-making speed has increased; overload of information is common; and there is more distortion of information which creates a need for computerized decision support to assist in individual, group and organization decision-making [11].

There are so many benefits that are attached in using decision support system such as helping users in making decisions by performing complex data analysis and retrieves information from a large data warehouse, analyses it in accordance with user specifications, then produce the results in a format that users can readily understand and use [55] because it provides access to a number of different models which consist of statistical analysis of data that can serve as guidelines for certain decisions [54], and also automate tasks at which humans tend to be slow and inaccurate, such as sorting and mathematical calculations [39] and incredibly powerful because the better the information means the better the decisions [45]. However, there are some issues in using Decision Support System such as sometimes the result of the decision analysis is not clear which make it hard for the user to make a clear decisions either [1].

1.2 Purpose and Description

Several web-based question bank application has created and some universities has using question bank system but those system doesn't feature an item analysis.

• *Lack of facility dedicated for the storage of test questions.*

The researchers conducted a survey to twenty (20) faculty of Saint Michael's College of Laguna. Based on results, there were about 16 or 80% answered that the questions created are most commonly saved in their respective computers, the 2 or 10% stored the questions in their flash drive and the 2 or 10% save it in their respective email accounts. Saving test questions in personal computer or flash drive is more likely be proned to viruses which can cause the loss of data and the deletion of files accidentally [12].

• *Difficulty to retrieve questions.*

In the survey conducted to twenty (20) faculty from the Saint Michael's College of Laguna, 20 or 100% of the respondents answered that they had a hard time in retrieving questions. According to Johnson [24], it is inconvenient and time consuming for the users to locate their preferred files in computer especially when files is poorly managed wherein they have to search and scan through folders in finding the preferred files.

• *Difficulty to monitor valid and reliable questions.*

Based on the results of the survey conducted to twenty (20) faculty of Saint Michael's College of Laguna, 10 or 50% of the respondents make used of the questions in their previous exams but 8 or 40% of them do not while the other 2 or 10% still revise some of the questions used in the previous exams. According to Brown [7], one of the problems that arises for the teachers is that they do not analyze their student's performance in their test items, much revise those items. As a result, teachers continue to reuse the same items or types of items over and over again even though those items.

The main objective of the study is to develop a test question bank decision support system that will determine the validity of the questions through item analysis.

• *To design a dedicated storage for questions.*

The proposed system helps the Instructor to store the test questions. Questions can be created under several category such as the identification and multiple choices type of question. Lesson and subject making the system more organized. With question bank, Instructors can easily create an exam by just adding questions or selecting questions from question bank.

• *To retrieve questions easily using query expansion algorithm.*

The researchers used query expansion technique, to make it easier for the instructor to search questions they want to add in the exam by expanding the query with additional relevant terms through stemming. Stemming algorithm helps to reduce the indexing files by simply matching the word with its stems in the database. The Instructor can select test questions by searching specific topic or word then the system will expand the word so the instructor can easily find the questions. Aside from that, the proposed system will also rank the questions depending to its number of used.

• *To design a system that will monitor the valid and reliable questions.*

The system features an item analysis that will assess the quality of test items and determine the validity and reliability of questions. The system will label the questions as either "retain" or "reject" depending on the results in the item analysis. This feature will help the Instructor monitor and maintain the effectiveness of questions. The system will also generate reports for the results of item analysis of questions which help the admin decide what action to take in maintaining the good quality of questions.

1.3 Significance of the Study

The results of this study will be beneficial to the following:

*Educational Institutions***.** The system will contributes for the attainment of the school objectives on quality of education.

The Teachers. The system helps the teachers to provide quality test questions, thus make them effective and efficient.

*The Students***.** The system provides greater accessibility and may enhance the student learning skills since the question created and valid and reliable.

The Future Researchers **–** The study will serve as guide or reference to other who will conduct study.

1.4 Scope & Limitation

a. *Home page module.* This module showed the Registration and login page

*b. Login Module***.** This module allows the authorize user to access the system.

*c. Profile Module***.** This module allow the user to manage personal account by updating personal information and change of password.

*e. Administrator Account***.** This module is dedicated to the Dean of the School authorize to access all the modules of the system:

e.1. Registration of Instructor account

e.2. Manage Account to add the departments, subjects and/or courses they offered in their school that to be included in the system.

e.3. Reports Module that provide graphical presentation of report for item analysis of test questions.

e.4. Add Subject Module **–** The Admin is responsible in adding subjects that the school offered to be able to save it to the system.

*f. Sign up Module***.** This module allows to student to create an account to access the system.

*g. Department Head Account***.** This module is assign by the Administrator.

*h. Instructor Account***.** This module allow the Instructor to create questions by categories e.g. identification and multiple choice type

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

search question, view examination, lessons and details of the questions including its creator, create specific group account

h.1. Search Module. allows the Instructor to search the questions created by the author.

h.2. Examination Module allow the Instructor to create the test questions.

h.3. Manage Examination allow the Instructor to view all the examination that he/she created.

h.4. Groups Module allow the Instructor to create, edit and generate a code for a specific group.

h.5. Lessons Module allow the Instructor to add or create and view the lessons.

h.*6. Question Module* allow the Instructor to create, it categories by identification and multiple choices type of question, and also can view all the details of the question including its creator and the time and date it was created.

i. Student Account – This is the account that can be manage or control by the students. This account has three (3) modules:

i.1. Join Group allow the student to join the group provided by the Instructor.

i.2. Groups allow the student can choose the group where he/she already joined.

i.3. Manage Examination provide access to the student to take exam created by the instructor. The system will automatically check the exam and compute the score of the students.

Limitation

• The system will not include the grammar check capability for the created question, the essay type of question, rank the scores of the students,

2. METHODOLOGY

The researchers used Rapid Application Development to serve as a pattern in developing the system of the study. It enables speed and collaboration across the full application lifecycle from idea conception all the way through to production and subsequent iterations. The result is the faster release of higher quality applications. The cycle comprises of four (4) phases:

• *Planning Phase*

The researchers used the Gantt chart to plan the schedule in determining the task involved in developing the system and in allocating enough time to each task. To determine the situation in the current system, the researchers conducted a survey with the faculty involved in the current system to gather data. Through this the researcher was able to determine the problem.

• *System Design Phase*

Tools, charts, diagram and model regarding on the flow of the processes are created that serves as the guide of the researcher in developing the system such as Context Diagram, Data Flow Diagram (DFD), Hierarchy Input-Process-Output (HIPO) chart and Entity Relationship Diagram (ERD).

• *Development Phase*

The developer based from the agreed used of open source approach prepared the tools to be used in the development such as C#, Bootstrap, Asp.net, SQL and CSS and the application requirements.

• *Cutover Phase*

The researchers used the ISO 9126 Software Evaluation to determine the validity of the proposed system. This is to assess whether the system meets the user requirements. System testing was done by the researchers using Random sampling. Users evaluated the system in Six (6) areas on Functionality, Usability, Reliability, Efficiency, Maintainability and Portability.

3. RESULT & DISCUSSION

Result of the Planning Phase

Group meetings were conducted to brainstorm on concept of the project, outlining the scope of the system, its modules and features and flows.

For the development of the project the researchers agreed to use the open source application, tools, browser, and storage and internet bandwidth.

Requirement	Minimum	Recommended
Internet Bandwidth	2mbps	2mbps and above
Browser	For IE not lower than version 9	Google Chrome

Table 1. Web and Internet Requirement

Software	Minimum Requirement	Recommended Requirement
Operating System	Windows (32 or 64 bit)	2mbps and above
Database	SQL	SQL
Web Browser	SQL Server	SQL Server

Table 2. Software Requirements

Results of System Design Phase

The researchers/developer used the detailed system area models presented through Context Diagram and HIPO Chart Model to ensure that the critical functions will be delivered in the required time frame and creation of prototype design and discussed all the interaction of the procedures and data are identified in the Data Flow Diagram and ERD Model. These models aided the developers on the processes, functionalities and effectiveness of the system.

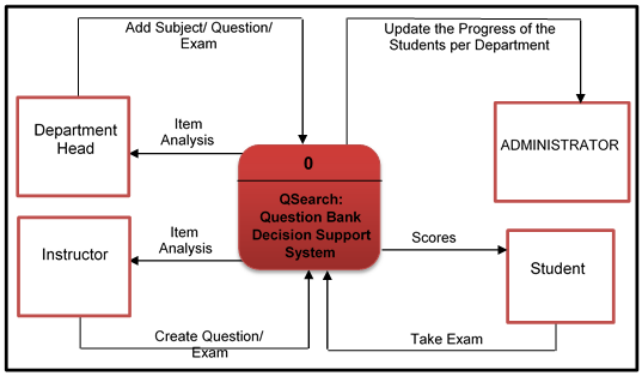


Figure 1. Context Level Diagram

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Figure 1. showed the boundary between the system, and its environment, showing the entities that interact with it called external entities. Those entities are Students, Instructors, Department Head and Admin. Department head and instructor can add subject, question, and create an examination and system will analyze the question created if its valid through the exam taken by the students but the Instructor is not allowed to add subject in the system, only the Administrator is allowed to update the questions and exam created by the Instructor per Department.

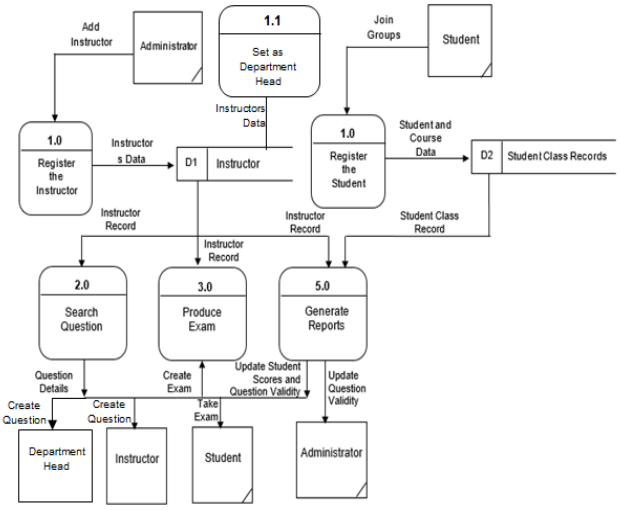


Figure 2. Data Flow Diagram

Figure 2. shows the data flow diagram, a diagrammatic representation of the information flows within a system, showing how information enters and leaves the system, and where information is stored. A data flow shows the flow of data from a source to destination. The researchers used data flow diagram to show the access and task of each users to the system.

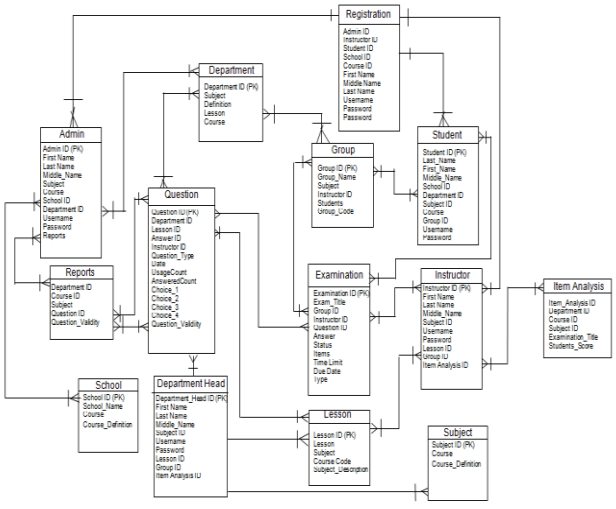


Figure 3. Entity Relationship Diagram

The above shown diagram is the Entity Relationship Diagram that shows how the entities related to the other entities that component of data that stored in the database.

An Admin is allowed to create or register an account of Instructor and it also allows to set the Instructor as Department Head. In which the Department Head can add subject and question. Admin can view the reports of the validity of the questions from the results of the exam. A student or a number of students can create an account in the system and join in one or many groups, take one or a number of examinations created by an instructor or a number of Instructors in which the Instructors can add lesson/s, question/s and create examination/s.

Result of the Development Phase

This phase is about the development of the system. The researchers/developers used several web technologies and tools in creating the system such as asp.net, CSS, Bootstrap, C# and SQL.

The following are some of the features and user's interface design of the system:

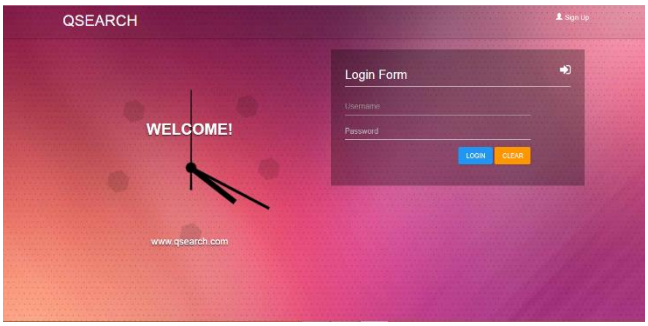


Figure 4. Login Page

The user's login page prompts the user to enter their Username and password to access their respective account.

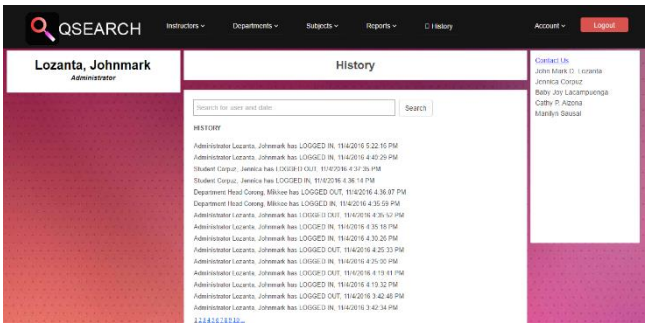


Figure 5. Admin's Homepage

The homepage shows the history of the activities consists of user's name, the logged in/logged out, date and time. A search bar is created to easily locate and filter the desired information.

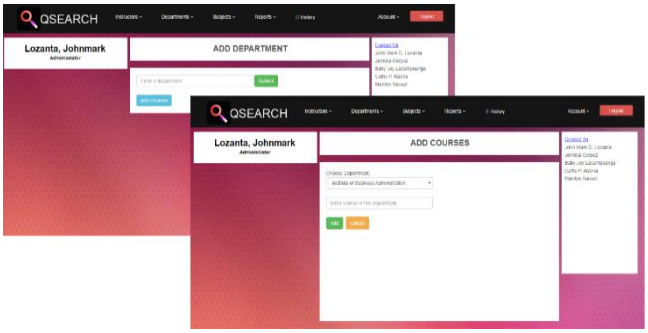


Figure 6. Departments

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

In the Departments Module allows the Admin to input the departments and courses offered.

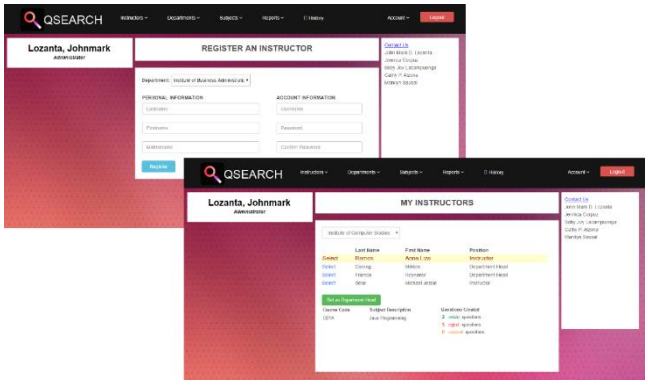


Figure 7. Instructors

In Register Instructor, the page prompts the form asking personal Information. Note: Instructor account is created by the Admin to access the account. On the other hand, the Admin can view all the Instructors registered in the system and authorize to set the Instructor as Instructor Head.

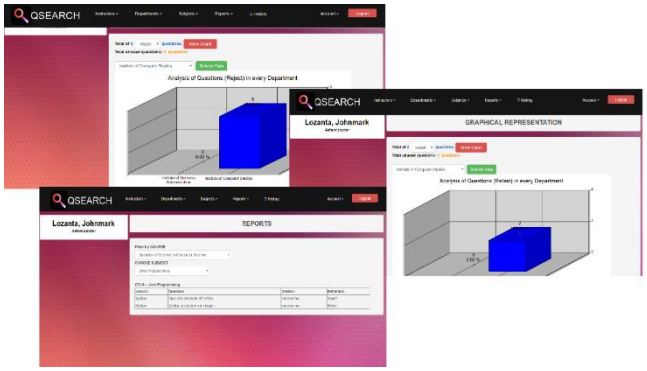


Figure 8. Reports

In reports module, the reject and retain questions can be viewed through graphical representation. The questions can also be filtered by course and subject also the system will produce all the details of the questions including the lesson, question, creator and its definition.

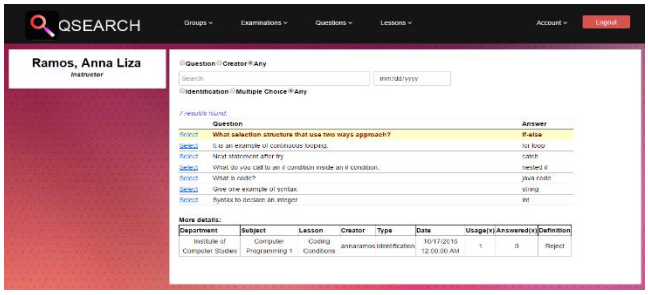


Figure 9. Instructor's Home Page

This page displays all the questions created and this can be filtered by question, creator, identification, multiple choice or any. Once the question is selected all the details about the question can be viewed such as department, subject, lesson, creator, type, date, usage, answered and definition.

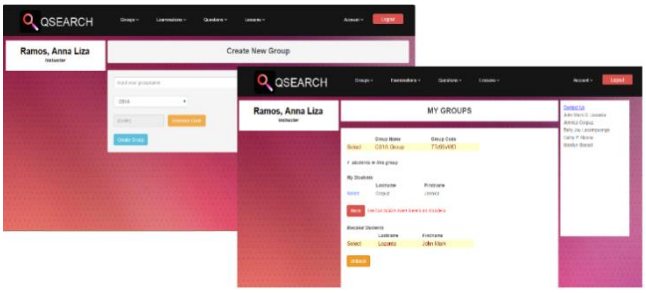


Figure 10. Groups

In group page, it prompts the Instructor to enter the group name and choose course code to generate the code designated for the group, view the students who joined in the group and block the intruders that joins the group.

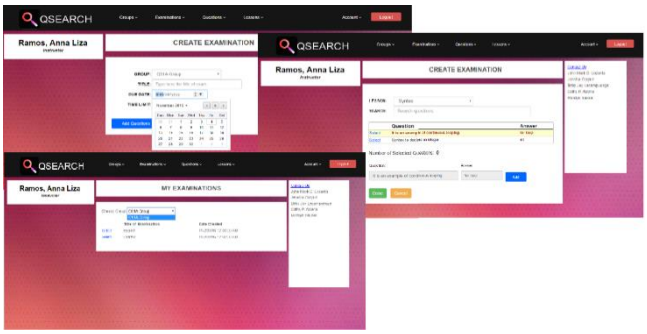


Figure 11. Examinations

In creating the exam, Instructor can choose a group to post the exam, create the title of the exam and set the due date and time limit of the exam. To add questions in the exam, instructor have to select questions from question bank. Instructor can filter questions by lesson or search it through the search bar. All the exams created by the Instructor can be viewed and can be filtered by group.

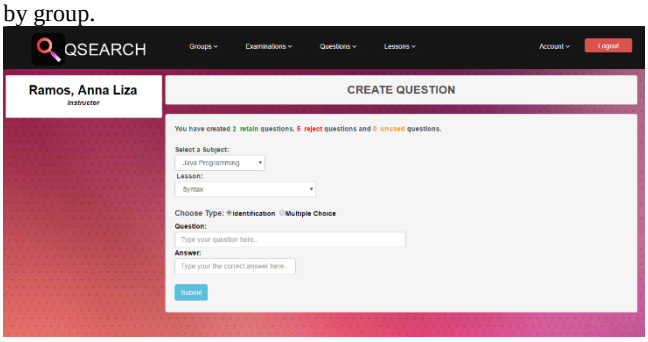
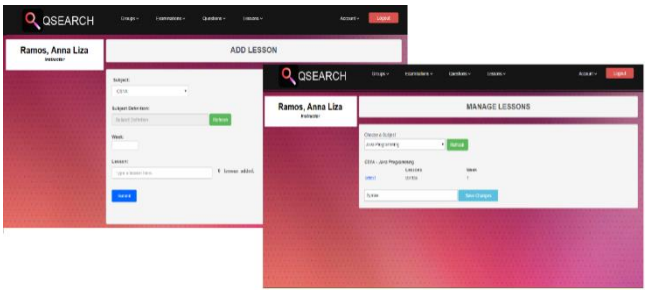


Figure 12. Create Question

To create question, Instructor select a subject, lesson and type of question then input the question together with its answer.



https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Figure 13. Lessons

In adding lesson, the system require Instructor to select subject, week and then type the question to be added in the system. The system also display all the lessons made and can be edited for any changes.

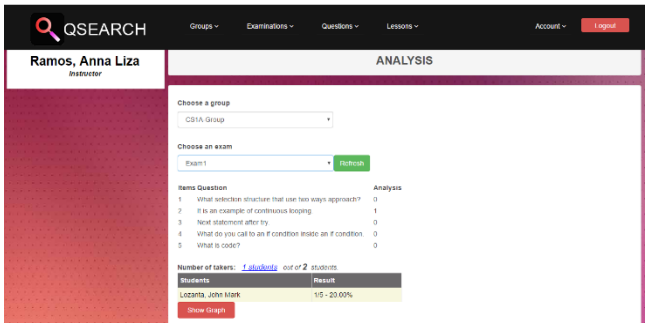


Figure 14. Analysis

In this page, instructor can see the number of students who got the correct answer in each test items and also the number of students who took the exam. Instructor can check it by group and by exam.

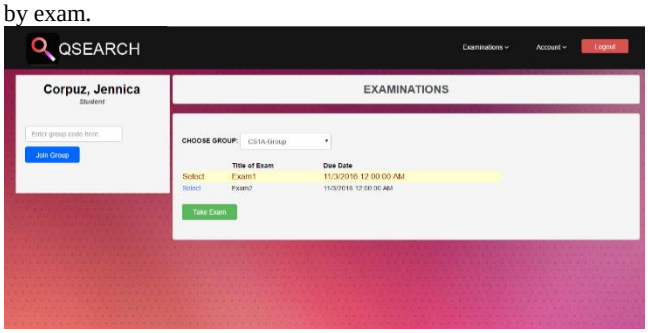


Figure 15. Student's Home Page

In this page, Students can view the exam posted by the Instructor, including the title of exam and its due date. By selecting the exam, students can take the exam. "Join a group" can also be seen in this page where the students can type the group code.

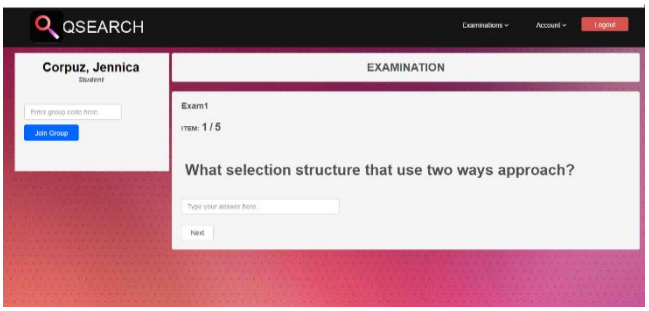


Figure 16. Examination Taking

This is how it looks like in taking the exam where the questions are written with bigger font and then there's a field where the answer must be placed. To continue answering the exam, students must click the "next" button.

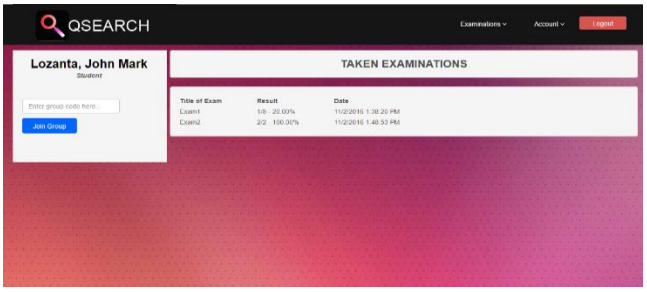


Figure 17. Taken Examinations

In this page, all the exams taken by the students are shown; they can select this to view their results.

Result of Cutover Phase

The researchers/developers utilized the ISO 9126 Software Evaluation to evaluate the developed system. The characteristics of a good and effective software from the given evaluation are functionality, usability, reliability, efficiency, maintainability and portability.

Characteristics	Weighted Mean	Verbal Interpretations
Functionality	4.25	Satisfactory
Usability	4.18	Satisfactory
Reliability	4.33	Satisfactory
Efficiency	4.33	Satisfactory
Maintainability	4.2	Satisfactory
Portability	3.75	Average
Total Weighted Mean	**4.17**	**Satisfactory**

Table 3. Result of the System Evaluation

Table 3. Showed the results of the evaluation conducted by the researchers to the Student and Faculty. The participants answered the software evaluation form to evaluate the (a) Functionality in terms of suitability, accurateness, security, completeness and consistency (b) Usability in terms of understandability, learnability, operability and attractiveness (c) Reliability in terms of consistency and error tolerance (d) Efficiency in terms of time behavior and execution (e) Maintainability in terms of analyzability, changeability, stability and testability and (f) Portability in terms of installability

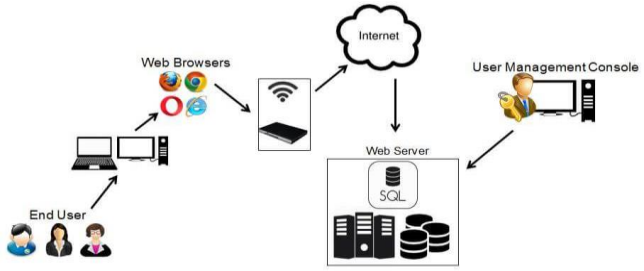


Figure 18. System Architecture

Presented above is the QSearch System Architecture. The system itself is located in the Web Server that receives and retrieves data from the Database server. The System Admin has the full control over the system in which permissions in term of system accessibility and usage will always be depend upon the actions of the system Admin and the other Users of the System.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

4. CONCLUSION

With the proposed system capabilities and features which have been summarized in the previous section, the researchers made the following conclusions:

• *A developed system dedicated for the storage of questions.*

Based on the results, the Instructor can create and store questions with a weighted mean of 4.25 "Satisfactory" which means that the system perform the task required.

• *A developed system that would allow the user to retrieve the questions easily.*

Based on the results, the Instructor can retrieve questions efficiently with a weighted mean of 4.25 "Satisfactory" which means that the system will help to eliminate the time consumed in searching the questions.

• *A developed system that would monitor the valid and reliable questions.*

Based on the results, the system can monitor the validity and reliability of questions through the item analysis which marked a weighted mean of 4.33 "Satisfactory" which means that the system is capable to produce the desired results.

5. RECOMMENDATION

5.1 Grammar Checker in Posting of Exam.
This feature is needed to make everything posted by the instructor is grammatically correct with accuracy and integrity. The inclusion would make the creator convenience and have a sense of fulfilment.

5.2 Ranking of the Scores in the Results of Exam.
With this feature, the Instructor can easily determine the performance of the students who took the exam.

5.3 Auto Generation of Exam.
The developers recommend this feature to future developers to make it much easier for the instructors in creating the exam.

5.4 More Type of Question.
To further enhance the system inclusion of other types of question will result flexibility and reliability and also challenge the student higher order thinking skills.

5.5 Mobile Application Version.
The conversion into Mobile Application is highly recommended for greater accessibility.

6. ACKNOWLEDGEMENT

The researchers would like to give our deepest gratitude to the following persons who extended their help in one way or another to make our study successful. To the Instructors, Students, Deans of Saint Michael's College of Laguna for giving their valuable time to participate in the interview and System Testing and to the members of the panelist Mr. Michael Jessie Theodore A. Sese, Mr. Reynante M. Francia and Ms. Karla Mirasol A. Maranan for their comments, recommendation, suggestion to make the study valuable and especially to Ms. Inecita R. Cuevas for her solicitous grammar checking and editing on this manuscript

7. REFERENCES

[1] Andersson, A. (2012). *Analyzing Decision Support Systems*. 543, 552, DOI: 10.1016/j.giq.2012.05.007

[2] Baeza-Yates, R., Ribeiro-Neto B., (2009), *Modern Information Retrieval*, Department of Computer ScienceChemnitz University of Technology: Straße der Nationen 62, 09111 Chemnitz

[3] Bhatt G. D., Averi Z. J., (2002), *The Enabling Role of Decision Support Systems*, Volume 32, Issue 3, 297-309 doi.org/10.1016/S0167-9236(01)00120-8

[4] Bloom, B., (2014). *Asking Questions to Improve Learning*, Washington University in St. Louis

[5] Borrajo. (2014), *Journals*. The Scientific World OJournal Volume 2014, Article ID 132158, doi.org/10.1155/2014/132158

[6] Boughanem, M.,Ounis, I., (2009), *Studying Query Expansion Effectiveness*: Springer-Verlag Berlin Heidelberg, ECIR 2009, LNCS 5478, pp. 611–619,

[7] Brown, J. D., (2013*)*, Statistics Corner: *Solutions to problems teachers have woth classroom testing*, University of Hawai'i at Mānoa: Shiken Research Bulletin

[8] Canvas. (2016). *How do I create a question bank in a course?*, Canvas Help Center: Instructure

[9] Carumba, Lexter E. Et.al., (2016). *Genetic Algorithm*. Retrieved from Plass: A Programming Learning Environment.

[10] Claxton, Guy. (2009). *Teachertools.* Retrieved from teachertools.longdongt.org/?page=questioningTechniques

[11] Dan, P., (2009). *What is the need for decision support?* : DSSResources.com

[12] databackuponlinestorage.com. (2015). *7 Greatest Causes of Data Loss*: Data backup and Online Storage

[14] Elias, M. (2014*). The Importance of Asking Questions to Promote Higher-Order Competencies*. George Lucas Educational Foundation: edutopia

[15] El-Sofany, H. F., El-Seoud S. A., Ghaleb, F. F. M., Ibrahim S., Al-jaidah N., (2009)., *The Question-Bank System to Enhance E-Learning in School Education*. Retrieved from online-journals.org/i-jet/article/view/978

[16] Frost, M., (2010). *An Educational KM Site: Decision Support System:* Knowledge Management Tools

[17] Gale. (2009*). Decision Support System*: Encyclopedia of Management

[18] Gautam, A., Jain K., Pushkar K. V., Rai S. K., (2013), *International Journal of Computer Applications*, (0975 – 8887) Volume 70 – No3, May 2013: International Journal of Computer Applications

[19] GIS Test Bank. (2013). *GIS Test Bank*, San Diego State University: SDSU Library & Information Access : 5500 Campanile Drive: San Diego : California

[20] Hasan, A., (2014). *Using Technology in the Classroom – EdTechReview™*, A5 3rd Floor Shankar Garden (Vikaspuri):
Delhi, New Delhi, India,

[21] Imran, H., Sharan A., (2009), *Thesaurus And Query Expansion*, International Journal of Computer science & Information Technology (IJCSIT), Vol 1, No 2 School of Computers and System Sciences, Jawaharlal Nehru University: New Delhi, India

[22] iNetTutor. (2016). *Inventory with Decision Support System*, iNetTutor.com: Online Programming Lessons and Tutorials

[23] ITegrity. Steve Kozyk (2016) *What is Asp.net?*, 7576 Clairemont Mesa Blvd: San Diego, CA 92111
[24] Johnson, St. (2009). *Managing Files and Folders*, Perspection Inc.
[25] Khan, Z. (2015*). Why Question Bank is an Important Devise of Teaching in India?*, Your Article Library.
[26] Lohrey, J. (2009) *The Importance of Information Storage & Retrieval Systems in an Organization*, Hearst Newspapers: LLC
[27] Long Beach. (2009). How to Use Question Banks: Definition of Question Bank: Office of Academic Technology.
[28] Martinez, Ivy., (2012*). Item analysis*, Far Eastern University: Institute of Education
[29] McGill, M. and Salton, G. (2016). *Introduction to Modern Information Retrieval*, McGraw-Hill, Inc.: New York, NY, USA
[30] Microsoft Developer. (2016). *Introduction to the C# Language and the .NET Framework*. Microsoft Developer Network
[31] myessaypoint.com., (2015*). The Importance of Technology in Education*: My Essay Point
[32] OES. (2010). *Online Examination System*: Sourceforge
[33] Online Exam Manager. (2011) *Design and Development of an Online Exam Maker and Checker*, Vol 10, No 5 International Journal Of Computers & Technology,
[34] Osadebe, Dr. P.U. (2015*), Difficulty to monitor valid and reliable question*, Department of Guidance and Counselling,Delta State University, Abraka.,P.O. Box 88 Obiaruku, Delta State Nigeria ISSN 2222-288X (Online) Vol.6, No.1, 2015
[35] Oshkosh. (2012). *Item Analysis.* Unversity of Wisconsin: Oshkosh
[36] Power, D. J., (2015). *Chapter 1: Decision support systems revisited* :TechTarget: Search Business Analytics
[37] Power, D. J., (2013). *A Brief History to Decision Support System:* Dssresources.com
[38] QB365. (2016). *Advantages of Question Bank*, LinLax InFoTech Private Limited: India
[39] Reference An., (2016*). Technology, Computers & Hardware:* Reference
[40] Referenceforbusiness.com. (2016). *Decision Support System Forum:* Reference for Business
[41] Rivas, A. R. (2014*). Study of Query Expansion Techniques and Their Application in the Biomedical Information Retrieval*, Volume 2014 (2014), Article ID 132158, 10 pages: doi.org/10.1155/2014/132158
[42] Rouse, A., (2016). *SearchCIO: decision support system (DSS):* TechTarget
[43] Saomya, Saxena. (2013*). How Important is use of Technology in Education - EdTechReview™*, A5 3rd Floor Shankar Garden (Vikaspuri):Delhi, New Delhi, India
[44] Seattle, W.A. (2016). *Office of Educational Assessment*. University of Washington: Seattle, WA
[45] Sinclair K., (2016). *The Importance Of Decision Support Systems:* Opmantek
[46] SurveyMonkey. (2016). *SurveyMonkey Help Center*: SurveyMonkey Help Center
[47] TCExam. (2015). *TCExam:* Linuxlinks.com
[48] Udel. (2009*). Item Analysis of Classroom Tests: Aims and Simplified Procedures*,
[49] Wahm.com. (2016). *Advantages of CSS in Website Design*: Wahm.com
[50] Ward. A. W. (2009). *Guidelines for the Development of Item Banks*, Valencia College: Orlanda, Florida
[51] Wigmore Ivy.(2016). *Data set*: TechTarget
[52] Wolaita S. (2014). *Online Examination System For Distance Learner*: Information Builders
[53] WordPress. (2013). *Decision Support System*, Information Builders: Business Intelligence, Business Analytics, Master Data Management and Data Integration
[54] Zandbergen, P., (2016). *Study.com: Decision Support Systems*,Study.com
[55] Zopounidis, Constantin., Doumpos, Michael., & Hillstrom, Laurie. (2016). *Decision Support Systems*: Reference for Business

Access Model with Rights Evolution "AMWRE"

Samir TAHIRI
Hassan II University
ESTC,RITM Lab
Casablanca Morocco
Tahirisamir@gmail.com

Nadia AFIFI
Hassan II University
ESTC,RITM Lab
Casablanca Morocco
nafifi@est-uh2c.ac.ma

Reda FILALI HILALI
Hassan II University
ESTC,RITM Lab
Casablanca Morocco
filalihilalireda@gmail.com

Mohammed Ouzzif
Hassan II University
ESTC,RITM Lab
Casablanca Morocco
ouzzif@est-uh2c.ac.ma

***Abstract*—The preservation of the confidentiality of information and data in an information system has become a major player today. Indeed with the omnipresence of the computing and the putting on line of the applications, the stakes of the security have become considerable. Access control is a mechanism that governs how data or information is to be used. It defines and imposes the rules of authorization and prohibition. The adoption of an access model has become essential to ensure optimal security of an information system. With the diversity and richness of information systems, classical models show limits. But they have contributed to the birth of other models more suited to our needs. In this article we propose an access control model that we will implement to cover the security of a stepwise step-by-step operation. This model allows granting evolutionary rights according to the path traveled. It is based on the prior elaboration of the possible scenarios in a defined system.**

***Index Terms*—Security, Access model, Information system, Access matrix, Rights, Graph, scenario**

I. INTRODUCTION

Access to the resources and data of a system is considered a very important critical act. It is only allowed to persons with necessary and eligible rights. These rights of access to resources are granted to users, and they are governed and controlled by security models in order to intercept any intrusion.

The security model is a process that is designed to meet the requirements of information systems in terms of security. It consists of putting in place the means who guarantee its safety and reliability. Many organizations define and implement security policies governing their information systems to mitigate the risks associated with any intrusion.

Several access controls have been proposed, we present in this article some classic models, and we show their limits in relation to attacks. We then propose an access control model that better meets our need. Management and assignment of rights in an Evolutionary way.

II. BACKGROUND

The information system is the set of resources, hardware or software of an organization. It represents an important heritage that needs to be protected. IT security consists in guaranteeing these resources and framing the environment of its operation. It ensures that a resource is used only within the intended framework. Security is the set of means used to guarantee, retain and re-establish an information system. It ensures access to the user with a legitimate right while preserving resources against disclosure and unauthorized use.

Several techniques are used to ensure security, among it access control, and cryptography. We are interested in this research by the access control.

A. Classical Access Models

In the literature, several access models exist and are classified into three main families. The Discretionary Access Model (DAC) [10], Mandatory Access Model (MAC), and the Role-Based Access Control (RBAC) Model [3].

1) DAC Model

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

The discretionary model grants the owner of the "information" property rights of access, manipulation and the possibility of spreading them to others at his discretion. Rights can be granted by this person to a user and / or to a group of users. A subject who holds the rights to manipulate an object has the freedom "at its discretion" to share the permissions available to it to other subjects. [3]. The best known discretionary models are the Lampson Model.

2) Lampson model

	O1	O2=D1	O3	O4
D1	Read		*Owner	
D2	Read, Write	Control	*Write	
D3	Owner			

This model is based on three main components for defining the access rules [4]:

a) A set of "O" objects: These are the properties of the protected system. Each object has a unique identifier;
b) A set of "D" domains: These are the properties allowed to access objects;
c) Access matrix "M": Matrix of access operations [4]

A cell M (D, O) contains the access rights that domain D has on object O.

* Nuances meaning the right of delegation of access ownership.

These components (Object, Domain and Matrix) are governed by a set of rules determining how the matrix entries can be exploited [4]:

- ✓ R1: A domain can remove access attributes for any domain that controls it.
- ✓ R2: a domain having a privilege over an object o with the right to delegate, without being the owner, can pass this privilege to other domains.
- ✓ R3: A domain owner of an object can add access attributes on that object for other domains.
- ✓ R4: A domain that owns an object can remove access attributes on that object. [4]
- ✓

3) Disadvantage DAC

Although the DAC model has the advantage of being extremely flexible, it turns out to be an important disadvantage. Indeed, even if the DAC allows insurance on the protection of the flows, it is possible that some restriction of access indicated in the authorizations is deviated. This failure is caused by the fact that a user with certain permissions can later communicate a resource to other users who do not have the necessary permissions to access it. In addition it is very useful to distinguish between users and subjects. A user is a passive entity that generates topics or processes that are active entities with permissions and that perform operations. Without this distinction, the system is vulnerable to malicious attacks such as Trojan horses.

Thus, DAC is more suitable for systems having resource sharing is more important than that protection.

4) MAC model

The MAC defines the unavoidable rules, governing the rights of access to objects by subjects. These rights are not defined by the creator of the data but by the system administrator [7]. It restricts the privileges of a subject over the objects that belong to it [2]. The best known MAC is:

Bell-LaPadula model:

This model was first proposed by David Bell and Leonard Lapadula in 1973 [11]. In 1975 it was elaborated by the US Department of Defense [1]. It is based on an approach that protects information against disclosure in an information system. The objective of this model is to preserve the confidentiality of an object, against the access of unauthorized subjects, [6]. It defines constraints to control the execution of applications in order to prevent attacks

TABLE 1:
ACCESS RIGHTS MATRIX.

In this model, subjects and objects are classified according to a level of security that is associated with them. For each object, a security level is given in the form (Classification Level, Category Set). The subjects are characterized by a maximum security level and a current security level that can be changed dynamically. The different levels of classification are ordered by the relation "<", example: not classified <confidential <secret <top secret.

Disadvantage:

The MAC has serious limitations because of the restrictions on actions imposed by its system. It does not permit dynamic rights changes and requires the system and its user to be trusted beyond the framework of the model [1].

5) RBAC Model:

In this model the role is the central concept of the security policy [5]. For each role one grants a set of right and permission. Users are therefore assigned one or more roles, which allows them to subsequently access the roles assigned to their roles, as shown in Figure 1. Unlike the discretionary access control model, the policy based on RBAC does not apply directly to users [13].

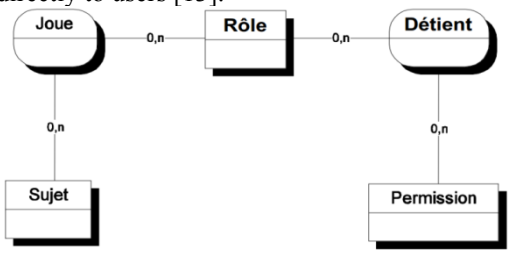


Fig 1: The RBAC model [9]

Disadvantages:

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

The RBAC has been criticized for the following reasons:

- ✓ The absence of a generic permission structure. These are considered to be dependent on the practical application of the model [2] [9].
- ✓ The concept of role hierarchy is somewhat ambiguous. In general, the hierarchy of roles does not quite match the organizational hierarchy. For example, the hospital director has a superior administrative role as a physician. However, a hospital director is not necessarily a physician, so it is not feasible to grant the physician permission. [2] [9]
- ✓ The distinction between the concept of role and that of group is unclear [2] [9].
- ✓ The impossibility of expressing permissions and especially permissions that depend on the context. Therefore, it would be difficult to specify that a physician has permission to access a patient's medical record only if the patient is his or her patient [2] [9].

B. Synthesis

Although these models offer a high level of security for some systems, their disadvantages are major risks for other systems. In very sensitive transactions such as banking transactions, not only

The attribution of a right to an entity must be controlled but also the presence of that entity in that stage of the transaction is legitimate. The model we are going to propose defines an access control mechanism that controls the attribution of rights and entitlements of an entity in each step of the system.

III. PROPOSED MODEL

A. Background

The access model defines the set of rules that govern the operation of a system. These rules are specified in terms of instructions and control mechanism [14]. The implementation of an access control model, requires a multi-phase approach each deals with a different level of design, based on [2]:

- ➢ Security policies: It is constituted by all the laws, rules and practices. The latter control both the processing of sensitive information and the use of resources by the hardware and software of a system [5]. In our work we are interested in the logical security policies implemented by the system itself.
- ➢ A security model: It is composed of a formal expression of the rules of the security policy. It allows demonstrating theorems concerning the security of the information [5].
- ➢ Security mechanisms: these define the low-level functions (software and hardware) to implement the controls imposed by the security policy [2].

This development based on three concepts offers several advantages. It allows to combine the implementation of multiple security policy, which provides more flexibility [2].

B. Development of the access model with evolution of law "AMWRE"

The progress of the flow, In an information system, is carried out in several actions. The latter define phases of progression. A step may be considered to be, a phase or set of progress phase. The sequence of these steps defines a scenario. In a system one can list the authorized operations and subsequently the possible and authorized scenarios. The scenario graph is the graphical representation of legitimate scenarios in an information system.

The model we have developed is based on a mathematical modeling of the scenario graph, in order to be able to increase and enhance the right, while successfully traversing the steps of the system. In this model the law is dynamic.

C. Modeling of the "AMWRE" model

The operation of the AMWRE is based on the representation of the system in several stages. This representation offers important information, that of the previous stage. This information is necessary to evaluate the right of a user in a step Ei. Indeed the right acquired in the previous stage is the basis of the calculation of the right of the stage in court. Arrived at Ei can be done with different path. Each path used makes it possible to calculate a right different from the other path.

The following figure shows a graph of steps:

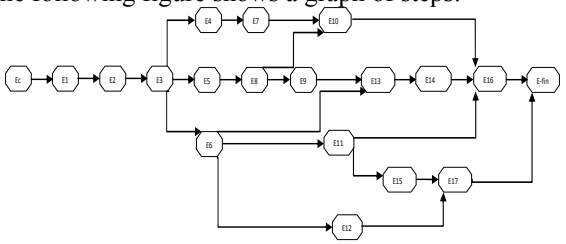


Fig 2: Graph of steps.

The root of the "Ec" graph represents a trusted step, it is considered to be without any potential risk, starting step, with basic privileges and permissions.

1) Formal representation of the Model

With the use of the scenario graph approach, the system can be modeled as a "Maccès" access matrix. The access matrix is defined as follows:

- ➢ For a n-stage system the size of the matrix is $M_{accè}(n,n)$;
- ➢ For two stages Ei and Ej: If Ei leads directly to Ej, we have M (i, j) = 1;
  Otherwise M (i, j) = 0;

The following figure shows the access matrix of the graph of FIG. 2.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

	Ec	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	EFin
Ec	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E2	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E3	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
E4	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
E5	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
E6	0	0	0	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0
E7	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
E8	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
E9	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
E10	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0
E11	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0
E12	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
E13	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
E14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
E15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
E16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
E17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

Fig 3: Access matrix.

The development of a matrix approach allows us to develop a mathematical model.

The AMWRE model is based on the evolution of the use of the system according to the scenarios predefined by the administrator. To follow a scenario is to successively activate steps one after another. A user can only activate one step at a time.

An activated step Ei activates the next step Ej provided that it has a direct path between it. Enabling Ej automatically disables Ei.

Activating a Step:

If Active(i) =0 ↔ Step Ei is disabled;
If Active (i) = 1 ↔ Step Ei is activated;
If Active (i) = 1 ∀ ∀ j ≠ i Active (j) = 0;

- Activation function of i via j:

$$f(i,j) = M(j,i)*Active(Ej);$$
$$Active(Ei) = f(i,j);$$
$$Active(Ej) = 0;$$

- A step Ei can be activated (Active) ↔ active (Ei) = 0 and j as active (Ej) = 1 and M (j, i) = 1;

The initial rights vector: VdInit (d1, d2, d3, ..., dn): It contains the initial rights for each step. It has a sensitivity level acquired by default, and relative for each step. It will be exploited to determine the right of action, that which allows to exploit the data of the stages. This fee is calculated by combining the right of action of the activated prior step with the initial right relating to the step in court.

The access right functions for a step Ei:

The right of action of the step Ei (action (Ei)) will be evaluated according to the initial right and the right of access of the previous step as follows:

- Initialisation du droit d'accès de l'étape de départ :

  $d_{action}(E_{depart})=d_1$ (Par convention $E_{depart}= E_1$) Avec $[Active(E_{depart})=1$ et $\forall$ i≠1 $Active(E_i)=0]$;

- Calcule de droit d'accès de Ei d_{action} :

  $d_{act}(E_i) = \sum_{j=0}^{n} M(j,i)*d_{action}(E_j)*Active(E_j)+d_i$

  et $Acive(E_i) =1$ et $\forall$ j≠i $Active(E_i)=0$;

  Cette fonction ne prend en compte que le droit d'action de l'étape activé. Les autres seront annulés soit par la non existence de chemin vers l'étape en cour, soit par la non activation de l'étape.

- Initialization of the right of access of the starting step:

  $d_{action}(E_{depart})=d_1$ (By convention $E_{depart}= E_1$) with $[Active(E_{depart})=1$ and $\forall$ i≠1 $Active(E_i)=0]$;

- Ei action access right calculation (d_{action}) :

  $d_{act}(E_i)= \sum_{j=0}^{n} M(j,i)*d_{action}(E_j)*Active(E_j)+d_i$ and $Acive(E_i) =1$ et $\forall$ j≠i $Active(E_i)=0$;

This function takes into account only the right of action of the activated step. The others will be canceled either by the non-existence of path to the stage in court or by the non-activation of the stage.

2) Characteristics of the AMWRE model

- Each step defines a working environment. It proposes a set of functionality accessible by access rules governed essentially by the importance of acquired rights of action;
- For the start step Edepart, the right of action is the same as the initial right. This step represents the first step of accessing the system. Edepar = d1;
- The right of action is assessed according to the previous step and the initial right;
- The right of action is calculated before the activation of the step;
- Only access to a step does not automatically provide the right to exploit all these features. Depending on the path traveled, different rights of action are acquired;
- For two different paths Ci and Cj, with the same arrival stage and the same starting step. The acquired right is not necessarily the same;
- For a system that works with the initial starting rights VdInit (d, d, d, ..., d). The path that runs the most step, acquired a greater right of action action;
- The system accepts a single step Ei activated: Active (Ei) = 1 and ∀ j ≠ i Active (Ei) = 0;

IV. CONCLUSION

In this paper, we presented an access model based on assigning users rights dynamically. The mere presence of one in a step does not give us all the rights to use this feature, and to exploit this data. Indeed, in most information systems, one can reach a stage of progression, taking two different courses or more. Hence the thought of imagining a mechanism that supports this difference before assigning a right of manipulation.

The assignment of the rights to act on the objects in our model is done in a scalable way in the system, taking care of the origin of the user.

In our perspective, it is envisaged to include the notion of roles in combination with the access matrix and the legal function in order to improve the security requirements, to cover the availability property of the objects.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

REFERENCES

[1] Michael A. Harrison,Walter L. Ruzzo, and Je_rey D. Ullman. Protection in operating systems. Commun. ACM, 19(8) :461_471, 1976.

[2] [DEA_Modelisation et vérification de politique de sécurité MODELISATION ET VERIFICATION DE POLITIQUES DE SECURITE. Amal HADDAD. Université Joseph Fourier 2005.

[3] ANALYSE FORMELLE DES POLITIQUES DE SÉCURITÉ. IKHLASS HATTAK. UNIVERSITÉ DU QUÉBEC 2010.

[4] Bulter W. Lampson. Protection and accees control in operating systems. In Operating Systems, Infotech State of the Art Report 14, 1972, pp 309-326, 1972.

[5] Directive 95/46/CE du Parlement européen et du conseil, de 24 octobre 1995, relative à la protection des personnes physiques à l'égard du traitement des données à caractère personnel et à la libre circulation de ces données. Journal officiel n° L 281 du 23/11/1995 p. 0031 - 0050

[6] Pierangela Samarati and Sabrina de Capitani di Vimercati, Access Control: Policies, Models, and Mechanisms, FOSAD 2000, LNCS 2171, pages 137-196, 2001

[7] Pierre KONOPACKI UNIVERSITE PARIS-EST Thèse de doctorat Une approche événementielle pour la description de politiques de contrôle d'accès 4 mai 2012

[8] Artile Les modµeles de sécurité. Frederic Cuppens et Nora Cuppens-Boulahia.

[9] Haut-Commissariat aux droits de l'homme "principes directeurs pour la réglementation des fichiers informatisés contenant des données à caractère personnel" Adoptée le 14 décembre 1990 par l'Assemblée générale des Nations Unies .

[10] CTCPEC - Canadian Trusted Computer Product Evaluation Criteria, ftp://ftp.cse.dnd.ca/pub/criteria/, 2001.

[11] ITSEC - Information Technology Security Evaluation Criteria, juin 1991.

[12] Butler W. Lampson, Protection, In 5th Princeton Symposium on Information Science and Systems, pages 437-443, 1971. Reprinted in ACM Operating Systems Review 8(1): 18-24, 1974.

[13] ORBAC: un modèle de contrôle d'accès basé sur les organisations. Anas Abou El Kalam Laboratoire d' Analyse et d'Architecture des Systèmes du CNRS, 7 avenue du Colonel Roche, 31077 Toulouse Cedex4

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

A Novel Technique for Paper Currency Recognition System

Dr. O Rama Devi[1], Y.Padma2, J.Sirisha[3] D.Kavitha[4], K.Sindhura[5]
[1]Assistant professor, Dept. of IT, PVP Siddhartha Institute of Technology, Kanuru, Vijayawada
odugu.rama@gmail.com
[2]Assistant professo, Dept. of IT, PVP Siddhartha Institute of Technology, Kanuru, Vijayawada
[3]Assistant professor, Dept. of IT, PVP Siddhartha Institute of Technology, Kanuru, Vijayawada
[4]Assistant professor, Dept. of IT, PVP Siddhartha Institute of Technology, Kanuru, Vijayawada
[5,]Student, III/IV B Tech, Dept. of IT, PVP Siddhartha Institute of Technology, Kanuru, Vijayawada

Abstract. Paper currency recognition is an important area of pattern recognition. A system for the recognition of paper currency is one type of intelligent system which is a very important need of the current automation systems in the today's modern world. It has various potential applications including electronic banking, currency monitoring systems, money exchange machines, etc. The recognition system mainly consists of few basic steps. They are image acquisition, pre-processing, feature extraction and recognition of the currency. Generally scanner is used in order to acquire the image. Then, these images are processed by using various pre-processing techniques. The features of these images which are the key concepts for classification and the neural network are used for classification. Recognition ability depends on the currency note characteristics of the particular country and extracted features.

Keywords: Currency recognition, Pre-processing, Feature extraction, Classifier, Neural network.

1 Introduction

Currency recognition is one of the image processing techniques that is used to classify currency of different countries. Probabilities that the paper currencies of different countries are perhaps interweaved together hence rises increasingly. Paper currency recognition systems should be capable to recognize banknotes from each side and each direction. Since there are some nodes defaced in circulation, the design system should be accurate in detecting worn or torn notes.

There are roughly 50 currencies all over the world with each of them looking completely different. For instance the size of the paper is different, the similar color and pattern. The staffs who work for the money exchanging have to differentiate different types of currencies and that is not an simple job as they have to remember the symbol of each currency. This may cause some problems, so they need an efficient system to help their work.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

2 Steps For Paper Currency Recognition

2.1. Image Acquisition

This can be broadly defined as the action of retrieving an image from the source, usually a hardware based source. Performing image acquisition is forever the first stair in the workflow sequence. So, without an image no processing is possible. It is the creation of digital images typically from a physical scene. The image is a currency note and is usually acquired by means of digital camera. The image is then stored for further pre-processing.

2.2. Pre-Processing

The main aim of image pre-processing is, to suppress undesired distortions or enhance some image features that are essential for further processing or analysis. It significantly improves the performance of the recognition system. It includes

2.2.1 Image Adjusting: When we get the image from the scanner, the size of the image is so big. In order to decrease the calculation, we decrease the size of image. Image adjusting is done with the help of image interpolation. It is a technique that is used for certain tasks such as zooming, rotating, shrinking and for geometric corrections.

2.2.2 Image smoothening: When we use scanner for image acquisition and then perform some image transfers, some noise will appear on the image. Removing noise is an important task in this image pre-processing. This noise may affect pattern matching and segmentation. Convolution method is used for image smoothening. In this method the neighbor of the pixel is used to do some transforming techniques and after that a new pixel is created. The neighbor of the pixel, consisting with some other pixels builds up a matrix where the target pixel is located on the middle of the matrix.

3 Feature Extraction

Feature extraction is the method of extracting certain features of our interest and presented for further processing. It is an important procedure considerably for currency recognition. This effect on design and performance of the classifier intensively [1]. There are mainly two types of features [1] as, Structural feature: It describes about the geometrical and topological uniqueness of pattern by representing its global and local properties. Statistical Features: It describes characteristic measurements of the pattern It is a type of dimensionality reduction. Features are significant clues towards the recognition of an object. There are many features of currency notes, here we consider features like color[6], texture, shape. In order to store these features we must create a feature vector, n*1 array that encodes the n features of an image.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

3.1. Texture Feature

For texture features gray-level co-occurrence matrix (GLCM) is used. Texture is the visible feature of the paper currency.

3.1.1. Gray Level Co-occurrence Matrix: A statistical method of examining texture is that, it considers the spatial relationship of pixels is the gray-level co-occurrence matrix (GLCM), also known as the grey-level spatial dependence matrix. Grey Level Co-occurrence Matrices (GLCM) is one of the earliest technique used for image texture analysis. Texture analysis is the extraction of textural features from images .In image analysis, texture is defined as a utility of the spatial difference in intensities of pixels. To create a GLCM, use the graycomatrix function.

glcm = graycomatrix(I)

It creates a gray-level co-occurrence matrix (GLCM) from image I. So, it creates the GLCM by calculating how often a pixel with gray-level value i occurs horizontally adjacent to a pixel with the value j.

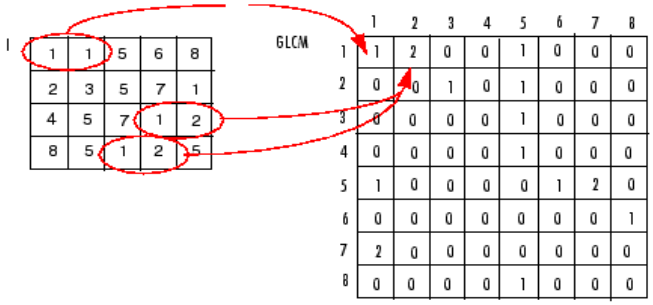


Fig.1. glcm

3.2. Color Feature

As the primary image is in RGB format, then it converts to XYZ color space[2] that encompasses all color vibrations that an common person can experience. And then it is converted to CIELUV color space, is especially helpful for additive mixtures of lights, due to its linear addition properties. It is a non-linear color space, but the conversions are reversible. Then we find the mean, color skewness and color variance for each channel of l ,u ,v.

3.3. Shape

Histogram is the most commonly used characteristic to represent the feature composition of an image. The edge in the image is considered as an important feature and it is extracted [5] to represent the content of the image. Five Edge types are defined in the Edge Histogram. They are four directional edges and one non-

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

directional edge. The four directional edges include vertical, horizontal, 45 degrees and 130 degrees diagonal edges. These directional Edges are extracted from the image blocks. If the image block contains an uninformed edge without any directionality, then it is classified as a non directional edge. Then Sobel mask is applied, max sobel gradient and index of the orientation are calculated. Canny's edge detection technique is used to identify the edges. Multiply edge images with the types of orientations detected by the Sobel masks in order to find histogram.

4 Classifier

After receiving features of currencies, it is necessary to recognize the pattern of the currencies on the base of these features, which should be accomplished by an efficient recognition system called as classifier. The input of the classifier will be the test currency images and the output of the classifier will be the corresponding currency name.

A Neural network based recognition system is used to extract the features that are fed into a multilayer perception which is trained for recognition. A Neural network based recognition scheme is used for Bangladeshi banknotes [3]. This scheme can efficiently be implemented in a cheap hardware which may be very useful in many places. The recognition system takes scanned images of banknotes and these are scanned by low cost optoelectronic sensors. So, these are fed into a multilayer perception, trained by back propagation algorithm, for recognition. Baiqing Sun [4] proposes a kind of currency recognition system, in which a three-layer network is used as a classifier. They proposed it, in order to improve the performance of currency recognition system. The classifier here used is feed-forward back propagation model, which classifies effectively with high performance.

5 Experimental Results

The above mentioned method has been implemented and tested for a database of 110 images. Reasonably quite elegant results have been observed. The Radial Basis Function Network Classifier was tested with a database of 110 images, 10 of which are tilted with an angle less than 150. The rest of the currency images consist of mixed including noisy and normal images 50 each. The recognition results are as shown in Table 1. Average recognition rate was seen as 91.51% which is quite practical and acceptable in various cases. When computation time is concerned, the Radial Basis Function Network Classifier took almost 3 seconds per image, in average, for classification.

Table 1. Experimental Results of the Radial Basis Function Network Classifier.

Normal Non-Tilted Images	Noisy Non-Tilted Images	Tilted Images	Average Recognition Rate
95.37%	87.5%	91.65%	91.51%

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

As shown in the above results, the Radial Basis Function Network Classifier has provided with quite satisfactory results. Still everybody searches for a better method of recognition which can provide superior results than the Radial Basis Function Network Classifier. The motivation for improvement can be seen due to the reason that, in the case of Radial Basis Function Network, the Network is built when the image is input. Afterwards, the Network is trained with a little number of input vectors, due to time constraints, and finally the image is classified. This way of building the network does not permit the weights of the connections between neurons to converge to the best values. This might be the main reason for the performance is not attainment to 100% recognition.

6 Conclusion And Future Work

As shown in the above results, the Radial Basis Function Network Classifier has provided with quite satisfactory results. Still everybody searches for a better method of recognition which can provide superior results than the Radial Basis Function Network Classifier. The motivation for improvement can be seen due to the reason that, in the case of Radial Basis Function Network, the Network is built when the image is input. Afterwards, the Network is trained with a little number of input vectors, due to time constraints, and finally the image is classified. This way of building the network does not permit the weights of the connections between neurons to converge to the best values. This might be the main reason for the performance is not attainment to 100% recognition.

References

1 Parminder Singh Reel, Gopal Krishan, Smarti Kotwal, Image Processing based Heuristic Analysis for Enhanced Currency Recognition, International Journal of Advancements in Technology, Vol 2, No 1, January 2011.

2 G. Trupti Pathrabe, Mrs. Swapnili Karmore, A Novel Approach of Embedded System for Indian Paper Currency Recognition, International Journal of Computer Trends and Technology- May to June Isue 2011, ISSN: 2231-2803.

3 Nadim Jahangir, Ahsan Raja Chowdhury, Bangladeshi Banknote Recognition By Neural Network with Axis Symmetrical Masks, IEEE Transactions, 1-4244-1551-9/07.

4 Baiqing Sun, Research on Rejection Capabilities of Paper Currency Recognition System with the Neural Network Employing Guassian Function, Kochi University of Technology, Japan,2006.

5 M. Tanaka, F. Takeda, K. Ohkouchi, Y. Michiyuk ,*Recognition of Paper Currencies by Hybrid Neural Network*, IEEE Transactions on Neural Networks, 0-7803-4859-1/98, 1998.

6 G. Trupti Pathrabe, Mrs.Swapnili Karmore, *A Novel Approach of Embedded System forIndian Paper Currency Recognition*, International Journal of Computer Trends and Technology, May to June Issue 2011, ISSN: 2231-2803.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

A Proposed Design of a Smart Bracelet for Facilitating the Rituals of Hajj and Umra

Gamal H. El-Adl[1]
[1]*Information Systems Department, Faculty of Computer and Information Sciences, Mansoura University, Mansoura, 35516, Egypt*

gamalhelmy@mans.edu.eg

Abstract

In this paper, a proposed design of a smart bracelet for facilitating the rituals of Hajj and Umra in order to mitigate the problem of congestion/overcrowding between pilgrims. Every year, there are nine million of Hajj and Umra performers/visitors. The proposed smart bracelet is based on multiple technologies such as (GPS, GIS, LED, Smart Card, wireless sensors, its tags). It is used to determine the correct direction of the rotation of the Holy Kabba (TAWAF) without repetition or decrease/lack. Furthermore, it can be used to provide the support and the guidance in the correct seeking (SAEE) between Safa and Marwa for 7 times. There are many advantages that are associated with applying this smart bracelet; this technology is not limited as an alternative to religious guide, it can be used as a quick assistant and as a religious facilitator. Furthermore, it can be used as an answer to queries within crowd of pilgrims and allows them to focus on the worship and pray.

Keywords: Smart Bracelet, Hajj/Umra, Holy Kabba, GPS, GIS, Sensor, Religious facilitator

1. Introduction:

Nowadays, there is no doubt that there is a competition between companies in the provision of different innovative solutions that are always characterized by speed and accuracy. These innovation solutions or products are used to solve real-world problems. It should be based on scientific research methods as well as the performance of the service and provide them also effectively and well.Technology has been developed for the purposes of facilitating the delivery of services.

A smart wearable device has become today's fashion. Electronic wearable devices can be worn on the body. It has the ability to connect to the Internet, enabling data to be exchanged between network's devices [1]. Examples of wearable devices include smart watches, glasses, e-textiles and smart fabrics, headbands, jewelry such as smart bracelets. Smart bracelet includes smart watches and smart wristbands, but in bracelet form rather than watch. It has a screen, various sensors and has the ability to connect to the phone. Companies have started to evolve more types of smart wearable devices that include powerful sensor technologies that can collect and deliver information about their surroundings. In general, wearable computing can change the way of human life as it is experienced today. Wearable small sensors and gadgets are increasingly used in healthcare, sports, and fitness [2]. Therefore, there is a need to design smart bracelet in order to facilitate the huge visitors of Holy Kaaba. According to the statically reports of Saudi Ministry of Hajj and Umra (MHU), on the beginning of Umra season, a number of Umra pilgrims will be increased over the past year by 100% proper ratio. Furthermore, in order to mitigate the problem of

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

congestion/overcrowding between pilgrims. To this purposes, a proposed smart bracelet is designing as an attempt to utilize the usage of Information and Communication Technology (ICT) on generally and in particular a smart bracelet.

This paper is organized into the following: Section 2 introduced a related work. A prototyping of the proposed design of smart bracelet is presented in section 3. Additional features of the proposed smart bracelet are investigated in section 3.1.A summary of the benefits of applying the proposed smart bracelet is discussed in section 4. The conclusion is drawn in section 5.

2. Related Work

Leonardo et al.(2013) presented a desirable smart bracelet for older adults. It aimed to enhance the life of elderly people by monitoring their health status, reminding medications and supporting their everyday activities [3]. Its smart bracelet was based on digital payment for shopping and transportation, gave health monitoring alert, health data storage for facilitating health care diagnosis. Furthermore, it supported the multimodal interaction and contained a reminder with message notification. Pebble [4] and Sony Ericsson Live View [5] are the two common examples of Smartwatches that offer message and application notification from the smartphone in a small screen with easier, small touch zones, and small physical buttons.

In the last year, MHU presented E-Bracelet for pilgrims/ mu'tamir identification. E-bracelet ID can be used as a part of safety measure which stores that personal information of each pilgrim/mu'tamir such as (Visa No., Passport No., Place of entry, etc.) The information can be accessed using a smartphone by employees of the ministry, and security and services bodies [6].

Furthermore, MHU presented e-services for Hajj and Umra services such as 'Hajj QR Mobile App' for reading the Hajj e-bracelet. It can be used to help representatives of Authorized Agencies of Annual Haj pilgrimage identify the international and the local pilgrims present inside Saudi Arabia performing Haj rituals. By simply using our Android App, an Authorized Agency Representative User can scan the e-Bracelet worn by a Pilgrim to get his ‘Personal Info', 'Haj Service Provider Info’, and ‘Logistical Info’. Figure 1 shows the Hajj Bracelet Reader [7].

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

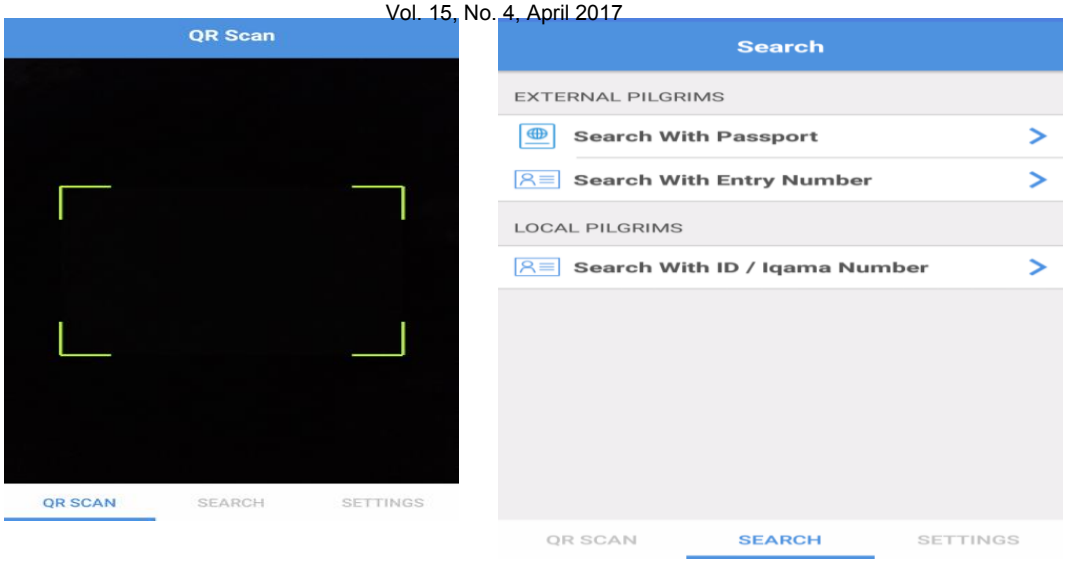
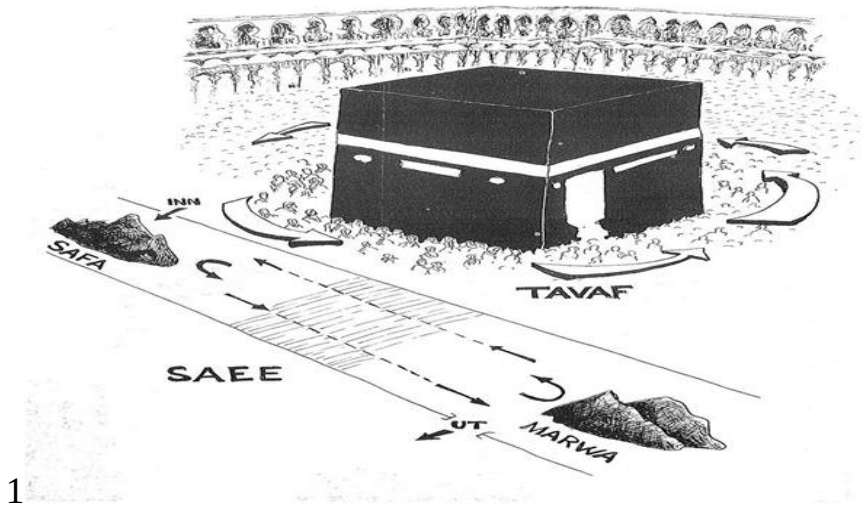


Fig. (1) Hajj QR Mobile Application [7]

3. A Prototype of the Proposed Smart Bracelet

In this section, the paper attempts to explain how the smart bracelet meets the requirements of pilgrims/mu'tamir needs with the newly developed concept of wearable assistant devices such as (smart bracelet). It is important to specifying the major functions of the proposed bracelet. Its major functionalities are depicted in figure (2) and it illustrates the religious rituals of TAWAF and SAEE. Furthermore, a demo version of the basic functions of the proposed smart bracelet is depicted in figure (3). Therefore, the next points summarize these basically functions of the proposed bracelet as follow:

1- Identifying the correct starting place for the pillars of Tawaf (inn/ Exit)
2- Recording the latitude and longitude of the Holy places (Black Stone, Master Abraham, Al-Safa hill, and Al-Marwa hill, Scrambling area)
3- Directing the Correct route in your left direction of the Holly Kaaba
4- Correct Counting for the complete route (Tawaf) from 1:7
5- Giving an alert after finishing the current ritual



1

Fig. (2) Illustration Diagram of the Tawaf and SAEE Rituals

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Fig. (3) a Demo Version of the basic functions of the proposed Smart Bracelet

It is easy to program the previous functions inside the proposed smart bracelet by using the advantages of the current modern technologies. These technologies are not only Geographical Information System (GIS) which link the spatial location with its database but also the Global Positioning System (GPS) that will be used as a satellite-based navigation system. We can't ignore the role of wireless sensors and its tag which use as an electronic module/component in order to detect event or changes in its surrounding environment. The smart card can be imbedded inside the proposed bracelet components because of its major function in the identification of personal and its strong security authentication. Furthermore, it can be used to store personal information and support application processing. Light-Emitting Diode (LED) is a semiconductor light source which lights when activated. It can be used as an integrated optical component in order to alert environmental and task lighting.

3.1 Additional Features Consideration

In the near future, this proposed bracelet will be the base for developing and adding any further feature. It can be used as a permanent requirement for performing the rituals of Hajj and Umra. It can embed all modern technologies such as Bluetooth, ZigBee, WI-FI. It is not limited to a particular technology. The proposed smart bracelet will be an integrated solution for the pilgrim/mu'tamir in order to arrive to his/her homeland safely after completing the rituals of Hajj and Umra.

4. Benefits Gaining from Applying the Proposed Smart Bracelet

According to Saudi press Agency (SPA) 2015, the death ratio was 226 and the loss ratio was 462 for the 2015 Hajj. Therefore, after applying this smart bracelet we will gain multiple advantages such as facilitating the easy access to the religious places. Moreover, it can be used as an assistant guidance and allows easy access to the holy places. Also, it can be used as an integrated info about the pilgrim/mu'tamir. Table 1 shows the differences between the current technologies and our proposed smart bracelet.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Table 1. The differences between the current technologies and the proposed smart bracelet

Items	**Current Technologies**	**The Proposed Smart Bracelet**
GPS, GIS	Not supported	Fully Supported
Smart Card	Not Supported	Fully Supported
Direction	Manual Direction	Automatic Direction
Personal Identification	Supported	Fully Supported
Lossless& Crowding problem	Founded	Reduce
Guidance and Inquiring	Human Based	Automatic Based
Infrastructure	Limited mobile-based application	Smart wearable devices/smart bracelet

5. Conclusion

There are advantages from applying the smart bracelet. It can be used as an alternative and facilitator of the religious guidance for Hajj and Umra. I recommend all companies implement and deploy this technology as soon as possible in order to reduce the deaths and lossless ratio. It can help huge numbers of pilgrims to answer his/her queries, allows them to focus only on the worship and pray and return to their homelands safely.

References

[1] Wearable Technology Definition Investopedia http://www.investopedia.com/terms/w/wearabletechnology.asp#ixzz4eDl8VMWI last accessed January 2017.

[2] Tehrani, Kiana, and Andrew Michael. “Wearable Technology and Wearable Devices: Everything You Need to Know.” Wearable Devices Magazine, WearableDevices.com, March 2014. Online available at http://www.wearabledevices.com/what-is-a-wearable-device/

[3] Leonardo Angelini, et al, "Designing a Desirable Smart Bracelet for Older Adults", UbiComp'13, Zurich, Switzerland, September 8-12, 2013.

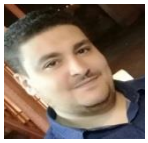
[4] Pebble, E-Paper Watch for iPhone and Android. Online available at http://getpebble.com/ Last accessed January 2017.

[5] Sony LiveView, a wearable wireless micro display. Online available at https://www.sonymobile.com/global-en/products/smart-products/smartband2-wrist-strap/ Last accessed January 2017.

[6] "E-bracelets a 'must' for pilgrims this Hajj", Arab News, Published at Thursday, 30-June-2016 on line available http://www.arabnews.com/node/947221/saudi-arabia Last accessed February 2017.

[7] Hajj Services & Umrah Services, "Hajj Bracelet Reader", Online available at www.haj.gov.sa/english/eservices/pages/apps.aspx Last accessed February 2017

[8] Definition of Modern Technology (LED, GPS), Wikipedia , online available at https://en.wikipedia.org/wiki/Light-emitting_diode last accessed February 2017



Gamal H. Eladl Completed his Ph.D. from Mansoura University, Egypt. He is having over 13 years' of experience in researching and teaching undergraduate and post-graduate students of Computer and information sciences. He published more than 18 International journal and conference papers. He has visited several countries such as KSA, Greece and Qatar for academic and research purposes. His research interests include Medical Information System, Security and Privacy Issues, E-society services and new innovation methods in Computer technologies.

Hybrid Privacy-Preserving Authentication Protocol for Secure Communication under Malicious Attacks in MIPMANET

Abdurahem El Atman Igrair
Department of Computer Science
& information Technology
Sam Higginbottom Institute of Agriculture,
Technology & Sciences Allahabad India.'

RaghavYadav
Department of Computer Sciences
& Information Technology
Sam Higginbottom Institute of Agriculture,
Technology & Sciences Allahabad India.'

***Abstract*— Use of wireless network like mobile communications, mobile ad-hoc networks is now days very common and increasing worldwide. Due to open nature of such networks, there is the possibility of different types of attacks on a network such as malicious nodes, black hole nodes, selfish nodes, DoS attacks, etc. Hence it is vital to have security mechanism for wireless networks. In this paper, our scope is limited to Mobile Ad Hoc Networks (MANET). The requirements for secure data communication, as well as privacy preserving, are significant research problem for MANET. In this paper, we are presenting the novel routing protocol design called HPriauth (Hybrid Privacy-Preserving Universal Authentication) to achieve efficient, secure data communication and user privacy preservation under different types of security threats. There number of methods presented individually either for secure data communication or user privacy perseveration. HPriauth is based on existing Priauth protocol which is proposed for privacy preserving and authentication without actual evaluation. In this paper, we addressed the problem of Quality of Service (Quos) requirements while providing the data security and privacy preservation under malicious attackers. The data protection method is designed based on onion routing terminologies. The simulation results are showing the proposed HPriauth routing protocol having best QoS performance under a different number of malicious attacks as compared to existing routing protocols.**

Keywords*— Secure Routing, Wireless Networks, Quality of Service, Priauth, HPriauth, Loss Rate, Malicious Attack

I. INTRODUCTION

Wireless Ad hoc network and can be deployed without infrastructure. Each node acts as a router as well as a host and forwards each other's packets to enable the interaction between nodes not directly connected by wireless links [1]. Mobile networks as an autonomous system of mobile nodes inter connected via wireless connections without using any subsist network infrastructure. A common challenge in the design of ad hoc networks is the development of dynamic routing protocols that can efficiently find routes during the interconnecting links. In this paper, we are presenting the new techniques for wireless networks privacy preserving, authentication and secure communication as security is major research problem for MANETs. Away from this privacy preservation and authentication, secure communication is another research challenge for wireless networks like MANET. Secure communication between the nodes was not addressed in Priauth method [2] [3]. To acquire the privacy preservation and authentication in wireless networks we research various techniques and from which Preauth is designed and implemented as MANET routing protocol. In literature there are different techniques demonstrate for MANET security attacks on various parameters and strategies however such security techniques having some limitations. The motivation for illustrating the hybrid secure routing methodology in which both goals privacy preserving with authentication as well as secure network interaction will be addressed. We analyzed this techniques and observer this performance with boundary for our research motivation.

Privacy preservation and validation the techniques proposed in [1] [5]. The practical implementation and valuation of proposed approach are completed by using the NS3 simulator. Networks are designed by considering the varying many number of malicious nodes attacks in the network to check the performance of proposed techniques. In section II, the malicious node attack model is presented which we used for valuation of proposed and existing security methods. In section III, we are performing the algorithm designed for HPriuath and other security methods. In section IV, the simulation configurations and results achieved are presented. In section V, the conclusion is discussed.

II. MALECIOUS ATTACK MODEL

Black hole attack is also known as the malicious attack. The malicious device has been able to insert itself during the communicating nodes it can do anything with the packets passing between them. When the attacker receives a request for a route to the destination node it creates a highly short route. If the malicious reply arrive the starting node before the response from the actual node a fake route gets generated [6]. An attacker uses the routing protocol to advertise itself as having the smallest path to the node whose packets it wants to stay an attacker listens to the requests for routes in a flooding based protocol. It can remove the packets between them to perform a denial of service attack or use its place on the route as the first step in a man in the middle attack [7]. As shown in Figure 1 below source node 1 broadcasts an RREQ message to discover a route for sending packets to destination node 3. An RREQ

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

broadcast from node one is received by neighbouring nodes 2, 4 and 5. Malicious node 5 sends an RREP message immediately without even having a route to destination node 3. The first message reaches to the source node RREP message sent by the malicious attacker node. When the node of origin receive the message sent by the malicious attacker node, updates its routing table for the new route to the intended destination node and then also desert any RREP message from other neighbouring nodes even from an actual destination node [8]. It sends the data packets immediately from the path which is provided by the malicious attacker node When the Source node gets the route. A Black hole node removes all data packets rather than forwarding them on.

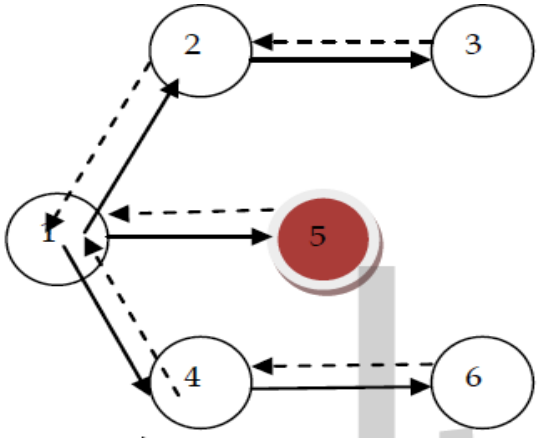


Fig.1. Example of Malicious Node Attack

Such nodes show one or more of the following behaviour:

- Does not forward it., when Packet Drop Simply consumes.
- Battery Drained- Performing additional operations a malicious node can waste the battery.
- Buffer Overflow- A node under attack can fill the buffer with fake updates so that official updates cannot be stored further.
- Bandwidth Consumption- A malicious node consumes the bandwidth.
- Malicious Node Entering- Without authentication a malicious node can enter the network [10].
- Stale Packets- To inject stale packets into the network to generate confusion in the system.
- Delay- Any malicious node can purposely delay the packet forward to it.
- Link Break- If the malicious node is between them. This can result in restricting the two legitimate nodes from interconnection.
- Message Tampering- A malicious node can tamper the content of the packets.
- Denying from Sending Message- Sending messages to other legitimate nodes. Any malicious node may deny.
- Fake Routing- There exist a path during nodes, a malicious node can send fake routes to the legitimate nodes to get the packets.
- Node Not Available- To create delays when the source node chooses another alternative path. An intruder can isolate the node from taking part in any transaction.
- Stealing Information- The content, location, the sequence number can be stolen by the malicious node to use it further for the attack.
- Session Capturing- When to take some meaningful information two legitimate nodes communicate a malicious node can capture their session.
- Others- Other methods also in which a node behaves in a malicious manner.
- The usual and the malicious behaviour of a node can be easily understood by the algorithm below.

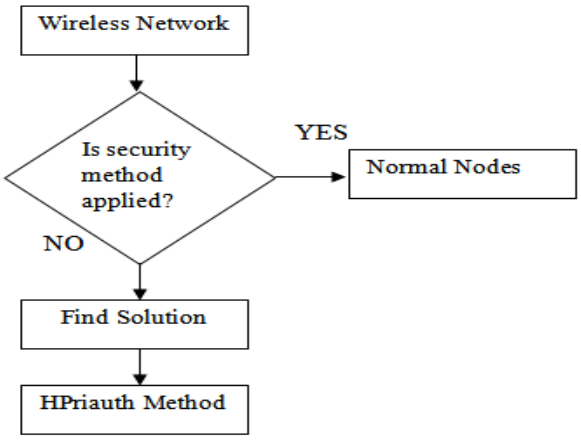


Fig.2. Defined Algorithm for Normal & Malicious Behavior of a Node

III. PROPOSED METHODOLOGY

In this paper, we are presenting new efficient HPriauth routing protocol. Follow discussing the algorithm designs, figure 3 is showing the system flowchart used for simulation work. HPriauth is designed as routing protocol which is compared with existing privacy preserving techniques called Priauth and YHWD. Depend the performance of routing protocol on four parameters under the attacks such as packet delivery ratio, throughput, an end to end delay and rate of packet loss. The novelty of HPriauth is that it is supplying efficient privacy preservation, efficient user authentication and most vital effective secure interconnection between mobile links.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

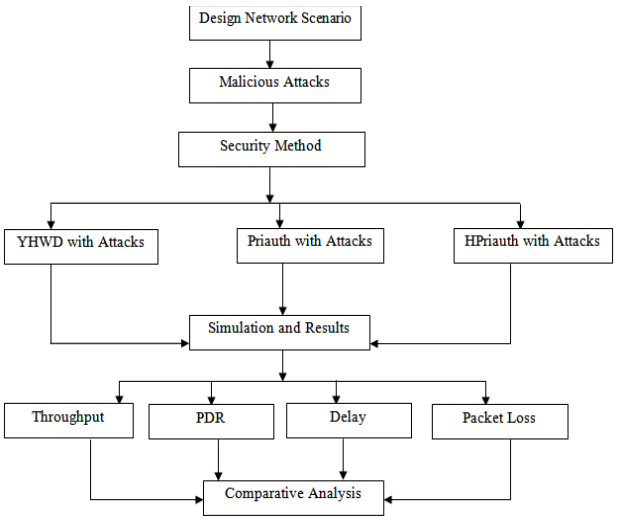


Fig.3. System Flowchart

Following are two important algorithms proposed for HPriauth protocol. Algorithm 1 is for privacy preservation and authentication. Algorithm 2 is for secure routing in MANET. The algorithm of privacy preserving and authentication are designed as per the below system model showing in figure 4.

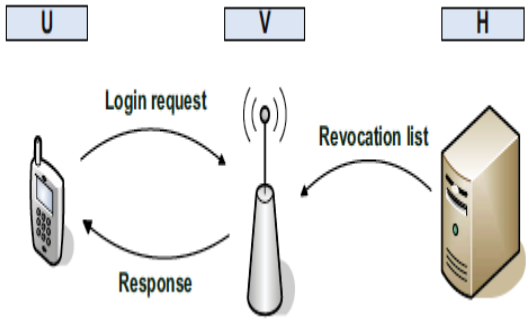


Fig.4. System Model for Privacy Preservation and Authentication Algorithm (Algorithm 1)

Algorithm 1: Privacy Preserving and Authentication

Step 1: VLR-GS. Keygen (,)

1.1. The group manager randomly selects a generator $\in$ and ˜$\in$. Additionally, it selects $h \in$ for all $\in$ [1,].

1.2. Then it selects $\in \mathbb{Z}_*$ and computes = . Subsequently, it selects $\in \mathbb{Z}_*$ and computes = 1/(+) for all $\in$ [1,].

1.3. After that, it computes = h for all and . The master public key mpk is (, ˜, h1, . . ., h,). Each subscriber's secret key [] is (,).

1.4. The revocation token at an interval of subscriber with the secret key (,) is [][] = .

Step 2: VLR-GS. Sign (, [], ,)

2.1. Select random number , , $\in \mathbb{Z}_*$.

2.2. Compute 1 = ˜, 2 = ˜, 3 = (, h) , and 4 = .

2.3 Compute = {(, , , ,): 1 = ˜$\wedge$2 = ˜$\wedge$3 = (, h) $\wedge$4 = $\wedge$(,) = (,)} ().

2.4. Output the group signature = (1, 2, 3, 4,).

Step 3: VLR-GS. Verify (, , , ,)

3.1. Signature check. Check that σ is valid, by checking the V.

3.2. Revocation check. Check that the signer is not revoked at the interval, by checking 3≠ (4,) for all $\in$.

Step 4: Stop

Algorithm 2: Secure Onion Routing

Step 1: Generate the PKI.

Step 2: PKI creation done by broadcasting source node ID.

Step 3: Extract the Public Key, Private Key and Session Key.

Step 4: Insert all three current keys into the routing table.

Step 5: At Source Node

Step 5.1: Extract the current routing information

Step 5.2: Get the current session key

Step 5.3: Generate the new session key and update the routing table entries

Step 5.4: Broadcast RREQ Packet

Step 5.5: Apply the Key encryption onion at intermediate nodes and destination node

Step 5.6: Signing by source node with its private group key

Step 5.7: Broadcasting finally the authenticated RREQ

Step 5.8: Set the status 'P' and update the routing table entry for current path with this status

Step 6: At Intermediate Node

Step 6.1: Verify the received packet with private group key

Step 6.2: If package verification is successful then extract information details from the received packet else marked current received packet is from the malicious node or links and removes it.

Step 6.3: Transfer the received packet further by follow steps of onion routing

Step 6.4: If the NSQ exists in the table but with an old timestamp it has been processed before and will be ignored, else current rreq is new, and it will proceed further.

Step 6.5: If its destination node apply decryption operation, else forward it to next hope by performing the encryption operation by using the keys generated

Step 6.6: Signing the Source node with its private group key

Step 6.7: Set the status 'P' and updated routing table entry with current route

Step 7: At Destination node

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Step 8: Step 6 are repeated to get the original data at the original destination node.

Step 9: Stop

IV. RESULTS AND DISCUSSION

The transcript of proposed methodology is done using the NS3 software. We have designed wireless networks with 50 mobile nodes and two servers with changing multiple of malicious attackers in the network. HPriauth is compared against YHWD and Priauth method in results.

A. *Network scenario*

Security Routing Protocols: Priauth, YHWD and HPriauth

Number of wireless nodes: 50

MAC: 802.11

Simulation Time: 30 Seconds

Mobility Speed: 5 (m/s)

Number of Attacks: 1, 3, 5, 7, 9

Results Measurement

Throughput vs. Varying Number of Attacks

Loss Ratio vs. Varying Number of Attacks

Overhead vs. Varying Number of Attacks

Delay (Time) vs. Varying Number of Attacks

B. *Performance Metrics*

1) Avg. Throughput

Throughput= (seq number * segment size * 8) / active duration (1)

2) Packet Delivery Ratio (PDR)

PDR= (number_of_received_packets/number_of_generated_packets) * 100 (2)

3) End to End Delay

end-to-end= N[dtrans+dprop+dproc+dqueue] (3)

where,
end-to-end = end-to-end delay

dtrans= transmission delay

dprop= propagation delay

dproc= processing delay

dqueue= Queuing delay

N= number of links (Number of routers - 1)

C. *Comparative Results*

Below comparative graphs for various performance metrics showing the results achieved from the spacious simulation work.

Average Throughput vs. Number of Attackers:

Throughput performance metrics plays a vital role in deciding the efficiency of a routing protocol in MANET. Better the routing protocol we need the higher throughput. As showing in the graph of figure 5, proposed HPriauth method has more throughputs as compared to existing methods under varying much number of malicious attackers. It is showing that as the attackers growing, throughput performance is dropping.

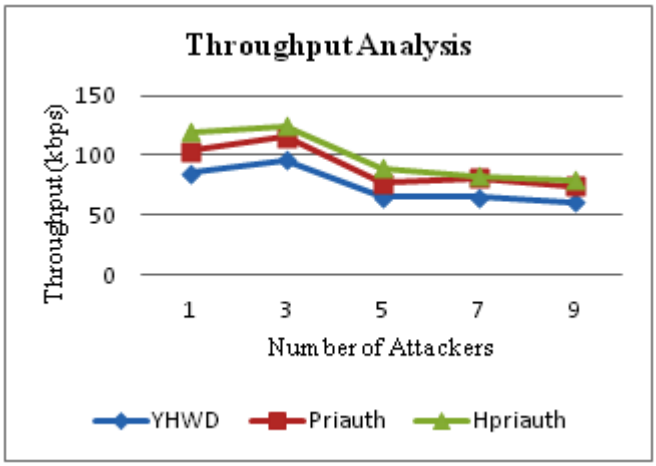


Fig.5. Throughput Performance Analysis with Varying Number of Malicious Attackers

Packet Delivery Ratio vs. Number of Attackers

Some successfully delivered packets from the source node to destination node are nothing but the Packet delivery ratio under home server and foreign server scenario. Figure 6 is showing proposed method achieving number of throughput performance in the presence of a number of attackers in the network.

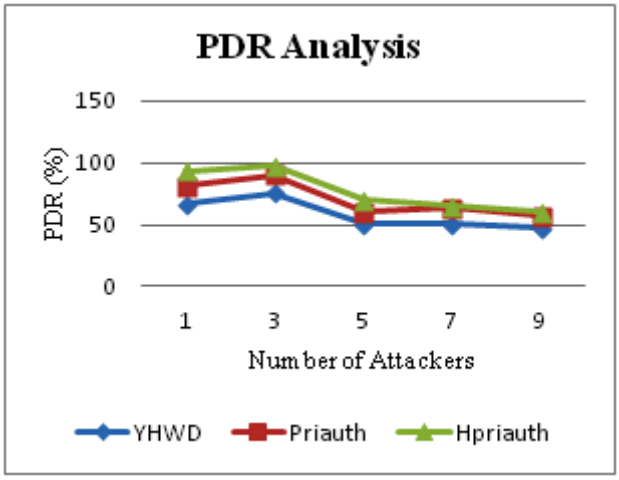


Fig.6. PDR Performance Analysis with Varying Number of Malicious Attackers

Loss Rate vs. Number of Attackers

Packets dropped in MANET means Malicious attacks mainly resulted into information leakage. The efficiency of security methods is mainly based on damages rate performance. The number of efficient method is having less

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

number of packets removes. Figure 7 is showing the comparative analysis of damages rate for all three simulated security techniques. It is clearly showing that as the number of attacker's growth, packet drops growing. In such case, proposed HPriauth is achieving less packet drop performance as compared to existing methods.

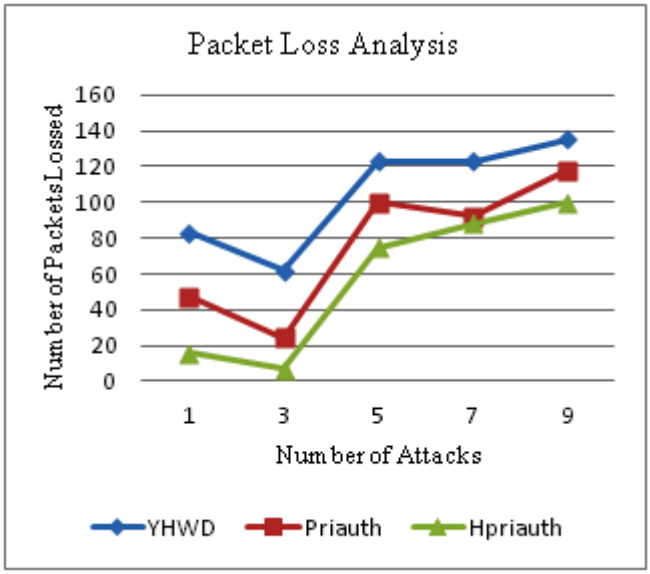


Fig.7. Loss Rate performance Analysis with Varying Number of Malicious Attackers

End to End Delay Vs. Number of Attackers

Figure 8 is showing the end to end delay performance. HPriauth is showing better delay performance against YHWD and HPriauth.

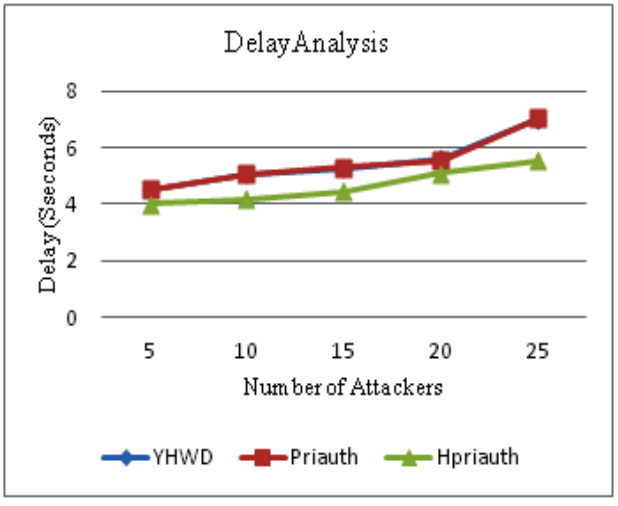


Fig.8 Delay performance Analysis with Varying Number of Malicious Attackers

CONCLUSION AND FUTURE WORK

For wireless networks like mobile ad hoc network, there are two major security concerns such as privacy preservation with mobile user authentication as well as secure communication among mobile nodes. There are some attacks such as DoS, blackhole, grayhole, selfish node, malicious node attacks, etc. In this paper, we proposed hybrid security routing protocol for MANET which is based on two methodologies such as Priauth and Secure Onion Routing. The proposed routing protocol is called HPriauth which designed and simulated using NS3. Malicious node attack model is discussed in this paper. The network scenarios are based on varying number of malicious nodes in the network. The simulation results are showing that proposed HPriauth is showing better QoS performance as compared to existing methods under a different number of attackers. For future work, we suggest working on various network conditions and systems.

REFERENCES

[1] D. He, M. Ma, Y. Zhang, C. Chen, and J. Bu, “A strong user authentication scheme with smart cards for wireless communications,” *ComputerCommun.*, 2010, doi: 10.1016/j.comcom.2010.02.031.

[2] G. Yang, Q. Huang, D. S. Wong, and X. Deng, “Universal authentication protocols for anonymous wireless communications,” *IEEE Trans.WirelessCommun.*, vol. 9, no. 1, pp. 168-174, 2010.

[3] [3] D. He and S. Chan, “Design and validation of an efficient authentication scheme with anonymity for roaming service in global mobility networks,” Wireless Personal Commun., 2010, doi: 10.1007/s11277-010-0033-5

[4] G. Yang, D. S. Wong, and X. Deng, “Anonymous and authenticated key exchange for roaming networks,” IEEE Trans. Wireless Commun., vol.6, no. 9, pp. 3461-3472, 2007.

[5] Daojing He, Jiajun Bu, Sammy Chan, Chun Chen, and Mingjian Yin, "Privacy-Preserving Universal Authentication Protocol for Wireless Communications," IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS, VOL. 10, NO. 2, FEBRUARY 2011.

[6] Elhadi M. Shakshuki, Senior Member, IEEE, Nan Kang, and Tarek R. Sheltami, Member, IEEE, "EAACK—A Secure Intrusion-Detection System for MANETs," IEEE IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, VOL. 60, NO. 3, MARCH 2013.

[7] K. Liu, J. Deng, P. K. Varshney, and K. Balakrishnan, "An acknowledgment-based approach for the detection of routing misbehavior in MANETs," IEEE Trans. Mobile Comput., vol. 6, no. 5, pp. 536–550, May 2007.

[8] S. Marti, T. J. Giuli, K. Lai, and M. Baker, "Mitigating routing misbehavior in mobile ad hoc networks," in Proc. 6th Annu. Int. Conf. Mobile Comput. Netw., Boston, MA, 2000, pp. 255–265.

[9] T. Sheltami, A. Al-Roubaiey, E. Shakshuki, and A. Mahmoud, "Video Transmission enhancement in presence of misbehaving nodes inMANETs,” Int. J. Multimedia Syst., vol. 15, no. 5, pp. 273–282, Oct. 2009.

[10] R. Balakrishnan, “An Acknowledgement based approach for the detection of routing misbehavior in MANETs,” IEEE Trans. Mobile Comput., vol. 6, no. 5, pp. 536–550, May 2007.

[11] Jian-Ming Chang, "Defending Against Collaborative Attacks by Malicious Nodes in MANETs: A Cooperative Bait Detection Approach," Published in: IEEE Systems Journal (Volume: 9, Issue: 1), 2014.

[12] Abdurahem El Atman Igrair, Dr. Raghav Yadav, “Review: Privacy Preserving Authentication (PPA) Protocols for Wireless Mobile Networks," Volume 6, Issue 5, May 2016, International Journal of Advanced Research in Computer Science and Software Engineering.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Analysis Of Classification Methods For Diagnosis Of Pulmonary Nodules In CT Images

Capt. Dr. S.SANTHOSH BABOO
Associate Professor
P.G & Research Department Of Computer Science
Dwaraka Doss Goverdhan Doss Vaishnav College
Arumbakkam-106

E.IYYAPPARAJ
Research Scholar
P.G & Research Department Of Computer Science
Dwaraka Doss Goverdhan Doss Vaishnav College
Arumbakkam-106

***Abstract*-The main aim of this work is to propose a novel Computer-aided detection (CAD) system based on a Contextual clustering combined with region growing for assisting radiologists in early identification of lung cancer from computed tomography(CT) scans. Instead of using conventional thresholding approach, this proposed work uses Contextual Clustering which yields a more accurate segmentation of the lungs from the chest volume. Following segmentation GLCM features are extracted which are then classified using three different classifiers namely Random forest, SVM and k-NN.**

Keywords—Computer aided detection(CAD);computed tomography(CT) imaging;lung cancer ;support vector machine(SVM);

I. INTRODUCTION

According to the recent statistics collected by National Cancer Registry Programmes(NCRP) India occupies 11th position among top 15 countries in the world with higher Age Adjusted Incidence Rate(AAR). Further it is calculated that total number of new cancer cases registered will reach 13,88,397 by 2015 and 17,34,886 by 2020. Among these lung cancer alone accounts for 10% among male and 3% among female. However survival rates is still low (<50%) in most part of India. Therefore detection of Lung cancer at earlier stages is of great importance and it can increase survival rate of cancer patients .So an computer-aided detection (CAD) system in supplement to radiologists' diagnosis has become a promising tool to serve such purpose.

On the diagnosis of lung cancer the most important and nontrivial task is the Detection of pulmonary nodules since appearance of pulmonary nodules varies in a wide range, and also nodule densities have low contrast when compared with adjacent vessel segments and other lung tissues. For nodule detection Computed tomography(CT) has been shown as the most popular and widely used imaging modality in [2], [4], because of it's ability to provide reliable image textures for the detection of small nodules. Over a past few decades there has been a significant progress[5],[6] in development of lung nodule CAD systems using CT image modality. Generally, such CAD systems consist of following three steps: 1) Segmentation 2) Feature extraction and 3) Classification.

In this work once various regions in CT images are obtained by segmenting the image they can be further used for different types of analysis and interpretations. Therefore, segmentation of image mainly involves extracting important features and deriving the relevant metrics to segregate regions of homogeneous intensities. In order to achieve this, it is necessary to choose a selective region of interest by considering the application requirements. Recent techniques used for segmentation in literatures are statistical methods, include geometrical, structural, model based, signal processing methods, spatial domain filters, Fourier domain filtering. In [7] a novel approach to extract the lung region in chest X-ray images is presented which uses adaptive contrast equalization and non-linear filtering for image enhancement. Followed by preprocessing based on morphological operations an initial estimation of lung area is obtained and then it is improved by region approach to find the accurate final contour, then for rib suppression, oriented spatial Gabor filter is used. In [8] a new method for segmenting lung CT images by combining fuzzy logic with bitplanes was proposed to locate the region of interest which consists of following three steps, namely identification, rule firing, and inference. In this paper, CC along with the region growing algorithm have been used for effective segmentation of the CT Lung image.

The remainder of this paper is organized as follows: Section 2 discusses the methods proposed in related works. Section 3 explains the method used in this work. Section 4 provides the results. Section 5 gives the conclusion on this work and also provides some possible future works.

II. RELATED WORKS

Sometimes lung nodules may present on the lung parenchyma region. So if the lung region is not segmented completely the lung nodule on parenchyma border may get lost and accuracy gets decreased. With this aim it is very important to separate voxels belonging to lung region from voxels belonging to surrounding area.

In [15] using an optimal thresholding and mathematical morphological method, the authors first acquired the rough image of segmented lung. Finally, they used a fast self-fit segmentation refinement algorithm to adapt for the unsuccessful left-right lung segmentation in previous stage. In [6] an efficient method for segmentation denoted as Complex-Valued Artificial Neural Network with Complex Wavelet Transform (CWT-CVANN) is proposed. This architecture is made of two stages. The first stage extract features using different levels of complex wavelet transform followed by

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

segmentation with complex-valued artificial neural network in second stage. In [13] authors introduced an novel geometric method for segmentation of lungs using novel Adaptive Border Marching algorithm. This work models the lung segmentation as a smoothing process of contours in continuous space and exist low computational cost.

Lin DT et al [10] proposed proposed a neural network-based fuzzy model to detect lung nodules present in the CT lung images. In their work segmentation is achieved by series of techniques including thresholding, median filtering, morphological closing, and labeling. In the next step features are extracted from ROIs which are fed into neural network based fuzzy model for classification. In [11] segmentation is done by thresholding each image by an optimal threshold derived by comparing the curvature of the lung boundary along with the ribs. A combination of background-removal operator together with iterative gray level thresholding is used by Antonelli et al. [12] for segmenting the lung region. In their work, due to the presence of noise the background was not well eliminated well.

Ozekes et al [14] author proposed a four step process. In first step lung region of the CT images is segmented using Cellular Neural Networks trained by genetic algorithm. In their work, the lung regions were specified using the 8 directional searches and +1 or -1 value were assigned to each voxel.

In the work proposed by Cao Lei et al [8], a rough image of lung was acquired by combining optimal thresholding together with mathematical morphology. A self-fit segmentation algorithm was then applied on the segmented result to obtain a final refined output. In [16] a novel three step segmentation process is proposed for the analysis and segmentation of lung CT images. In the first step, the extraction of region of interest and preprocessing techniques such as labeling, shrinking and expansion is done in the CT. In the second step of their work, parameters such as mean value, standard deviation, and semi interquartile range are extracted from GGO shadows. In the final step,Variable N-Quoit (VNQ) filter is used to extract suspicious shadows from GGO. The suspicious shadows are then classified into their appropriate classes using feature values calculated from the suspicious shadows.

III. METHODOLOGY

This section describes proposed method for lung cancer detection. The proposed method involves three stages are shown in Fig.1. Initially the CT lung images are segmented using contextual clustering along with region growing algorithm. Next stage is Feature extraction which is done by extracting GLCM features. The third stage is classification with three different types of classifiers namely k-Nearest Neighbor(k-NN), Random forest(RF) and Support vector machines(SVM).

A. Segmentation Via Contextual Clustering With Region Growing

Region growing [1] is an iterative approach for segmentation. This technique involves identification of ROIs that are connected depending upon some predefined rule following some connectivity.

First an initial seed point is taken then the pixel is compared with its connective neighbors for some condition if the condition is satisfied it is added to region. The whole procedure is repeated until there is no more pixels to be added to the region.

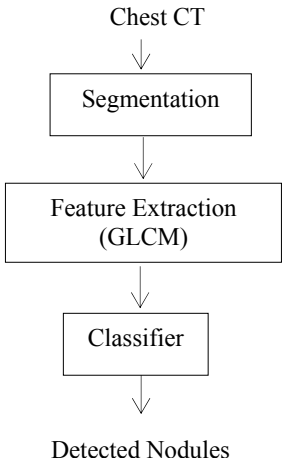


Fig. 1. Overall view of proposed method

In our approach, a region growing approach along with the clustering is used to fix the threshold in order to segment the region of interest present in the CT lung images. The initial seed point in region growing is a 3x3 voxel in central slice and it was selected. Fuzzy rule is used to fix threshold in region growing.

Recently, a lot of researchers use statistical clustering in image segmentation [3]. Contextual clustering [4,9] is a supervised algorithm for segmentation which uses spatial information by considering number of activated neighbors of voxel and following this a rule is designed for clustering. The quality of segmented image in contextual clustering depends upon following four factors 1) A defined threshold value T provided by user for segmentation(T=140),2) a controlling parameter β in the range 0 to 1, 3) the median value of the all pixels in the pixel window 4) the total number of intensity values inside the window.

Let us simple assume that contextual clustering segments a data into two different categories namely category 1 (ω_0) and category 2 (ω_1) based on the grown region. The steps in proposed method for implementing the contextual clustering to segment the lung region from CT lung images are mentioned as follows.

1) Choose the decision parameter T,β first. Assume the neighbors to be 8-connected and set N to 8. Let V_i be intensity of a particular voxel.

2) For each voxel in image if $V_i > T$ label the voxel to ω_1 and store the result in variable G_1 , else label the voxel to ω_0 and store the result in variable G_0.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

3) For each voxel 'i' compute the number of neighbors N_i who belongs to ω_1 using the variable G_1.

4) Relabel a voxel V_i to ω_1 if $V_i + \frac{\beta}{T}\left(N_i - \frac{N}{2}\right) \leq T$ else label it to ω_0.

5) Go back to step 3 and repeat the procedure until the labeling assigned in previous iteration equals the one got in current iteration.

The following figure describes flow of proposed algorithm.

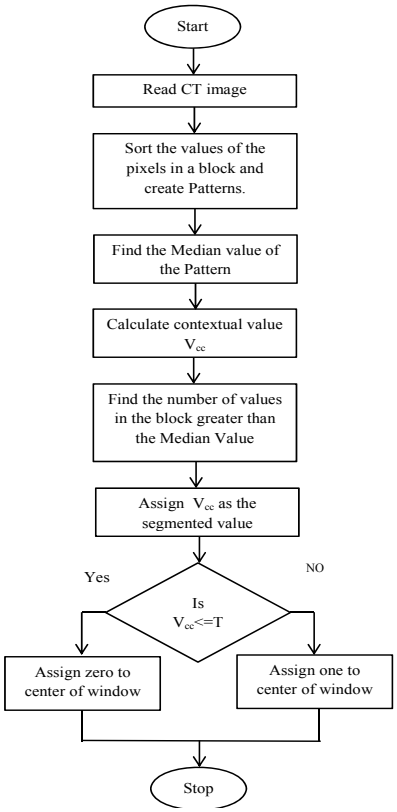


Fig. 2 Flow diagram of proposed algorithm

$$V_{cc} = Median\ value + \frac{\beta}{threshold} * \left\{u - \frac{window\ size}{2}\right\} \quad (1)$$

B. Extraction Of GLCM Features

Usually when texture features are extracted by texture analysis from image two types of approach may be followed one based on statistics and another based on structure. In this work we use statistical approach for texture analysis and extract Grey Level Co-occurrence Matrix(GLCM) features. GLCM also known as Grey Tone Spatial Dependency Matrix is a simple tabulation of how frequent different combination of gray levels occur in particular position with respect to other in the image. Depending upon number of gray levels in each combination statistics may be first-order, second-order or third-order etc. Third and higher order statistics considers the relation between three or more pixels and these statistics are theoretically possible but they are difficult to implement due long time taken for computation and interpolation. So GLCM uses second order statistics and this approach is used in large number of applications.

A GLCM is basically a square matrix with number of rows and columns equal to number of gray levels in the image. An element in GLCM matrix is denoted by P(i, j| Δx,Δy) which denotes the relative frequency that two pixels with intensity 'i','j' separated by distance of Δx,Δy in x &y direction lie within the given neighborhood. Similar to P matrix element M(i, j | d, ɵ) denote the second order statistical probability for changes between gray levels 'i' and 'j' with respect to displacement distance (d) and angle (ɵ).

Using a large number of gray levels implies storing a lot of temporary data but when dimension of GLCM is very large they become more sensitive to the size of texture samples from which they are extracted. To eliminate with disadvantages total number of gray level is reduced to nominal one.

C. Classifier

Three types of classifiers are used for classification namely Random forest, SVM and k-NN.

1) SVM: After the features are extracted the next step is to classify whether tumor is present or not. Usually two types of approach is used for classification either supervised model or unsupervised one. In this work we use a supervised learning model for classification namely Support vector machine(SVM). Basically SVM models each feature vector of size N extracted as a point on a N-dimensional plane. Given such points on a N-dimensional plane the SVM tries to find a hyper-plane that best separates the point belonging to two classes. During testing the weights of hyperplane obtained is used to classify whether tumor is present or not. The feature vectors that nearer to hyperplane and satisfy their classification are called support vectors.

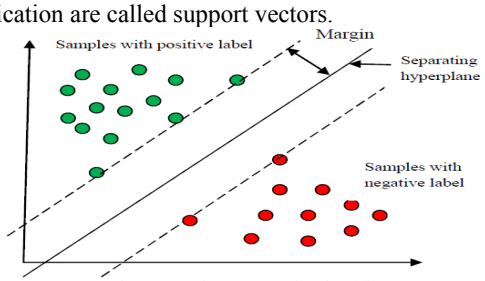


Fig. 2. Maximum margin classifier

In the proposed method we are using linear kernel for SVM classifier. Since our main target is to find is to find a best hyper plane that represents the largest separation or margin between the two classes we choose the hyperplane so that the distance from it to the nearest data point on each Side of hyperplane is maximized. If such a hyper plane exists, it is known as the maximum margin hyperplane and such a linear classifier is defined as maximum classifier, which is shown in Fig. 3.

2) Random forest(RF): Random forests is one an ensemble learning method which is mainly used for the task of

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

classification and regression. Random forest is created by combining several decision tree (Fig.4) by exploiting certain amount of randomness. Jeng et.al in [20] proposed CART method for building RF tree using binary split approach to create homogenous and near homogenous nodes.

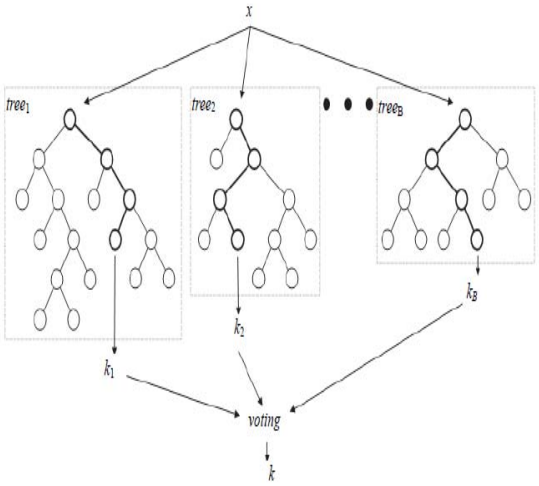


Fig. 3. Random Forest Classifier

According to this approach a good binary split must create a split such that data in the daughter nodes tends to be homogenous. Conventional random forest is very different from CART and is made of hundreds to thousands trees by bootstrap sampling of original samples. In addition to above mentioned difference another important difference is that a RF tree is built by a two-stage randomization procedure. In the first stage randomization bootstrap sampling of original sample is used. In second stage randomization rather than splitting a tree node using all predictors, only a random subset of predictors are selected at each node and used as candidates to find the best split for the node. This two stage randomization results in decorrelation of decision trees giving a low variance for whole forest ensemble. The Breiman's approach to build random forest generally consist of following main steps:

- Draw n-tree bootstrap samples from the original data.
- For each bootstrap data set grow a tree. At each node of the tree, randomly select m variables(predictors) for splitting. Continue growing the tree so that each terminal node has no fewer noes than nodesize cases.
- Aggregate information from the n-tree for classification.
- Using the data not in bootstrap sample compute an out-of-bag (OOB) error rate.

*3) k-Nearest Neighbor(k-NN):*The k-nearest neighbor algorithm (k-NN) proposed by Cover and Heart in 1968[4] is a non parametric method used for classification and regression. k-NN makes prediction from using training set directly. predictions are made by new vector for by searching through entire dataset for finding k most similar neighbours and summarizing the output of those k values. Incase of classification this might mode class value and for regression this might be mean output variable.

To determine which of k vectors in dataset are close to given input some kind of metrics is used. Normally for real valued data Euclidean distance is widely apart from these hamming, manhattan, minkowski distance are also used. Euclidean is used when input data are of same type. Manhattan distance is used when inputs are not of similar data type. The computation complexity of k-NN increases with increase in dataset size. There also several other forms of k-NN namely instance based learner, lazzy learner, non-parametric learner. k-NN when used for classification the class with highest frequency from k similar instances is calculate as output. Class probabilities are calculated as normalized frequency of samples that belong to set of k class with similiarity.When number of class is odd choose k as an even number when number of class is even choose k as an odd number.

IV. RESULTS

The proposed CAD system is implemented in MATLAB 2015b and was validated using one of the largest publicly available database namely Lung Image Database Consortium image collection (LIDC-IDRI)[21]. The entire dataset contains CT images from a total of 1018 patients and the complete data along with annotated results can be downloaded from the website http://cancerimagingarchive.net.

Figures 4-13 depict results obtained from proposed method. Fig.8 show the lungs segmented from their background. Fig.10 represent the output of SVM similarly Fig.11 represent the output of k-NN and Fig.12 represent the output of RF classifier.

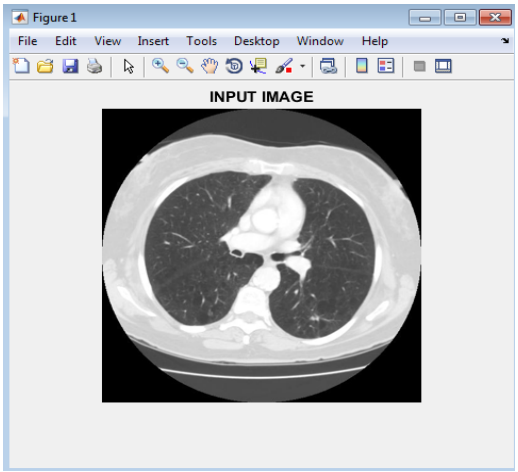


Fig. 4. Input CT image

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

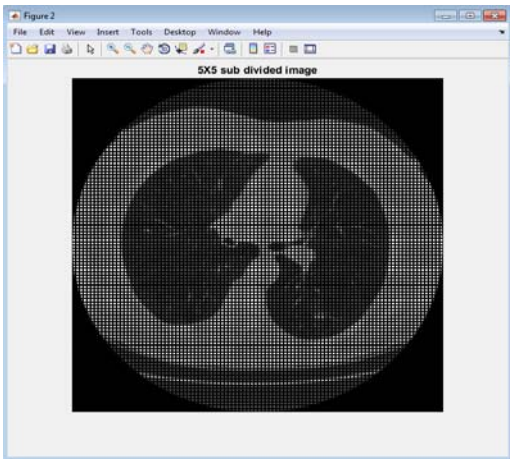


Fig. 5. Input image divided into 5x5 blocks

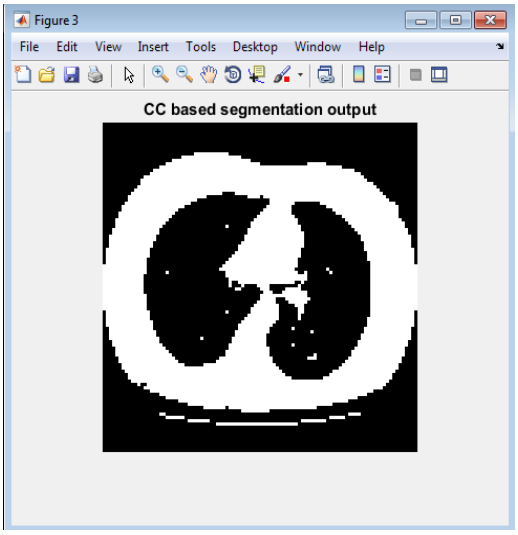


Fig. 6. Output of CC based segmentation

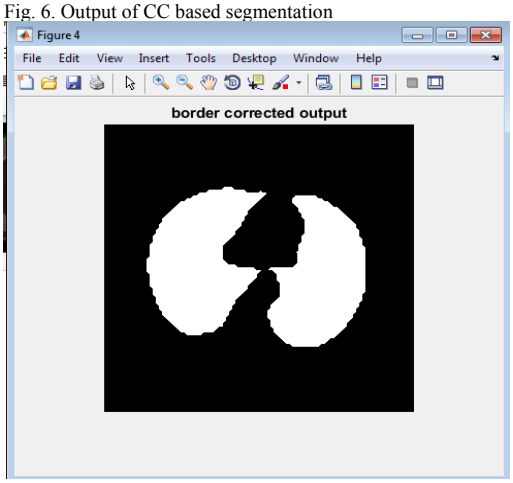


Fig. 7. Output with border connected

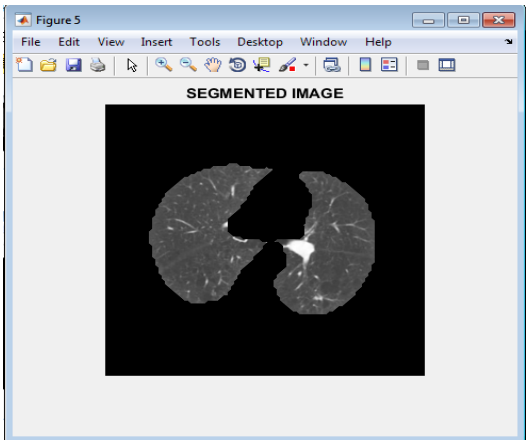


Fig. 8. Segmented Lungs

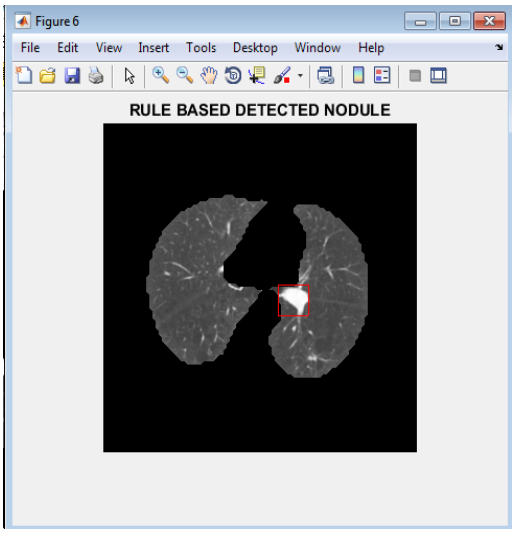


Fig. 9. Detected Nodule

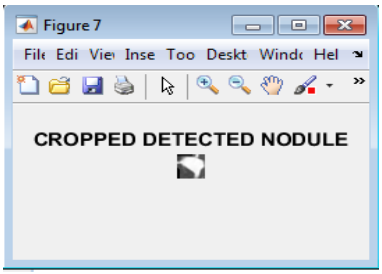


Fig. 10. Detected nodule region

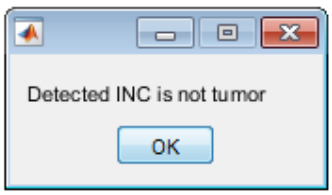


Fig. 11. Output of SVM classifier

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

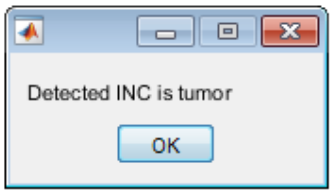


Fig. 12 Output of k-NN classifier

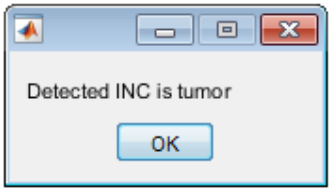


Fig. 13 Output Of Random Forest Classifier

TABLE I. PERFORMANCE METRICS

Metrics	Classifier		
	SVM	***RF***	***k-NN***
Accuracy	0.76	0.98	0.92
Sensitivity	0.825	0.975	0.95
Specificity	0.50	1	0.8
Precision	0.868	1	0.95
Recall	0.825	0.975	0.95
F_Measure	0.846	0.987	0.95
Gmean	0.642	0.987	0.872

Inorder to evaluate the preformance of different classifiers the the metrics accuracy, sensitivity, specificity, precision, recall, f_measure, gmean are calculated on the whole database and results are tabulated in Table I.

V. CONCLUSION

In this paper a novel Computer-aided detection (CAD) system for classification of pulmonary nodules in CT images is proposed. The proposed system uses contextual clustering based region growing for segmentation followed by GLCM features extraction. The extracted features are classified using three different classifiers. From performance metrics obtained it is found that Random Forest based classifier outperforms other classifiers.

REFERENCES

[1] B. S. Morse, Lecture 18: Segmentation (Region Based), 1998-2000.

[2] Giorgio De Nunzio, Eleonora Tommasi, Antonella Agrusti, Rosella Cataldo, Ivan De Mitri, Marco Favetta, Silvio Maglio, Andrea Massafra, Maurizio Quarta, Massimo Torsello, Ilaria Zecca, Roberto Bellotti, Sabina Tangaro, Piero Calvini, Niccolò Camarlinghi, Fabio Falaschi, Piergiorgio Cerello, and Piernicola Oliva, "Automatic Lung Segmentation in CT Images with Accurate Handling of the Hilar Region", Journal of digital imaging, Vol 24, No 1, pp 11-27, 2011.

[3] J. Quintanilla-Dominguez, B. Ojeda-Magaña, M. G. Cortina-Januchs, R. Ruelas, A. Vega- Corona, and D. Andina, "Image segmentation by fuzzy and possibilistic clustering algorithms for the identification of microcalcifications," Sharif University of Technology Scientia Iranica, vol. 18, pp. 580–589, Received 21 July 2010; revised 26 October 2010 accepted 8 February 2011.

[4] Eero Salli, Hannu, J, Aronen, Sauli Savolainen, Antti Korvenoja & Ari Visa 2001, 'Contextual Clustering for Analysis of Functional MRI Data', IEEE transactions on Medical Imaging, vol. 20, no. 5, pp.403-414, 2001.

[5] Linda G. Shapiro and George C. Stockman (2001): "Computer Vision", pp 279-325, New Jersey, Prentice-Hall, ISBN 0-13- 030796-3.

[6] Murat Ceylan, Yuksel Ozbay, O. Nuri Ucan, Erkan Yildirim, 2010, A novel method for lung segmentation on chest CT images: complex-valued artificial neural network with complex wavelet transform , Turk J Elec Eng & Comp Sci, Vol.18, No.4, pp. 613-623.

[7] Elaheh Soleymanpour, Hamid Reza Pourreza, Emad ansaripour and Mehri Sadooghi Yazdi, 2011, Fully Automatic Lung Segmentation and Rib Suppression Methods to Improve Nodule Detection in Chest Radiographs, JMSS, Vol. 1, No. 3, pp. 44-52.

[8] Faizal Khan, Z & Kannan, "Intelligent Segmentation of Medical images using Fuzzy Bitplane Thresholding", Measurement science and Review, Vol 14, No 2, pp-94-101, 2014.

[9] Faizal Khan, Z & Kavitha, V 2012, 'Estimation of objects in Computed Tomography Lung Images using Supervised Contextual Clustering', Research Journal of Applied Sciences, vol. 7, no. 9- 12, pp.494-499.

[10] Lin DT, Yan CR, Chen WT, "Autonomous Detection of Pulmonary Nodules on CT Images with a Neural Network-Based Fuzzy system", Comp Medical. Imaging and Graphics, Vol. 29, pp. 447-458, 2005.

[11] Prasad, M.N., Brown, M.S., Ahmad, S., Abtin, F., Allen, J., Da Costa, I., Kim, H.J., McNitt-Gray, M.F., Goldin, J.G. (2008). Automatic segmentation of lung parenchyma in the presence of diseases based on curvature of ribs. Academic Radiology, 15 (9), 1173-1180.

[12] Antonelli M, Lazzerini B, Marcelloni F "Segmentation and Reconstruction of the Lung Volume in CT Images". 20th annual ACM symposium on applied computing, vol I. Santa Fe, New Mexico, pp. 255-259, March 2005.

[13] JiantaoPu, Justus Roos, Chin A. Yi, Sandy Napel, Geoffrey D. Rubin, David S. Paik, "Adaptive Border Matching Algorithm: Automatic lung segmentation on chest CT images", Comp Medical Imaging and Graphics vol. 32, pp. 452-462, 2008.

[14] Ozekes S, Osman O, Ucan ON, "Nodule detection in a lung region that's segmented with using genetic cellular neural networks and 3D template matching with fuzzy rule based Thresholding", Korean Journal of Radiology, Vol. 9, pp. 1-9, 2008. [15] Cao Lei, Li Xiaojian, Zhan Jie,ChenWufan,

[15] "Automated Lung Segmentation Algorithm for CAD System of Thoracic CT", Journal of Medical Colleges of PLA, Volume 23,Issue 4, pp. 215-222, August 2008.

[16] Hyoungseop Kim, Seiji Mori, Yoshinori Itai, Seiji Ishikawa, Akiyoshi Yamamoto and Katsumi Nakamura, 2007, Automatic Detection of Ground-Glass Opacity Shadows by Three Characteristics on MDCT Images, World congress on medical physics and biomedical engineering 2006, IFMBE Pro2.

[17] Breiman, L. (2001) Random forests. Machine Learning Journal Paper, 45, 5-32.

[18] Wu, X.D. and Kumar, V. (2009) The top ten algorithm in data mining. Chapman & Hall/CRC, London.

[19] Biau, G., Devroye, L. and Lugosi, G. (2008) Consistency of random forests and other averaging classifiers. Journal of Machine Learning Research, 9, 2015-2033.

[20] Jeng-Shyang Pan, Shyi-Ming Chen, Ngoc Thanh Nguyen;November 2010;Computational Collective Intelligence. Technologies and Applications; Taiwan;Springer.

[21] S. G. Armato, G.McLennan, L. Bidautb,et.al"The lung image database consortium(LIDC) and image database resource initiative (IDRI): A completereference database of lung nodules on CT scans," Med. Phys., vol.38,pp.915–931,20

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Information Extraction with Speech Recognition

Amit Verma
Professor and Head Chandigarh Engineering College, Landran (Mohali)
dramitverma.cu@gmail.com

Iqbaldeep Kaur
Associate Professor
Chandigarh Engineering College, Landran (Mohali)
Iqbaldeepkaur.cu@gmail.com

Amit Kumar
Research Scholar
Chandigarh Engineering College, Landran (Mohali)
Aroramit26@gmail.com

Keywords:

Information Extraction, Automatic speech Recognition, Speech classes, Feature Extraction Techniques.

A B S T R A C T

The main objective is accessing the relevant information with Automatic Speech Recognition. For extracting relevant information from raw data in the small time frame as compared to manual reading. This paper represents the information extraction system with automatic speech recognition feature and discusses the major advance in last six decades of research. Overall process of information extraction and speech recognition system is represented. Different models, classes, and Techniques in speech recognition are represented. Various Feature Extraction Techniques with its characteristics, pros, and cons are represented. Speech recognition design issues are represented. Applications of speech recognition in various areas are represented.

1. Introduction

Today we live in the information age, technology specifically like the web and the internet, in particular, has changed the way we work and communicate. There is an enormous amount of information available for everyone. However, the amount of Information available is no use if there is not a suitable technique to process the information and extract knowledge from information. Text mining is one of the technologies that apply for those purposes which designed specially to deal with unstructured data. To make easier for a user to access the extracted information easily and effectively without and extra effect speech is applied. Speech now days are used for accessing any information. To do that user just interacts with the system by voice command and system recognizes the voice and invokes the necessary module for the output. Automatic Speech recognition system uses the process and technology related to that for converting speech signal to words or other linguistic by implementing the algorithm as a computer program.

1.1 Definitions:

Information Extraction is the process of accessing required information from unstructured data in short amount of time.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Automatic speech recognition is a process of translation of independent spoken language into text in real time.

1.2 Block Diagrams

1.2.1 Overall Process of Information Extraction:

Information extraction process has been depicted in figure 1. In this raw information is segmented and then from the list of string sub list is generated (list of list strings) called tokenization [1], then on that list speech tagging is applied and the list of tuples passes to next entity detection and at last relations are detected.

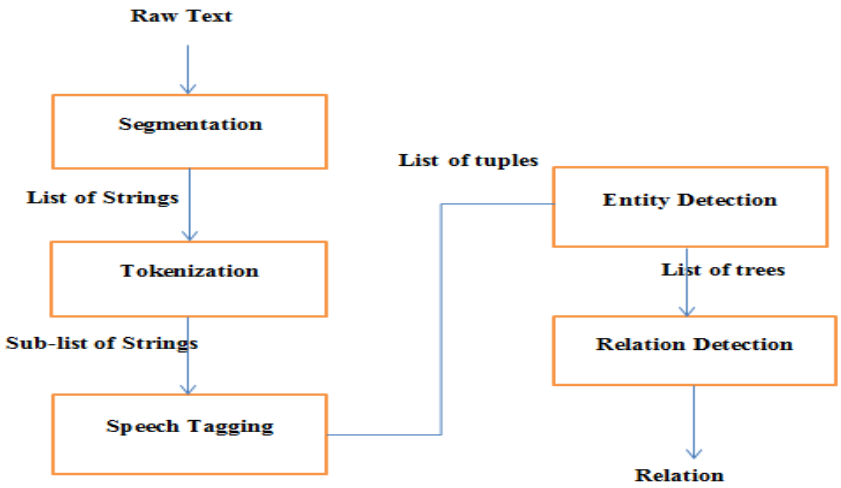


Figure 1: Information Extraction Process [2]

Information extraction process [3] is divided into different steps by different authors and combining them into bigger stages assigning the component of information extraction to accomplish the task. [4] However current work information extraction task is divided into six stages which are given below.

- Initial processing
- Proper name identification
- Parsing
- Extraction of events and relations.
- Anaphora resolution.
- Output results generation.

- **Initial Processing:**

There are different operations which generate basic steps of the information extraction process. The first step is to split a text into the various segments. This process is performed by the different components (tokenizes, text zones, segments or splitters). Tokenization is a very simple task for different texts in English language and the void space between characters called boundaries of words. But for different languages like Chinese or Japanese, these texts boundaries does not determine easily due to which this operation is complex and it required much more work to

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

complete that task. The next task in the processing stage is an analysis that includes part of speech tagging and phrasal unit identification. Speech tagging is helpful to the lexical analysis. It handles unrecognizable words and solves ambiguity problem by identifying speech of words due to which these ambiguities occur. The lexical analysis includes the special dictionaries and gazetteers for working, which contains different types of names like titles, cities, countries and position in companies etc. Each word in a document is checked with gazetteer and those words which present in gazetteer are then tagged with semantic classes of each word.

- **Proper Named Identification:**

Identification is the important operation in the chain of information extraction. In this case identification of different classes such as names of people or organization, dates, amounts, addresses etc. They can be encountered in all types of texts and they are the part of the extraction process. These names are recognized [5] using different patterns which are named as regular expressions.

- **Parsing:**

In parsing stage, the syntactic analysis of the documents is performed. In the last stage, noun and verb group are generated. Parsing stage is important for the next stage of relation extraction between the entities and events in which participation occur. The noun group and verb groups are work at the pattern matching step. The identification of groups is formed by applying a set of a regular expression. But the complete parsing is a very difficult task. It needs large computation which slows down the process of information extraction.

- **Extraction of Events and Relation:**

All previous stages are preparation for the important stage for the extraction of events and relations, which is related to the specification provided by client initially. This process is performed by applying and creating different extraction rules each of which define different pattern. Then text matching process occur with each defines pattern and after matching is successful then text labeling occurs and at last extracted. Each Information extraction systems formalize these rules differently from one another.

- **Anaphora Resolution:**

This particular problem was originally introduced and processed on the MUC-6 as the co-reference task before that co-reference presented as a difficult challenge and different researchers tried to resolve this problem.

Any entity in a text can refer multiple times and each time it refers differently. To identify all the different ways to name that particular entity throughout the whole document co-reference resolution process is performed. There are different types of co-reference, but the most commons are proper names co-reference and pronominal, when a noun is replaced by another noun then it is called as proper name co-reference and when a noun is replaced by a pronoun then it is called as pronominal.

- **Output Results Generation:**

Output results generation includes the transformation of the structure which is extracted during the last operations into the output templates according to the specification provided by the client. It

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

includes different operations for dates, currencies, time etc. For example, a rounding off task for percentages can be performed and a real number 65.86 will result into the integer as 66.

It is not necessary all tasks accomplished within one project of information extraction. Thus any particular information extraction system does not have all those possible needed components.

1.2.2 Automatic Speech Recognition Process:

Speech recognition system which contains Front-end unit, Decoder unit, language Models unit shown in figure 2.

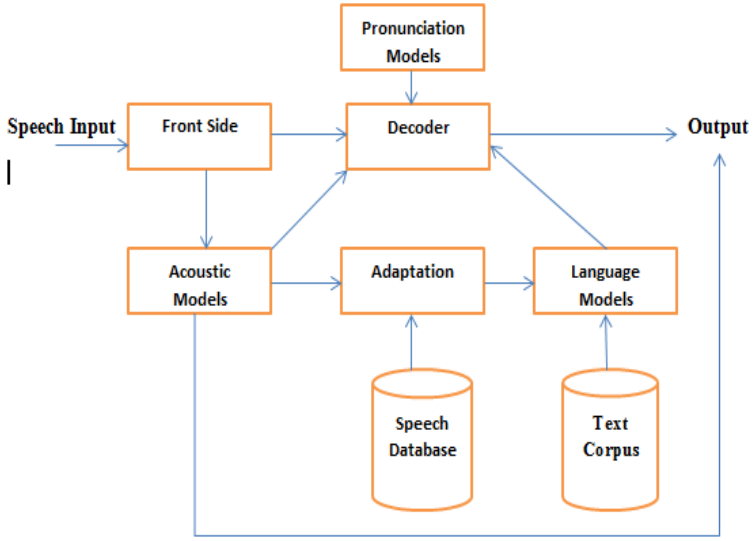


Figure 2: Basic Model of Speech Recognition System

Description of each model and speech database is given below.

A. Models:

According to the speech recognition structure, three different models [6] are used in speech recognition for the matching process:

- **Acoustic Model:** It provides acoustic properties which are used by context-independent models that contain properties (mostly feature vectors for each different phone) and context-dependent properties.
- **Phonetic Dictionary:** It contains a mapping from words to phones. This mapping is not effective. For example, only two or three pronunciation variants are noticed in this. The Task of this mapping is also effectively done by some complex function learned with a machine learning algorithm.
- **Language Model:** It is used for restricting word search. It defines pattern between different words that is it define which word could follow previously recognize words and then significantly restrict the matching process by neglecting the words not matched. Most commonly used language models are n-gram language models which contain statistics of each word sequences and finite state language models which define speech sequences with weights. The main issue with language model is vocabulary restriction. To deal with this problem, a language model includes smaller parts

or chunks like sub words. Search space in this case is not much considerable and thus similar recognition accuracy is lower with a word-based language model.

B. Speech Databases:

Speech databases have an important use in Automatic Speech Recognition. They are also used in different system like, speech synthesis, coding, and analysis which include language identification and verification process. These applications require large amounts of a database. Different types of databases that are used for speech recognition applications are described next.

Taxonomy of Existing Speech Databases:

The inter-speaker and variability of inter-speaker are important factors for an existing speech database. Variation can be generated from different emotion, variable speaking rates, and noise. The variation is caused by the different factors in system which includes lips and source excitation. Speech Databases are two types that are Single and Multi -Sessions. Multi-Session databases identify the temporal intra-speaker variability. The Acoustic environment indicates that the databases are either in a noiseless environment like the sound booth or in a noisy environment like home and office. Some corporations like SIVA, TIMIT and POLYCOST are designed for development and processing the speech recognition. Different databases were recorded in only one language which may be native language but other are in multiple languages which may be non-native languages. Thus in a non-native language, the language and speech recognition become the additional usage of those databases.

1.3 Different Approaches of Information Extraction and Automatic Speech Recognition

Information Extraction includes two basic approaches of extraction [7]: Knowledge Engineering Approach and Automatic Training Approach.

- **Knowledge Engineering Approach**

In this case, a set of extraction rules is manually written for extracting information from texts using a system which supports this approach. These rules are written by a knowledge engineer. But the designer should know the formulation of writing these rules. The knowledge engineer mainly has different texts which similar to the domain. But designer also finds common patterns after analyzing of texts and then write those rules according to analysis in its own way, which is a very important for high-level performance system creation. Then extraction system interpreted those rules and usable facts are extracted from the large text. This type of extraction process is very time consuming and require much more efforts this process. Knowledge engineer checks for the required result after applying those rules which are written by them. If desirable result does not obtains then modifications are done and rules are again examined until desirable result not obtained. This approach is also called rules based approach.

- **Automatic training approach:**

In Automatic Training Approach, extraction rules are not written manually. Due to which the person which perform information extraction operation does not have any knowledge of writing those rules and system working. In this case, the rule is written by machine learning algorithms. Due to which algorithm access a huge number of training texts related to the specific domain. Those texts are given manually in advance due to which algorithm can learn and give extraction rules. These algorithms

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

used for the automatic training approach are decision trees, maximum entropy models, and hidden Markov models**.** This approach is called the machine learning approach. Due to machine learning algorithm, this approach is applied to different domains thus it is named as a domain- independent approach.

Basically, a machine learning approach is of two types: Supervised and unsupervised approach. Supervised learning is used when a different number of documents help algorithm to learn about which information is to be extracted. Unsupervised learning means annotated document is not used to better the system level performance.

The important advantage of a machine learning based system is that it can be easily transferred to a different domain as long as specific texts and a person are available. But sometimes those texts are expensive to obtain or there is a less amount of useful documents present due to which an algorithm can learn, and manual annotation which provides reasonable levels of performance may be much expensive.

Types of Automatic Speech Recognition

Speech recognition systems can be separated into different classes by describing different types of utterances by recognizing ability. These classes are categorized as the following:

- **Isolated Words:**

Isolated word recognizer requires each utterance to have carried out discretely on both sides of the sample window. At one time, it accepts a single word or single utterance. These systems have two states that are “Listen- state” and “Not-Listen states”, which require the speaker to wait between each utterance.

- **Connected Words:**

Connected words are similar to isolated words, but it allows separate utterances or words to be run together with a small pause between each utterance.

- **Continuous Speech:**

Continuous speech recognizers allow users to speak normally, during that time computer determine the content. Recognizing with continuous speech capabilities are most difficult to create because they used special methods to determine utterance boundaries in speech.

- **Spontaneous Speech:**

It can be thought of as speech that is natural sounding and not rehearsed on a basic level. An ASR system with spontaneous speech ability can handle a variety speech features such as words being run together, "ums" and "ahs", and even slight stutters.

2. Speech Recognition Techniques

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

The main purpose of speech recognition is for the machine to able to listen, understand and process on given information. Different stages of speech recognition working described in figure3.

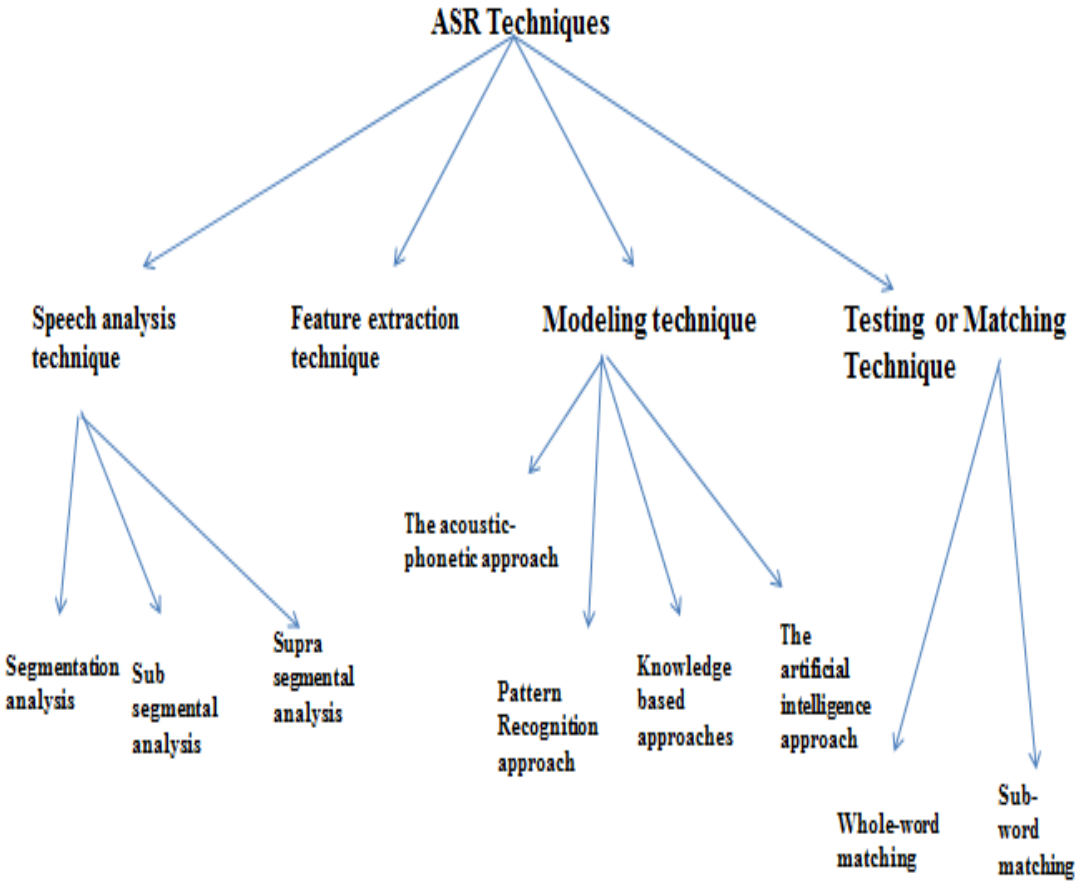


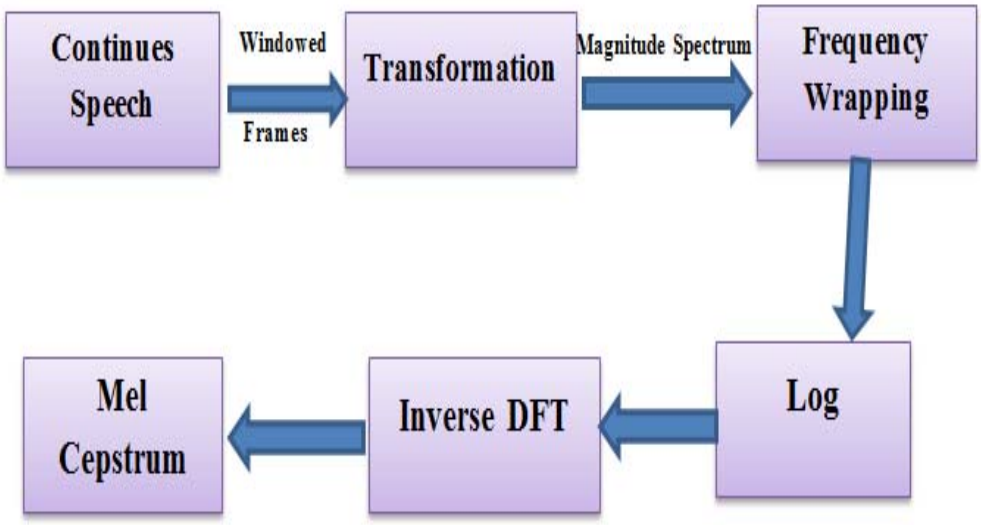
Figure 3: Automatic Speech Recognition Techniques [9]

1. **Speech Analysis Technique:** In the analysis process when the speaker speaks, speech data contains different information to identify the speaker. Information is different due to different factors like a vocal tract, the source of excitation and behavior of speaker. The speech analysis process sub-divided in three techniques as shown in the figure, which is described below.
   - **Segmentation Analysis**: In this Segmentation Analysis, speech is analyzed with frame size and shifts in between 10 to 30 milliseconds. In this case, vocal and tract information is extracted.
   - **Sub-Segmented Analysis:** In this Sub-Segmented Analysis, speech is analyzed with frame size and shifts in between 3 to 5 milliseconds. This analysis technique used for extracting and analyzing the excitation state.

- **Supra-Segmented Analysis:** In this Supra-Segmented Analysis, speech is analyzed with frame size and shifts in between 50-200 milliseconds. This analysis technique used for analyzing the behavior of speaker.

2. Feature Extraction Technique:

Feature Extraction is needed because there is large variability in the digital waveform, thus it reduces the variability. Feature extraction extracts the features that help in analyzing the speaker. Detail process of Feature Extraction technique from speech to transformation of speech is presented in the figure4.



.

Figure 4: Feature Extraction Technique [10]

Figure4 provide an overview of feature extraction process. In feature extraction process continuous speech is enter as input for windowing. Before entering in transformation stage windowing reduce the disruption process. After that speech signal which is in continues form converted in frames of the window. Then these frames are passed to Fourier transformation process which transforms frames of the window into a spectrum. After that spectrum is analyzed and Mel-spectrum is obtained at Mel-frequency scale with fixed resolution. Then it passes to log transformation and then to the inverse process of transformation that is inverse Discrete Fourier Transformation. Then the final result of Mel-spectrum is generated. Different Feature extraction techniques [11-20] with its advantages and disadvantages are shown in table 1.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Table 1: Feature Extraction Techniques

Technique	Characteristics	Pros	Cons
LPC	ARBSF, STATECH, FET & RESSDCVTIS	REL, ACCU, ROB GCS & LBRSE	WDWSV, DIALE & GRE
MFCC	ESP, MHAS& MFS (SLFlT & LOGHT 1000Hz)	ACCU, HPR, CMCPS & LC	FBNIDP & DFRP
RASTRA	BPFT, RNI, ES & WUNSS	RSV , FEV (in ARTF), ROB & CFWLM	MPD
PLDA	VET, SDV(of HMM) & FBGM	FLEXAM, NCM & ACCU	LEGA & LEGM

ACCU-Accurate, ARBSF- Automatic Regression Based Speech Feature, ARTF-Artifacts, BPFT-Band Pass Filtering Technique, CFWLM- Capture Frequency With Low Modulation, CMCPS-Captures Main Characteristics Of Phones in Speech, DFRP- Different Filters Reduce Performance, DIALE- Difficulty in Analyze Local Events, ES- Enhance Speed, ESP- Easy Speech processing, FBNIDP- Filter Bandwidth No Independent Design Parameter, FET- Format Estimation technique, FEV-Fast Environment Variation, FLEXAM- Flexible Acoustic model, GCS- Good Computation Speed, GRE- Generates Residual Error, HMM-Hidden Markov Model, HPR- High Performance Ratio, LBRSE-Low Bit Rate Speech Encoding, LC-Low Complexity, LEGA-Less Effective Gaussian Assumption, LEGM-less Effective Generative Model, LOGHT-Log Higher Than, LPC-linear predictive coding, MFCC-Mel Frequency Capstrum Coefficient, MFS – Mel Frequency Scale, MHAS- Mimics Human Auditory System, MPD- Minor Performance Degradation, NCM- No Covariance Modeling, PLDA-Probabilistic Linear Discriminate Analysis, PLP- Perceptual linear prediction, RASTRA-Relative spectra, REL- Reliable, RESSDCVTIS-Residual Sound close to Vocal Tract Input Signals, RNI- Reduce Noise Impact, RSV-Remove Slow Variation, ROB-Robust, SDV-State Dependent Variable, SLFlT - Spacing of Linear Frequency Less Than, STATECH- Static Technique, VET-Vector Extraction Technique, WDWSV-Distinguishing Words With Similar Vowel, WUNSS-Widely Used in Noisy Speech Signals.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

3. Modeling Technique*:* The purpose of modeling technique is to create speaker model by using the feature extraction. Modeling techniques are classified as Speaker Recognition and Speaker Identification. Speaker Identification identifies the speaker on the basis of information extracted. Speaker recognition further divides into two parts speaker dependent and speaker- independent. In speaker -independent system removes some specific features and extracts the information. Different modeling approaches are given below.

- **Acoustic –phenolic Modeling*:*** The main process followed by Acoustic- phenolic modeling is to identify the speech signals and then provide a label to these speech signals. Thus this approach indicates that phonemes present are finite in numbers which are described by properties of the acoustic model.
- **Pattern recognition approach:** This approach involves two steps- Pattern Training and Pattern Comparison. This further includes two which are Stochastic Approach and Template Approach. This approach with the use of robust mathematical formulas develops speech pattern.
- **Knowledge-Based Approach:** Expert knowledge about different variation in speech is coded into a system manually. But expert knowledge is very difficult to obtain and use successfully.
- **Artificial Intelligence Approach**: Artificial Intelligence approach works in similar to human mind thinking. As human thinks it also performs the same type of function on the machine level. Thus it takes a decision on the acoustic level. This approach is the formed by combining acoustic-phonetic approach and pattern recognition [21] approach.

4. Matching Techniques: The detected word is used by the speech recognizer to a word which is already considered or known by using one of the techniques which are shown below:

- **Sub word matching:** In this matching technique first Search engine analyze phonemes and after that pattern recognition is performed later. These Analyze phonemes are the sub-words due to which it is called sub- word matching. The storage required by this matching technique is in between five to twenty bytes per word which is less than the comparison of whole word matching technique. But one disadvantage of this technique is processing time is large.
- **Whole word matching:** This matching technique provides a template of pre-recorded form due to which input signal is matched by search machine. The processing of this technique takes less time in comparison to sub-word matching technique. The main disadvantage of this technique is that recording of each word is required which means that it is recognized beforehand for the system to recognize it due to which it can only be used when knowing about the vocabulary of recognition beforehand. These templates storage is much larger than sub-word matching technique, its storage lies in between fifty to five hundred twelve bytes per word. Due to which this matching technique provide the better result in comparison to other technique.

3. Literature Survey of Speech Recognition

The progress of Automatic Speech recognition [22] technology of four generations [23] is summarized in Table 2, Table 3 and Table 4.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Table 2: Literature Survey of First Generation of Speech Recognition

GENERATION	YEAR	DEVELOPER	RESEARCH
First Generation(1920-1970)	1922	EB	RR (toy)
	1936	Bell Labs	IFIST
	1939	Bell Labs	SSM (WFIN)
	1952	Bell Labs, DB&B	IDRFSS
	1956	RCA Labs	RMW
	1959	UE,UD,MIT Labs	PR (Vowels and Consonants)
	1960	S&N (RR Labs)	HVR
	1962	S&D (KU)	HPR
	1963	N (NEC Labs)	HDR

DB&B- Davis Biddulph & Balashek, EB- Elmwood Button , HDR-Hardware Digit Recognizer, HPR-Hardware Phoneme Recognizer, HVR-Hardware Vowel Recognizer, IDRFSS-Isolated Digit Recognition For a Single Speaker, IFST-Initial Phase in Speech Technology, KU-Kyoto University, MIT-Massachusetts Institute of Technology, PR-Phoneme Recognizer, RMW-Recognition of Monosyllabic Words, RR-Radio Rex , RR Labs- Radio Research Laboratory, S&D-Sakai & Doshita, S&N-Suzuki & Nakata, SSM-Speech Synthesis Machine, UD-University of Denes, UE-University of England, WFIN-world fair in New York.

In Table 3, literature Survey of second generation of speech recognition is presented.

Table 3: Literature Survey of Second Generation of Speech Recognition

Generation	Year	Developer	Research
Second Generation(1970-1990)	1970	IBM Labs	LVSR
	1972	AT&T Bell Labs	SISRS
	1973	DARPA	ASUP
	1980	NEC	RFSSCW
	1980	S (NEC)	TLDPA
	1982	B & B (JSRU)	OPM
	1985	M&R(Bell Labs)	LBA
	1986	L&R(Bell labs)	FSLBA
	1987	IBM	NWSR
	1989	CMU	LV, CSRS, SPHINX system.

ASUP-Ambitious Speech Understanding Project, AT&T- American Telephone and Telegraph Company, B&B-Bridle and Brown, CMU- Carnegie Mellon University, CSRS-Continuous Speech Recognition Systems, DARPA-Defense Advanced Research Projects Agency, FSLBA- Frame Synchronous Level Building Approach, JSRU-joint Speech Research Unit, LBA- Level Building

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Approach, L&R-Lee and Rabiner, LV-Large Vocabulary, LVSR-Large vocabulary Speech Recognition, M&R-Myers and Rabiner, NWSR-Neural Network Speech Recognition, , OPM-One pass Method, RFSSCW- Recognizing a fluently spoken string of connected word, S-Sakoe, SISRS-Speaker Independent Speech Recognition Systems, TLDPA-Two Level Dynamic Programming Approach.

In Table 4, literature Survey of third and fourth generation of speech recognition is presented.

Table 4: Literature Survey of Third and Fourth Generation of Speech Recognition

Generation	Year	Developer	Research
Third Generation (1990-2000)	1990	DARPA	PR, NLFER
Fourth Generation(2000-Present)	2000	GR	VBE (VB & CT) POAL(ASR)
	2003	SS	DNS
	2005	DARPA	LBCSR in Sphinx
	2008	Google	GVS in iPhone
	2010	Google	GVS in Android

ASR-Automatic Speech Recognition, CT- Clustering Technique, DARPA-Defense Advanced Research Projects Agency, DNS- Dragon Naturally Speaking, DS-Domestic Sector, GR- Giuseppe Richard, LBCSR- Large Vocabulary Continuous Speech[24] Recognition, GVS-Google Voice Search, NLFER- Natural Language Front End Recognizer, POAL- Problem Of Adaptive Learning, PR-Pattern Recognition, SS-Scan-Soft, VBE- Vibrational Bayesian.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

4. Applications of Speech Recognition

Various applications of speech recognition domain have been discussed in the following Table 5.

Table 5: Applications of speech recognition

Problem Domain	Application	Input pattern	Pattern classes
SPH,TEL, COMSEC & REC	TDENOA	SWF	SW
EDUSEC	TOS & PHS	SWF	SW
OES	COMGM & VGMPS	SWF	SW
DS	DW, REFG & WM	SWF	SW
MS	HPFA, TATC	SWF	SW
AIS	ROBOT	SWF	SW
GEN	AT, AUTOTEL, ATC, MI, CR & GS	SWF	SW
PH	LM	SWF	SW
DICT	DS	SWF	SW
TRNS	LT	SWF	SW

AIS-Artificial Intelligence Sector, AT-Automated Transcription, ATC-Air Traffic Control, AUTOTEL-Automatic Telematics, COMGM-Computer Games, COMSEC-Communication Sector, CR-Court Reporting, DICT-Dictation, DS- Dictation System, DW-Dish Washer, EDUSEC-Education Sector, GEN-General, GS-Grocery Shop, HPFA- High Performance Fighter Aircraft, LM-limited Mobility, LT-Language Translation, MI-Multimodal Interacting, MS-military Sector, OES-Outside education Sector, PH-physically Handicapped, PHS-physically Handicapped Students, PS-Precision Surgery, REC-Recognition, REFG- Refrigerator, SP-Speech, SW-Spoken Words, SWF-Speech Wave Form, TATC-Training Air Traffic Controllers, TEL-Telephone, TDENOA-Telephone Directory Enquiry No Operator Assistance, TOS-Teaching Overseas Students, TRNS-Translation, VGM-Video Games, WM- Washing Machine

5. Relevant Issues of ASR Design

Main issues on which recognition accuracy depends on have been presented in table 6. Issues of ASR like in environment factor noise problem, speech waveform variation occurs thus incorrect words are recognized. Age is main another factor comes under speaker factor. Each person with different age that is young and old age have different voice factor which also affects the speech recognition task.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Table 6: Relevant Issues of ASR Design

Factor	Issue
ENR	TON, SNR & WC
TRND	MICP, TEL
CHN	BA, DIST, Echo
SPEC	SPECD, SPECI, AGE & PS
SPHS	VT, PROD(IW, CSR,SS) SPEED
VOC	ATD

ATD- Available Training Data, BA-Band amplitude, CHN-Channel, CS- Continue Speech, DIST-Distortion, ENR-Environment, IW-Isolated Word, MICP-Microphone, PROD-Production, PS-Physical State, SPEC-Speaker, SPECD-Speaker Dependence, SPECI-Speaker Independence, SPSH-Speech Style, SRN- Signal noise Ratio, SS-Spontaneous Speech, TEL-Telephone, TON-Type of Noise, TRND-Transducer, VOC-Vocabulary, VT-Voice Tone, WC-working condition

6. Conclusion

Current work represents the initial background of Information Extraction and Automatic Speech Recognition. In this paper process of information extraction with different stages of processing and basic models of speech recognition is presented. Different approaches to information extraction and speech recognition are described. Different techniques of speech recognition comparison of feature extraction techniques with its advantages and disadvantages are presented. Last four generation of research in speech recognition is summarized. In the last sections, application and relevant issues in speech recognition process are described.

7. References

1. Appelt, D.E. “Introduction to information extraction.” Ai Communication 12, No. 3 (1999): 161-172.
2. Hobbs J.R. “The information Extraction System” processioning’s on the 5Th conference on Message understanding, (1993), pp. 87-91.
3. Turmo J., Ageno A.and Catala, N. “Adaptive Information Extraction”, ACM Computing Surveys, 38(2) (2006), pp.1-47.
4. Feldman, Ronen, and James Sanger. The text mining handbook: advanced approaches in analyzing unstructured data. Cambridge University Press, 2007.
5. Grishman, Ralph, and Beth Sundheim. "Message Understanding Conference-6: A Brief History." In COLING, vol. 96, pp. 466-471. 1996.
6. P.satyanarayana “short segment analysis of speech for enhancement” institute of IIT Madras feb.2009
7. Madina Ipalakova and Dr. John McNaught, “Information Extraction Initial Background

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Report" (2008), pp. 5-25.
8. Moens, Marie-francine. Information extraction: algrithms and prospects in a retrieval context. Vol. 21. Springer Science & Business Media, 2006.
9. Santosh K.Gaikwad, Bharti W.Gawali," A Review on Speech Recognition Technique" International Journal of Computer Applications (0975 – 8887) Volume 10– No.3, November 2010.
10. Om Prakash Prabhakar, Navneet Kumar Sahu,"A Survey On: Voice Command Recognition Technique" International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 3, Issue 5, May 2013.
11. Tomyslav Sledevic,˘ Artu¯ras Serackis, Gintautas Tamulevici˘ us, Dalius Navakauskas, International Journal of Electrical, Computer, Electronics and Communication on Evaluation of Features Extraction Algorithms for a Real-Time Isolated Word Recognition System Vol:7 No:12, 2013.
12. Celso Auguiar, in CCRMA - Center for Computer Research in Music and Acoustics. Stanford University on Modelling the Excitation Function to Improve Quality in LPC's Re-synthesis**.**
13. Shanthi Therese Chelpa Lingam, International Journal of Scientific Engineering and Technology (ISSN: 2277-1581) a Review of Feature Extraction Techniques in Automatic Speech Recognition, Volume No.2, Issue No.6, pp. 479-484 1 June 2013 19. Navnath S Nehel and Raghunath S Holambe Journal on Audio, Speech, and Music Processing, on DWT and LPC based feature extraction methods for isolated word recognition, 2012
14. Navnath S Nehel and Raghunath S Holambe Journal on Audio, Speech, and Music Processing, on DWT and LPC based feature extraction methods for isolated word recognition, 2012.
15. Nilu Singh, R.A Khan and Raj Shree, International Journal of Computer Applications (0975 – 8887), A Comparative Study on MFCC and Prosodic Feature Extraction Techniques:, Volume 54– No.1, September 2012.
16. Chia-Ping Chen Jeff Bilmes and Daniel P. W. Ellis, Department of Electrical Engineering University of Washington Seattle, WA on Speech Feature Smoothing for Robust ASR.
17. H. Hermansky and N. Morgan, Rasta processing of speech, IEEE Trans. on Speech and Audio Processing, vol. 2, no. 4, pp. 578{589, 1994.
18. Yuxuan Wang, Kun Han, and DeLiang Wang, Fellow, IEEE TRANSACTIONS ON AUDIO, SPEECH, AND LANGUAGE PROCESSING, Exploring Monaural Features for Classification-Based Speech Segregation, 2012.
19. Liang Lu, Member, IEEE and Steve Renals, Fellow, IEEE, IEEE SIGNAL PROCESSING LETTERS, Probabilistic Linear Discriminant Analysis for Acoustic Modelling, VOL. X, NO. X, 2014.
20. Jun Wang, Dong Wang, Ziwei Zhu, Thomas Fang Zheng and Frank Soong, at Center for Speaker and Language Technologies (CSLT), on I-vectors, a Discriminative Scoring for Speaker Recognition Based, 2014.
21. Khaled M. Alhawiti," Advances in Artificial Intelligence Using Speech Recognition" International Journal of Computer, Electrical, Automation, Control and Information Engineering Vol: 9, No: 6, 2015.
22. Sadaoki Furui, 50 years of Progress in speech and Speaker Recognition Research ECTI Transactions on Computer and Information Technology, Vol.1. No.2 November 2005.
23. B.H. Juang, Lawrence R. Rabiner," Automatic Speech Recognition – A Brief History of the Technology Development" Georgia Institute of Technology, Atlanta and Rutgers University and the University of California, Santa Barbara, August 2004.

24. John Butzberger, Hy Murveit, Elizabeth Shriberg, Patti Price," Spontaneous Speech Effects In Large Vocabulary Speech Recognition Applications" SRI International Speech Research and Technology Program Menlo Park.

Appendix

ACCU-Accurate, AIS-Artificial Intelligence Sector, ARBSF- Automatic Regression Based Speech Feature, ARTF-Artifacts, ASR-Automatic Speech Recognition, ASUP-Ambitious Speech Understanding Project, AT-Automated Transcription, ATC-Air Traffic Control, ATD-Available Training Data, AT&T- American Telephone and Telegraph Company, AUTOTEL-Automatic Telematics, BA-Band amplitude, B&B-Bridle and Brown, BPFT-Band Pass Filtering Technique, CFWLM-Capture Frequency With Low Modulation, CHN-Channel, CMCPS-Captures Main Characteristics Of Phones in Speech, CMU-Carnegie Mellon University, COMGM-Computer Games, COMSEC-Communication Sector, CR- Court Reporting, CS-Continue Speech, CSRS-Continuous Speech Recognition Systems, CT- Clustering Technique, DARPA-Defense Advanced Research Projects Agency, DB&B- Davis Biddulph & Balashek, DFRP- Different Filters Reduce Performance, DFT-Discrete Fourier Transformation, DIALE- Difficulty in Analyze Local Events, DICT-Dictation, DIST-Distortion, DNS- Dragon Naturally Speaking, DS- Dictation System, EB- Elmwood Button, EDUSEC-Education Sector, ENR-Environment, ES- Enhance Speed, ESP- Easy Speech processing, FBNIDP- Filter Bandwidth No Independent Design Parameter, FET- Format Estimation technique, FEV-Fast Environment Variation, FLEXAM- Flexible Acoustic model, FSLBA- Frame Synchronous Level Building Approach, GCS- Good Computation Speed, GEN-General, GS-Grocery Shop, GRE-Generates Residual Error, GR- Giuseppe Richard, GVS-Google Voice Search, HDR-Hardware Digit Recognizer, HMM-Hidden Markov Model, HPFA- High Performance Fighter Aircraft, HPR- High Performance Ratio, HPR- Hardware Phoneme Recognizer, HVR-Hardware Vowel Recognizer, IDRFSS-Isolated Digit Recognition For a Single Speaker, IFST-Initial Phase in Speech Technology, IW-Isolated Word, JSRU-joint Speech Research Unit, KU-Kyoto University, LBA- Level Building Approach, LBCSR- Large Vocabulary Continuous Speech Recognition, LBRSE-Low Bit Rate Speech Encoding, LC-Low Complexity, LEGA-Less Effective Gaussian Assumption, LEGM-less Effective Generative Model, LM-limited Mobility, LOGHT-Log Higher Than, LPC-linear predictive coding, L&R-Lee and Rabiner, LT-Language Translation, LV- Large Vocabulary, LVSR-Large vocabulary Speech Recognition, MFCC-MEL-Frequency Capstrum, MFS–Mel Frequency Scale, MHAS- Mimics Human Auditory System, MICP-Microphone, MPD-Minor Performance Degradation, M&R-Myers and Rabiner, MIT-Massachusetts Institute of Technology, MI-Multimodal Interacting, MS-military Sector, NCM- No Covariance Modeling, NLFER- Natural Language Front End Recognizer, NWSR-Neural Network Speech Recognition, OES-Outside education Sector, OPM-One pass Method, PH-physically Handicapped, PHS-physically Handicapped Student, PLDA-Probabilistic Linear Discriminate Analysis, PLP-Perceptual linear prediction, POAL- Problem Of Adaptive Learning, PR- Pattern Recognition, PR-Phoneme Recognizer, PROD-Production, PS-Physical State, PS-Precision Surgery, RASTRA-Relative spectra, REC-Recognition, REFG-Refrigerator, REL- Reliable, RESSDCVTIS-Residual Sound close to Vocal Tract Input Signals, RFSSCW- Recognizing a fluently spoken string of connected word, RMW-Recognition of Monosyllabic Words, RNI- Reduce Noise Impact, ROB-Robust, RR-Radio Rex , RR Labs- Radio Research Laboratory, RSV-Remove Slow Variation, S-Sakoe, S&D-Sakai & Doshita, SDV-State Dependent Variable, SISRS-Speaker Independent Speech Recognition Systems, SLFlT-Spacing of Linear Frequency Less Than, S&N-Suzuki & Nakata, SP-Speech, SPEC-Speaker, SPECD-Speaker Dependence, SPECI-Speaker Independence, SPSH-Speech Style, SRN- Signal noise Ratio, SS- Scan

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Soft, SS-Spontaneous Speech, SSM-Speech Synthesis Machine, STATECH-Static Technique, SW-Spoken Words, SWF-Speech Wave Form, TATC-Training Air Traffic Controllers, TDENOA-Telephone Directory Enquiry No Operator Assistance, TEL-Telephone, TLDPA-Two Level Dynamic Programming Approach, TOS-Teaching Overseas Students, TON-Type of Noise, TRND-Transducer, TRNS-Translation, UD-University of Denes, UE-University of England, VBE- Vibrational Bayesian, VET-Vector Extraction Technique, VGM-Video Games, VOC-Vocabulary, VT-Voice Tone, WC-working condition, WDWSV-Distinguishing Words With Similar Vowel, WFIN-world fair in New York, WM- Washing Machine, WUNSS-Widely Used in Noisy Speech Signals.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Load Balance for Multicast Traffic in SDN using On-Time traffic Monitoring

Alaa M. Allakany
Graduate school of Information Science and Electrical Engineering, Kyushu University.
Faculty of Science, Kafrelsheikh University, Kafrelsheikh, Egypt
744 Motooka, Nishiku, Fukuoka City,
819-0395, Japan
alaa_83moh@yahoo.com

Koji Okamura
Research Institute for Information Technology, Kyushu University.
744 Motooka, Nishiku, Fukuoka City,
819-0395, Japan
oka@ec.kyushu-u.ac.jp

***Abstract*— Software-Defined Networking (SDN) is a new technology to design, build and manage computer networks. SDN technology decouples the control plane logic from the data plane by moving networking control functions from forwarding devices (switches, routers). In a SDN network, a centralized and programmable software controller uses a global network view to manage network operations. The centralized control of the SDN network presents a tremendous opportunity for network operators to refactor the control plane and to improve the performance of the network. IP network uses multicast as an effective method to maximize bandwidth utilization. However, traditional multicast protocols designed for IP networks often cannot avoid network congestion, because of local view of the network and challenges to obtain real-time network traffic. Recently, methods based on SDN multicast have been introduced. Most of these methods led to network congestion, which is resulting from using static link weight for building multicast tree. Furthermore, some methods that use link utilization as link weights don't consider the different capacity of each link and assume that links that have same percent of utilization per second are equal in weight, for example, if there are two links L1 and L2, and the percent of utilization on both are 50%, but bandwidth of L1 is 100 Mbps and L2 is 10 Mbps, then the existing methods assume that both links have same weight, which increases the chance of congestion on L2.**

In this paper, we propose an approach for applying traffic load balancing to multicast traffic through real-time link cost and switch lead modification in SDN. In this approach, we proposed a concept of "available link bandwidth" and "available switch capacity" to be used as link and switch weights. The idea is that we could improve overall performance of the network and avoid both link and switch congestion by considering the different capacities of links and switches by using available capacity as weights rather than using the percent of utilization as weight. Multicast tree was calculated using the extend Dijkstra shortest path algorithm and based on real-time measuring available bandwidth and available switch capacity. We validate our method using the popular Mininet network emulation environment with Pox controller. Our results prove that our method can improve traffic distribution in network.

Keywords- Software Defined Networks, OpenFlow, Pox controller, Mininet, Multicast traffic, Dijkstra Algorithm, link load and switch load.

I. INTRODUCTION

Recently, there is a fast growth in the applications that require transmission data from one source to a group of receivers. Multicasting technologies are a good solution for this kind of communication, they can save network resources utilization and improve network performance by distributing the packets from source to multiple receivers by duplicating packets at routers along a multicast tree. Live video streaming, video conferencing, and on-line multiplayer games are examples of these applications. Management of these applications requires accurate and timely monitoring statistics of network resources. Researchers have proposed many new ideas for managing of these applications, but, these ideas often include nonstandard aspects that required change in current networks. It is difficult to incorporate these changes into IP networks since the devices in these networks do not allow changes to be made in their software systems.

Software Defined Networking (SDN) is introduced as a new technology that provides network operators more control of the network infrastructure by the following features: 1) Control and data planes are separated from each other. Therefore, network devices no longer have control functionalities. 2) Control plane is moved to an external entity called controller, and 3) data plane, is used to forward coming data based on pre-install flow in flow table. In SDN the controller and switch can communicate over the OpenFlow protocol (1). By taking the advantages of OpenFlow that enables controllers to query for statistics and inject packets into the network, we can monitor link and switch utilization and calculate available link bandwidth and switch capacity.

Recently, there have been several approaches for implementing multicast routing in SDN (6-7). They mostly show that using the advantage of the SDN can optimize and improve network performance comparing with IP Network. Most of these approaches consider, static link weight (8), link utilization as link weight only without assign weight of switch (7), or link and switch utilization as weights to link and switch (6). Almost, if we use the current link utilization as link weight

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

we can't to consider the different bandwidth assign to each link, "i.e., two links with different bandwidth size for example, 1000 Mbps and 10Mbps ,but both have same percentage of utilization 50%, this means that both have same weight". However, if we consider the available bandwidth of link in this case, the first link has 500Mbps and the second has 5Mbps .Therefor, it is unreasonable to assign same weight to both links. Moreover, assigning switch weight based in the current load of the switch gives same results "i.e., switches with different capacities, but have same percentage of load, will have same weights".

In contrast to other researches, in this paper, we havetook the advantage of the SDN architecture and built load balancing approach for multicast traffic over the network controller. Our application can track the topology of the network and collect on-time statistics over the network switches, and thus is able to calculate the available bandwidth between any two points in the network and available capacity over any switch. Then, we have modified Extending Dijkstra Algorithm for calculating shortest path multicast tree based on real-time available links bandwidth and available switches capacities in the network. By introducing the concept of *"available bandwidth"* of link and *"available capacity"* of switch, our approach can decide efficient weight that considers different links bandwidth and switches capacities and hence, this approach can maximize network resources utilization and avoid link and switch congestion.

The remainder of this paper, is structured as the following: In section 2, we have given a short background and discussed the existing multicast techniques used in SDN. In section 3, we have introduced our proposal method. Experimentally evaluation was discussed in section 4. Section 5, concludes this paper.

II. BACKGROUND AND RELATED WORK

Multimedia applications such as video streaming from one point to group of destinations requires a large amount of bandwidth consumption. In the last few years, the researcher proposed several approaches that take the advantage of the SDN to cover the limitation in IP network for solving the problem of load balance in multicast traffic. In this section firstly, we illustrate the SDN technology and its advantage. Secondly, we introduce related work to multicast traffic.

A. Motivation

Recently, many researches focused on studying Software Defend Networking after introduction of OpenFlow which is a clean slate project introduced by Stanford University (1). OpenFlow was implemented as the first open standard interface for SDN architecture. In SDN, the control and data planes are separated from each other. Network devices no longer have control functionalities, they become simple forwarding elements and the forwarding rules are made based on a center controller called SDN controller.

Fig. 1, shows the architecture of Openflow network. Basically, SDN architecture consists of three layers: the data plane, the control plane, and the applications. In addition, it also contains a set of APIs that enable network operators to manage network services, including routing, multicast, and traffic engineering. An OpenFlow Switch consists of one or more *flow tables* and a *group table*, which perform packet lookups and forwarding, and an OpenFlow channel to an external controller. The SDN controller provides the OpenFlow switches with the operational rules instructions, which is installed by the controller to the switch as individual flow entries in flow tables via a secured channel between them called *"OpenFlow protocol"*.

The switches search the flow table corresponding entries and if there is any rules match, it will forward the incoming packets according to the pre-specified actions in the entries. Two messages are used to install rules in OpenFlow switch. 1) packet-in, it is a message form switch to controller, when the incoming packet to the switch has not match any rule in the flow table, the switch will encapsulate the packet header into OpenFlow asynchronous message "*Packet_In*", and forwarded to the controller. 2) *Packet-out*, it is message from the controller to switch, after the controller receive packet-in message ,it uses the flexibility of software to do analysis and further do the path selection decision based on the routing algorithm, then install a flow entry to the switch together with associated action via *Packet_Out.*

By using these features introduced on SDN (a central programmable controller with global view of the network and open-flow switch), the network operators can implement their new ideas in order to optimize network utilization. Multicast routing in SDN work as unicast routing. The controller is responsible for managing multicast groups, and calculating effective multicast trees, while the switch forwards packet according to the multicast trees rules. In SDN the multicast packets can be forwarded to multiple ports by a single match in flow table.

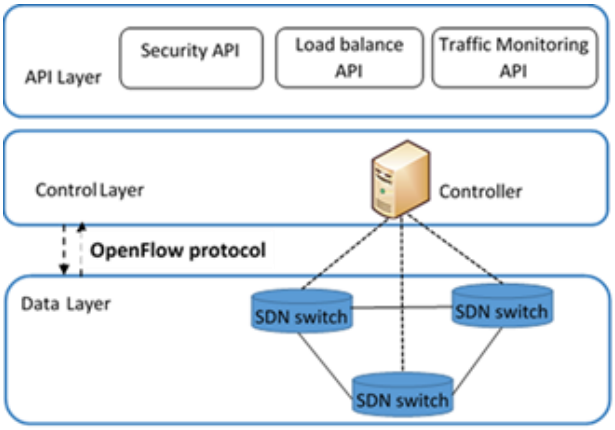


Figure 1. SDN Architecture

B. Related Works

In IP network, the multicast service usually requires the coordination of a set of protocols such as Protocol Independent Multicast Spare Mode (PIM-SM) and Multicast Open Shortest Path First (MOSPF) for calculating the multicast tree, and

Identify applicable sponsor/s here. *(sponsors)*

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Internet Group Management Protocol (IGMP) to management the multicast sections. When, any host wants to join existing multicast group, or initialize multicast section, the host sends IGMP messages to its multicast router. The router listens to IGMP messages, and periodically sends out queries to discover which groups are active. Then, routing protocol calculates the routing paths to construct a source-based tree or group-based tree for sending multicast packets.

So, why SDN? because there are limitations in IP Networks such as: Traditional routing protocols are implemented as distributed algorithms running on several network devices that communicate with each other to keep the routing information converged. This kind of communication causes processing delay. Furthermore, each device shares the information with neighbor's devices in order to implement multicast requirements, this means that routers can only calculate the next-hop network information without global network routing view. However, SDN controller obtains the ability to show the global view of network at the beginning of network construction. By updating topology information of global network, SDN controller can discover all paths in the network. By using this feature of global network view in SDN, the load condition of every global path or multicast tree can be evaluated.

In SDN architecture, many researches handling multicast traffic, but limited researches have been proposed load balance multicast traffic in SDN. In (2) the authors proposed a new multicast algorithm, called Avlanche Routing Algorithm (AvRA), the objective of this algorithm is to minimize the multicast tree created for each multicast section by tries to find the shortest path to the nearest node in current multicast tree. However, this algorithm is designed for special topologies used in data center network "FatTree". Moreover, it builds the tree based one the shortest number of hops and didn't assign any kinds of weights to links or edges.

The author in (3) proposed a Load balance for multicast traffic based in SDN, this paper used the feature of SDN to monitor real link state on-time and assign the weight of the link based on current utilization of the link. Then, the multicast tree was constructed using dijkstra algorithm. This paper shows that modification link-cost based on current link utilization is efficient way to propose load balance approach for multicast traffic. Our approach is similar to this paper, we have used the features of SDN for monitoring network statistics in order to propose load balance approach for multicast traffic for maximizing the network resources utilization. But, in our approach, we have introduced the concept of *"available link bandwidth"* and *"available switch capacity"* to calculate link weight and switch load respectively. On contrast of this method that uses the current utilization as link weight.

Multicast shortest path tree with minimizing the end-to-end delay have been proposed in (4). In this paper, the author calculated the multicast tree based on Dijkstra's the shortest path algorithm (5) that considered not only the edge weights, but also the node weights for a graph derived from the underlying SDN topology. This paper shows that extended Dijkstra algorithm is more efficient comparing with others two algorithms. This is because the extended Dijkstra's algorithm takes edge weights as transmission delays over edges and takes node weights as process delays over nodes, while the other algorithms consider only edge weights or no weights. However, this paper focused in optimizing end-to-end delay and calculated the weight of link and switch based on the current utilization of link and switch, respectively.

The main contributions of our paper are to present a load balance approach for multicast traffic in SDN in order to maximize utilization of network resources and avoid congestion in both link and switch. The goals of this study are:

- Providing load balance for multicast traffic over an SDN.
- Discussing how OpenFlow can efficiently be used for monitoring real-time network traffic.
- Introducing the concept of "Available link bandwidth" and "available switch capacity" to calculate link and switch weight respectively.
- Implementing extended Dijkstra Shortest Path Algorithm using our new weights for generation multicast tree.

III. Load Balance System for Multicast Traffic Design

In order to maximize the utilization of network resource and lighten the congestion of links and switches in SDN, our proposed architecture monitors on-time available capacity of each link and switch in the network at a periodically time set by the administrator. Then, our controller using Dijistra shortest path immediately calculates the best load condition of multicast tree when receiving any request for multicast session. Our proposed architecture is built based on POX controller, the component of this architecture are shown in Fig. 2. In the following, we will discuss the possibilities that OpenFlow introduces for implementing load balance for multicast traffic and present in details the modules of our method namely, Topology discover module, load monitoring module and multicast tree construction module.

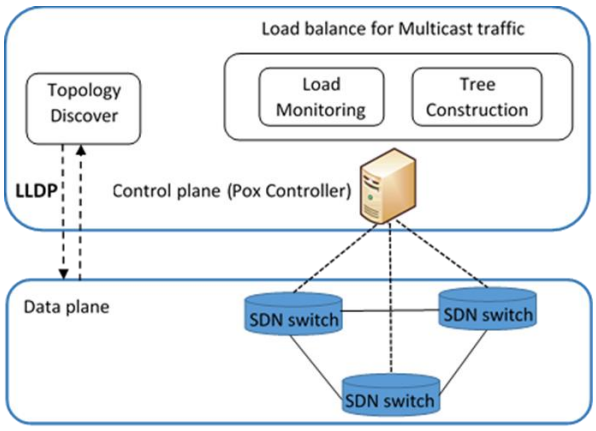


Figure 2. Proposed Architecture

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

A. Topology discover module

This module uses Link Layer Discovery Protocol (LLDP) to discover network topology. Most existing OpenFlow controllers support this protocol. By using the information resulting from this module, we can build up the network topology graph G (V, E), where the node set V corresponds to the switches and the edge set E corresponds to the links. Then, we can send the data relative to the topology graph G to tree construction module to build up the multicast tree.

B. Load Monitoring Module

In this module, we will use the advantages of OpenFlow protocol to query port statistics from every OpenFlow switch via OFPT_STATS_REQUESTS message. We periodically query all the switches inside the network and the links between them. Then, our application uses this information to measure the available capacity of each link and switch in the network. By, measuring the available capacity we can assign link weight and switch weight as in equation (3) and equation (6) respectively.

1) *Available Bandwidth of link*:

We first measure the available bandwidth (*AB*) for each link in the network, then we use *AB* to decide link weight as in equation (3) .To calculate *AB*, first we measure the current bandwidth utilization (BU_i) of every link *i* in the network topology. If we assume that B_t represents the transmitted bytes at link *i* at time *t* and the interval time used for this measurement is T, this means that previous measurement was at time $(t\text{-}T)$ is $B_{t\text{-}T}$. Then, the current bandwidth utilization (BU_i) of link i is calculated according to equation (1)

$$BU_i = \frac{B_t - B_{t-T}}{T} \quad (1)$$

The available bandwidth (AB_i) can be calculated by equation (2), where B_i is the capacity of link *i*

$$AB_i = B_i - BU_i \quad (2)$$

The link weighted is calculated using equation (3), where MAX_B is the maximum bandwidth capacity over the network.

$$LW_i = 1 \Big/ \frac{AB_i}{MAX_B} \quad (3)$$

2) *Available capacity of switch:*:

Also, to calculate the switch weight, we first measure the current switch utilization (SU_i) *for every switch i in the network* according to the following equation.

$$SU_i = \sum_{j=1\ to\ n} PU_j \quad (4)$$

Where PU_j represents the utilization of port j in interval time, T and n represent the total number of ports in switch i. then, we can calculate the *available switch capacity* ASC_i using equation (5). Where, SC_i is the capacity of switch *i.*

$$ASC_i = SC_i - SU_i \quad (5)$$

Then, we can calculate switch weight using equation (6). Where, MAX_c is the maximum capacity of any switch in the network.

$$SU_i = \sum_{j=1\ to\ n} PU_j \quad (4)$$

C. Multicast Tree Construction Module

In this module we use Extended Dijkstra Shortest Path Algorithm (4) to derive multicast tree using the link weight calculated in equation (3) and switch weight calculated in equation (6). In the original Dijkstra's algorithm, nodes are associated with no weight, but the Extended Dijkstra shortest path algorithm considers both the edge weights and the node weights for end-to-end routing. For a weighted, directed graph G= (V, E), a single source node (s) and a set of destination node (D), the Dijkstra's algorithm can return a multicast tree with shortest path on the tree from source to every destination. Paper (6) shows how extended Dijkstra algorithm can be used for deriving multicast tree. The steps of our load balance for multicast traffic are shown in Fig. 3.

Steps of our proposed method	
1:	Using Topolgy Discover module drive Graph G= (V, E)
2:	Set the periodically time for monitoring links and switches statistics.
3:	Using Load Monitoring module Calculate link weight using equation (3)
4:	Using Load Monitoring module Calculate switch weight using equation (6)
5:	For each source node S and destination group D Use Dijikstra algorithm to calculate multicast tree
6:	Install flows to OpenFlow switches

Figure 3. Steps of load balance for multicast traffic

IV. EXPERIMENTAL RESULTS

In this section, we test our method compare to shortest path tree proposed in (6), without considering any weights for link or switch. Our method is implemented as OpenFlow controller modules, we use POX controller (9) and Mininet (10) to emulate the network. We used random connected topology generated using the waxman generator provided by BRITE.

We assume that all link in the network have link capacity between 10Mb/s and 20Mb/s. the topology of 20 switch and 60 link is greeted. With each switch we suppose there are only one host is connected. We use 720p video in variable bit-rate MPEG4 format for multicast session using (*VLC application*). A machine with core i3 processor and 8G or Ram used for this

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

emulation. We tested network overhead resulting of both method. Our result are shown in the following figures.

In Fig. 4 and 5 we run number of multicast session, the number of groups: 2, 4, 6, 8 and 10, with fixed group size of 6 receivers. Fig. 1 shows the maximum bandwidth utilization over the network with different group's number, we see that our load balancing approach is better than the other approach and can avoid the congestion over the network links. Also, in Fig. 5, shows the maximum switch load over the network. We see that the result of our approach is better the other approach.

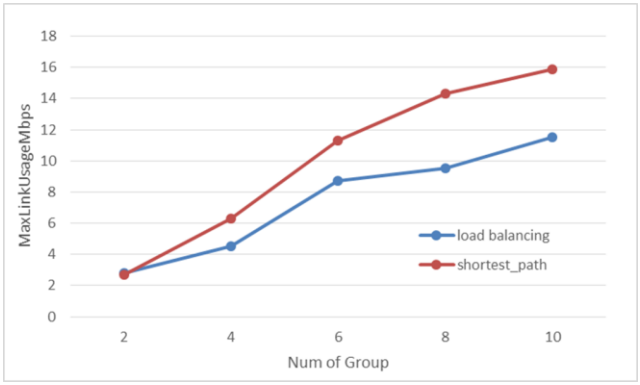


Figure 4. The max link utilization over the network Mbps

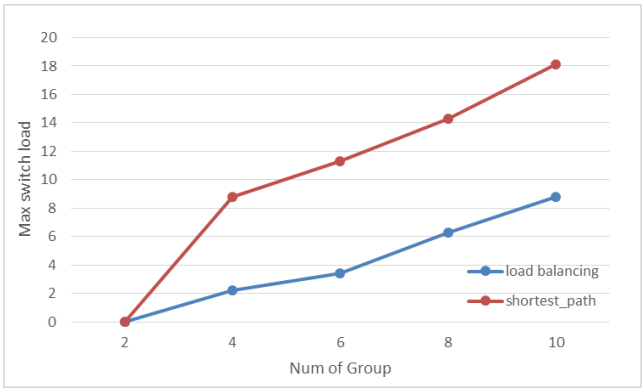


Figure 5. The max switch load over the network Mbps

The average switch load is shown in Fig. 6. It shows that our proposed approach can maintain the average switch load at a value better than the shortest path tree method.

The total numbers of flows installed over the network are shown in Fig. 7. We see that shortest path tree algorithm is better than our approach, because the shortest path algorithm considers the shortest path from source to every destination on the multicast tree, but our approach calculates the path with minimum links throughput and switch load, therefore, this path almost longer than the shortest path.

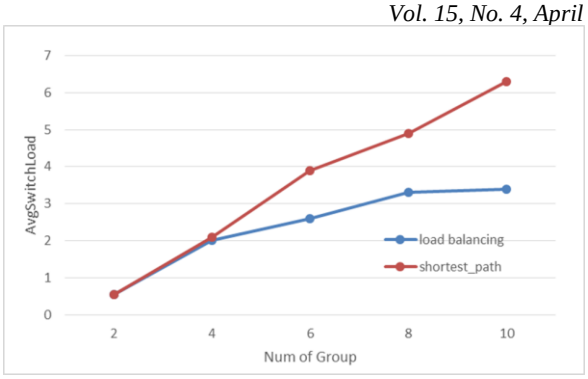


Figure 6. The average switch load

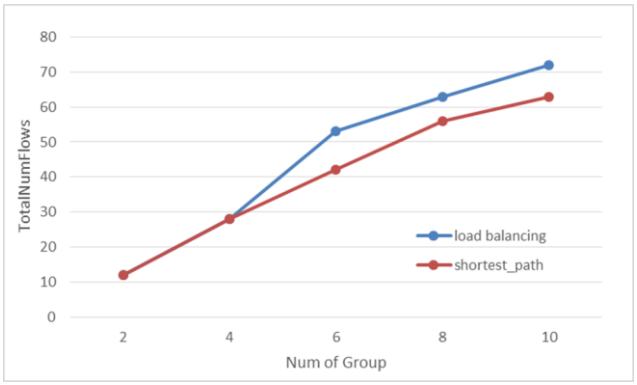


Figure 7. The maximum number of installed flow over the network

CONCLUSION

In this paper we present a load balance approach for multicast traffic in SDN. We calculate the routing based on calculating on-time link weigh and switch weight. We introduce in this work the concept of *"available link bandwidth"* and *"available switch capacity"* to calculate both link weight and switch weight respectively. By using available link bandwidth and available switch capacity we can cover the limitation resulting from using links with different bandwidth and switches with different capacities.

We evaluate our approach using Mininet network emulation with POX controller. Our evaluation indicates that real-time calculation of available link utilization and available switch capacity is effective in reducing link and switch congestion of multicast traffic.

REFERENCES

[1] M, Nick, "OpenFlow: Enabling Innovation in Campus Networks," ACM SIGCOMM Computer Communication, 2008.

[2] A. Iyer, P. Kumar, V. Mann, "Avalanche: Data center Multicast using Soft-ware Defined Networking", IEEE Communication Systems and Networks (COMSNETS), Sixth International Conference, 2014

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

[3] A. Craig, B. Nandy, I. Lambadaris, and P. Ashwood-Smith. "Load Balancing for Multicast Traffic in SDN using Real-Time Link Cost Modification" ICC, IEEE, 2015, page 5789-5795.

[4] J. Jiang, H. Huang, J. Liao, and S. Chen, "Extending Dijkstra's Shortest Path Algorithm for Software Defined Networking," Technical Report, National Central University, 2014.

[5] E. Dijkstra, "A note on two problems in connexion with graphs," Numerische mathematik, vol. 1, no.1, 1959, pp. 269-271.

[6] J. Jiang, W. Yahya, and M. Ananta. "Load Balancing and Multicasting Using the Extended Dijkstra's Algorithm in Software Defined Networking" ADFA, Springer-Verlag Berlin Heidelberg 2011.

[7] C. A. C. Marcondes ; T. P. C. Santos ; A. P. Godoy ; C. C. Viel ; C. A. C. Teixeira. "CastFlow: Clean-slate multicast approach using in-advance path processing in programmable networks" Computers and Communications (ISCC), July 2012 IEEE Symposium on.

[8] L. Bondan, L. F. Muller, M. Kist. "Multiflow: Multicast clean-slate with anticipated route calculation on OpenFlow programmable networks" Journal of Applied Computing Research, 2(2):68-74 July-December 2012

[9] NOX and POX SDN Controllers. retrieved: Sept.,2015.

[10] Mininet, An Instant Virtual Network on your Laptop (or other PC), http://mininet.org/, last accessed on June 2014.

AUTHORS PROFILE

Alaa Allakany received M.S. Degree in Computer Science Department, Faculty of Science from South Valley University, Egypt. And received B.S. in Faculty of science form South Valley University, Egypt. He is a Second year Ph.D. student and belongs to the department of Advanced Information Technology, Graduate school of Information Science and Electrical Engineering, Kyushu University, Japan.

Koji Okamura is a professor at Department of Advanced Information Technology and also at Computer Center, Kyushu University, Japan. He received B.S. and M.S. Degree in Computer Science and Communication Engineering and Ph.D. in Graduate School of Information Science and Electrical Engineering from Kyushu University, Japan in 1988, 1990, and 1998, respectively. He has been a researcher of MITSUBISHI Electronics Corporation, Japan for several years and has been a Research Associate at the Graduate School of Information Science, Nara institute of Science and Technology, Japan and Computer Center, Kobe University, Japan. He is Interested in Internet and Next Generation Internet, Multimedia Communication and Processing, Multicast/IPv6/Qos, Human Communication over Inherent and active Networks. He is a member of WIDE, ITRC, GENKAI, HIJK projects and Key person of Core University Program on Next Generation Internet between Japan and Korea sponsored by JSPS/KOSEF.

DOG oriented Structure Tensor based Active Contours

Brijesh N Shah
Department of Electronics and Communication Engineering, C S Patel Institute of Technology, Charotar University of Science and Technology, Changa, 388421, Gujarat, India
Brijeshshah.ec@charusat.ac.in

Jaymin K Bhalani
Department of Electronics and Communication Engineering, Babaria Institute of Technology, Varnama, Vadodara, Gujarat, India
Jaymin188@gmail.com

Abstract— This paper proposes a modified chan-vese model which can be implemented on texture image for segmentation. It can be done using linear structure tensor (LST). Structure tensor is a matrix representation of partial derivative information. The proposed model considers the real image as data channel (information channel) in figuring structure tensor. DOG is basically featuring enhancement in which we can get less blurred image of the original image. In this paper LST is modified by adding intensity information to enhance orientation information. Finally ACM is used to segment images. The proposed algorithm is tested in images having intensity inhomogeneity and corresponding results are presented.

Keywords-Structuer tensor, Image segmentation, Active contour, Difference of Gaussian(DOG).

I. INTRODUCTION

Image segmentation is very critical step from the point of view image processing as we get our region of interest from the given image[6] .In this paper we are using active contour model(ACM).ACM is well known for image segmentation[1],[5]. Generally in ACM, the steady state is achieved by making some rule starting with initial contour [11]. This way it can reach to the correct object boundary [2]. In various published papers ACM differs with selection of initial contour, various mechanisms and also when to stop contour for further evolution [8].

For compact representation of texture Linear Structure Tensor (LST) can be used [3], [4]. Structure tensor can be computed from spatial derivatives of the image.

II. LITREATUER SURVEY

2.1 LST

For a texture descriptor Covariance matrix based LST can be utilized. The main advantage of LST is that its calculation is relatively simple .So, it is often used for applications like corner detection or texture segmentation. For a gray scale image the matrix field of structure tensor [4], [14] is given by

$$J_0 = \nabla h \nabla h^T = \begin{bmatrix} h_x^2 & h_x h_y \\ h_x h_y & h_y^2 \end{bmatrix} \qquad (1)$$

$$\text{where } \nabla h = \begin{bmatrix} \frac{\partial h}{\partial x} & \frac{\partial h}{\partial y} \end{bmatrix}^T, h_x = \frac{\partial h}{\partial x}, h_y = \frac{\partial h}{\partial y}$$

and T = Matrix transpose

For avoiding cancellation of opposite signed gradient, when direct integration is performed, gradient is considered as form of its outer product. In order to make matrix field more immune to noise, smoothing operation is performed by convolving matrix component with a Gaussian kernel K_σ with standard deviation σ

$$J_\rho = K_\rho * \left(\nabla h \nabla h^T \right) \qquad (2)$$

Where, * indicate convolution operator.

An LST model can be used for segmentation of texture images. The texture type of images which have intensity inhomogeneity cannot be segmented by this model .Therefore this paper suggest the solution of this problem with a combination of filter based tensor values to LST.

2.2 Chan-Vese Model

The Chan-Vese(CV) model can overcome the difficulties of Mumford-Shah[10],[12] in minimization of energy function .

The Mumford Shah energy function can be described as follow:

$$E^{MS}(u,C) = \int_\Omega |u_0(x,y) - u(x,y)|^2 dxdy + \mu \int_{\Omega \setminus C} |\nabla u(x,y)|^2 dxdy + v.\text{Length(C)} \qquad (3)$$

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Here, μ and ν are constant (always positive), the image domain is denoted by Ω, the segmenting curve $C \subset \Omega$.
The chan-vese model can give solution to equation (3) by minimizing following energy function

$$E^{CV}(c_1, c_2, C) = \mu.Length(C) + \lambda_1 \cdot \int_{inside(C)} |u_0(x,y) - c_1|^2 + \lambda_2 \cdot \int_{outside(C)} |u_0(x,y) - c_2|^2 \, dxdy \quad (4)$$

Here, μ, λ_1 and λ_2 are constant, generally $\lambda_1 = \lambda_2 = 1$. c_1 and c_2 are the intensity means of μ_0 inside C and outside C.
In order to solve energy minimization problem, level set methods is used , in which level set function ϕ(x,y) is used in place of unknown curve[9],[15]. So, equation (4) can be re-described as follow

$$E_\varepsilon^{CV}(c_1, c_2, \phi) = \mu \cdot \int_\Omega \delta_\varepsilon(\phi(x,y)) |\nabla \phi(x,y)| dxdy + \lambda_1 \cdot \int_\Omega |u_0(x,y) - c_1|^2 H_\varepsilon(\phi(x,y)) dxdy + \lambda_1 \cdot \int_\Omega |u_0(x,y) - c_2|^2 (1 - H_\varepsilon(\phi(x,y))) dxdy \quad (5)$$

Where $H_\varepsilon(z)$ and $\delta_\varepsilon(z)$ the approximation of Heaviside functions of $H(z)$ and Dirac delta function $\delta(z)$ as follow,

$$H(z) = \begin{cases} 1 \text{ if } z \geq 0, \\ 0 \text{ if } z < 0, \end{cases} \quad \delta(z) = \frac{d}{d_z} H(z) \quad (6)$$

The problem of minimization can be solved by taking Euler-Lagrange equation and also by updating level set function ϕ(x,y) by gradient descent method[7];

$$\frac{\partial \phi}{\partial t} = \delta_\varepsilon(\phi) \left[\mu \, div\left(\frac{\nabla \phi}{|\nabla \phi|} \right) - \lambda_1 (u_0 - c_1)^2 + \lambda_2 (u_0 - c_2)^2 \right], \quad (7)$$

Here, c_1 and c_2 updates at each iteration by

$$c_1(\phi) = \frac{\int_\Omega u_0(x,y) H_\varepsilon(\phi(x,y)) dxdy}{\int_\Omega H_\varepsilon(\phi(x,y)) dxdy}, \quad c_2(\phi) = \frac{\int_\Omega u_0(x,y)(1 - H_\varepsilon(\phi(x,y))) dxdy}{\int_\Omega (1 - H_\varepsilon(\phi(x,y))) dxdy} \quad (8)$$

This model provides certain advantages, firstly objects boundary which cannot be defined by gradient can be dealt and secondly noise is less [13].
If we look at the disadvantages then are it cannot segment the image which has intensity inhomogeneity. Also, it is a time consuming process.

III. Proposed Method

In the proposed method we are using Difference of Gaussians (DOG). The DOG can be explained as below.

DOG is basically featuring enhancement in which we can get less obscured (blurred) image from the real image. Blurring using Gaussian kernel repress only high frequency spatial data. DOG is a BPF (band pass filter) that repress all spatial frequency except handful of spatial frequencies that are falls in real gray scale image. The principle advantage DOG offers is that it can provide better edge visibility. One more advantage that DOG provides is the removal of noise compare to other algorithms. Also, it is very fast as far as computational complexity is concerned.

The overall algorithm as follows:

- Determine DOG Kernal: To determine the kernel, the variance plays the important role. If ratio between two of kernel is large, image blurring would be more. Therefore in proposed model, the size of image is used to calculate the kernel variance.

$$DOG = G_{\sigma_1} - G_{\sigma 2} \quad (9)$$

$$DOG = \frac{1}{\sqrt{2\Pi}} \left(\frac{1}{\sigma_1} e^{-(x^2+y^2)/2\sigma_1^2} - \frac{1}{\sigma_2} e^{-(x^2+y^2)/2\sigma_2^2} \right)$$

Calculate Edges using DOG: DOG Kernels are used to calculate the edges of the image by convolving image with DOG kernels.

$$[I_x, I_y] = K\sigma_j \otimes I \quad (10)$$

- Calculate local structure tensor: Medical images can be considered as region of similar texture**.** Therefore to present its orientation, Structure tensor plays an important role. The structure tensor can be obtained by calculating image edges. In the proposed model, the edge obtained using DOG are used in the calculation of Linear Structure Tensor.

$$\frac{\partial \phi}{\partial t} = \delta_\varepsilon(\phi) \left[\mu \, div\left(\frac{\nabla \phi}{|\nabla \phi|} \right) - \lambda_1 (u_0 - c_1)^2 + \lambda_2 (u_0 - c_2)^2 \right], \quad (11)$$

- Apply Active Contour model over LST image: Later the LST based orientation information is used as an external force in ACM model. The equation (7) can be rewritten using LST as below.

$$\frac{\partial \phi}{\partial t} = \delta_\varepsilon(\phi) \left[\mu \, div\left(\frac{\nabla \phi}{|\nabla \phi|} \right) - \lambda_1 (LST - c_1)^2 + \lambda_2 (LST - c_2)^2 \right], \quad (12)$$

IV. Results

The proposed algorithms validation is found by applying the algorithm on standard image datasets obtained from Berkeley. The original images are shown in upper row (i.e. Fig. (a) to (c)).The obtained segmentation results are presented in lower row (i.e. Fig. (d) to (f)). In proposed method output

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

from local structure tensor is given to input of the active contour and finally we can get the segmented image.

V. CONCLUSIONS

This paper proposed structure tensor using DOG kernel .The orientation information obtained from Linear Structure Tensor is used in active contour model to obtain segmentation. It can be seen from the results obtained that the proposed model works effectively for images having inhomogeneity in their intensity. Future work is required to apply the proposed method on more medical image dataset to provide comparative analysis.

VI. REFERENCES

[1] M. Kass, A. Witkin, D. Terzopoulos, Snakes: active contour models, Int. J. Comput. Vision 1 (4) (1987) 321–331.

[2] Xiao-Feng Wang De-Shuang Huang Huan Xu," An efficient local Chan–Vese model for image segmentation, Pattern Recognition,No.43(2010),603-618

[3] Hiren Mewada & Suparva Patniak ," Local Phase Oriented Structure Tensor To Segment Texture Images With Intensity Inhomogeneity", International journal of Image Processing,Vol.7,Issue3,2013

[4] T. Brox, J. Weickert, B. Burgeth, and P. MrAazek. "Nonlinear structure tensors. Image and Vision Computing", Vol. 24 (1), pp.41-55, 2006.

[5] C. Li, C. Kao, J. Gore, and Z. Ding. "Implicit active contour driven by local binary fitting energy". IEEE Conf on Computer Vision and Pattern Recognition, 2007, pp. 1-7.

[6] G.S. Linda, C.S. George, Computer Vision, Prentice-Hall, New Jersey, 2001.

[7] A. Gelas, O. Bernard, D. Friboulet, R. Prost, Compactly supported radial basis functions based collocation method for level-set evolution in image segmentation, IEEE Trans. Image Process. 16 (7) (2007) 1873–1887.

[8] V. Caselles, F. Catte, T. Coll, F. Dibos, A geometric model for active contours in image processing, Numer. Math. 66 (1) (1993) 1–31.

[9] S. Osher, J.A. Sethian, Fronts propagating with curvature-dependent speed: algorithms based on Hamilton–Jacobi formulations, J. Comput. Phys. 79 (1) (1988) 12–49.

[10] D. Mumford, J. Shah, Optimal approximation by piecewise smooth functions and associated variational problems, Commun. Pure Appl. Math. 42 (1989) 577–685.

[11] T.F. Chan, L.A. Vese, Active contours without edges, IEEE Trans. Image Process. 10 (2) (2001) 266–277

[12] A. Tsai, A. Yezzi, A.S. Willsky, Curve evolution implementation of the Mumford–Shah functional for image segmentation, de-noising, interpolation, and magnification, IEEE Trans. Image Process. 10 (8) (2001) 1169–1186.

[13] B. Sandberg, T. Chan, and L. Vese. "A level-set and Gabor-based active contour algorithm for segmenting textured images". Technical Report 39, Mathematical Department, UCLA, Los Angeles, 2002.

[14] T. Brox. "From pixels to regions: Partial differential equations in image analysis", PhD Thesis, Mathematical Image Analysis Group, Department of Mathematics and Computer Science Saarland University, Germany, 2005.

[15] D.E. Maroulis, M.A. Savelonas, D.K. Iakovidis, S.A. Karkanis, N. Dimitropoulos, Variable background active contour model for computer-aided delineation of nodules in thyroid ultrasound images, IEEE Trans. Inf. Technol. Biomed. 11 (5) (2007) 537–543.

[16] Berkely image database https://www2.eecs.**berkeley**.edu/Research/Projects/CS/vision/bsds/

AUTHORS PROFILE

Brijesh N Shah has received the B.E. degree in Electronics & Communication Engg. from Saurashtra University, M.E. degree in Electronics & Communication Engg. from Dharmsinh Desai University in 2002 and 2004 respectively. He is currently working in E & C Engg. C S Patel Institute of Technology, CHARUSAT, Changa. He has more than 13 years of teaching experience. His area of interest is Image/Signal Processing.

Jaymin K Bhalani has received the B.E. degree in Electronics & Communication Engg. from South Gujarat University, M.E. degree in Communication System Engg. from Gujarat University and Ph.D. from The M S University of Baroda, Vadodara in 2000, 2003 and 2013 respectively. He is currently working as a Professor in E & C Engg. Dept., Babaria Institute of Technology, Varnama. He has more than 15 years of teaching experience. His area of interest is Wireless Communication Systems, Image/Signal Processing and VLSI Technology .

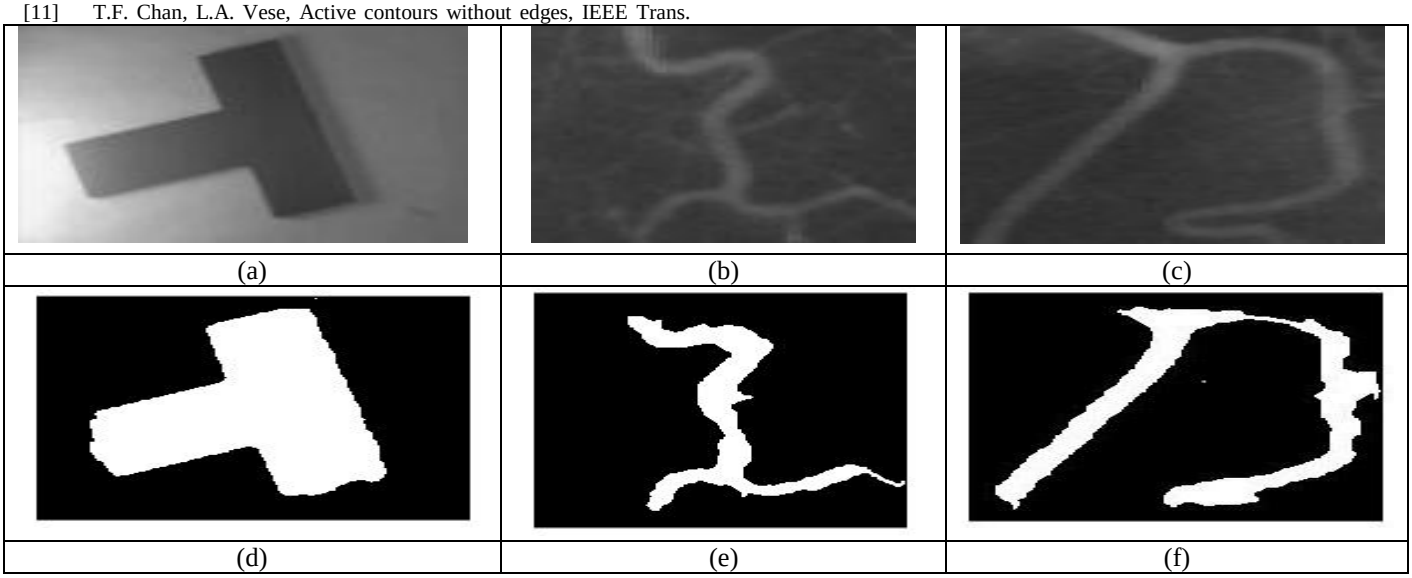


Figure (a) to (c): Original images Figure (d) to (f): Segmented images
(Image courtesy: Berkeley data base [16])

Mining Details from Single Opinion

Alaa Omran Almagrabi

Faculty of Computing and Information Technology at Rabigh, King Abdul Aziz University (KAU), Jeddah, Kingdom of Saudi Arabia
Email: aalmagrabi3@kau.edu.sa

Abstract: In the contemporary times, different companies summarize product reviews to improve the quality of their products. Not only the companies benefit from these reviews, but these reviews also influence to a great extent the decision of the buyer. Currently a lot of research is being conducted on the opinion summaries the companies use, while the end user/buyer still has to go through whole of the opinions/reviews in order to make their decision, whether to buy a product or not. A single sentence cannot cover all the possible feature/qualities of a product. And, sometimes a single opinion may not be self-explanatory. In the proposed work, the authors have given a model that can generate different 'signifieds' for a single opinion. Using the definitions and examples of WordNet Dictionary, the signifieds of 80% of the opinions have been generated. The generated signifieds are not only useful for the buyer, but the person writing their opinion can also select any of these signifieds to make their point as accurately and clearly as possible.

Introduction

Objective opinions show factual information while the subjective ones are users' personal opinions [1]; so these can be considered for further processing because there may be sentiment in subjective opinion. Users express their views either in implicit way or explicit way: explicit opinions can be detected easily, while the implicit opinions are very hard to detect [2][3]. For entity extraction [5][6] have used a method distribution similarity by comparing the similarity of the surround words of each candidate entity with those of the seed entities; and then ranking the candidate entities based on the similarity values. Topic modeling has also been used for entity extraction. Topic modeling is an unsupervised learning method that assumes each document consists of a mixture of topics and each topic is a probability distribution over words [1]. Latent Dirichlet Analysis LDA and Probabilistic Latent Semantic Analysis (PLSA) have been used for detection of topic from a document/documents [7][8][9]. To search a required document from a huge amount of published articles is very time consuming and laborious work, topic modeling offers a computational tool to find relevant topics by capturing meaningful structure among the collections of documents [10]. To obtain fine grained sentiment analysis, researchers have done work on aspects. Now product has been categorized with respect to entity; now each entity's aspects will be categorized. Method defined by [11] used extracted nouns based on the frequency and information distance as aspects. Noun phrase that has sentiment bearing

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

sentences can be considered as aspects [12]. Logic Programming, particularly Answer Set Programming (ASP), has been used to elegantly and efficiently implement the key components of syntax based aspect extraction. Logic Programming provides a convenient and effective tool to encode and thus test knowledge needed to improve the aspect extraction methods, so that the researchers can focus on the identification and discovery of new knowledge to improve aspect extraction [13]. A supervised learning algorithm has been used to extract aspects from an opinion of the product. The projected system implements aspect extraction using frequent item set at phrase level [14]. After the extraction of aspects, sentiment analysis can be done. Sentiment analysis means either opinion is positive or negative. This sentiment analysis can be done on all the opinions of all the products of a company; or on a particular product (entity extraction) [15][16]; or on a particular feature (aspect extraction) of a product [17] [18] [19][20]. To improve the precision and accuracy of each of the above mentioned techniques for sentiment analysis, researchers have also done work on the detection of spam opinion [21][22][23]; aspects grouping (different words belonging to same aspects) [25]; and co-reference resolution [24]. Analysis of opinions in shape of summary is useful for business decision making and recommendations systems [26]. The process of summarizing opinions by finding contrastive viewpoints [27], they wanted to produce contrastive summaries of opinions about two different products to highlight the differences of opinions about them. Authors of [28] Uses unsupervised approach to explore multiple viewpoints in text, their experimental results generate informative summaries.

Summaries of large data of opinions or Star Ratings actually show the performance of the product. It is actually the users who do these ratings. It is done by converting the Huge Text into the Small Text, while its reverse is equally useful and effective i.e. the conversion of Small Text into the Huge Text. The end users mostly read only the reviews about a product. Not everyone is able to convey their sense in a single line. Similarly, it is time consuming to write a huge detail about a thing. It is also the case that the exact words do not come to mind at a particular point. The proposed model attempts to overcome the problems of the sort. Whatever the kind of opinion the end user writes, the proposed model would suggest/display a list of generated signifieds about that opinion. The end user can select from that list the signifieds most accurate and relevant to their opinion. Then these signifieds will be stored in the form of a summary, and would link to the relevant opinion. It is useful in the sense that whosoever wants to understand that particular opinion or wants to know the details about that opinion, can do that by just clicking that opinion; or can simply ignore that option. The proposed model can be used effectively to make the opinions clearer, concrete and more easily understandable. This model would be equally useful for the person reading an opinion, and for the one writing it. It can be very helpful in making decisions about a product.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

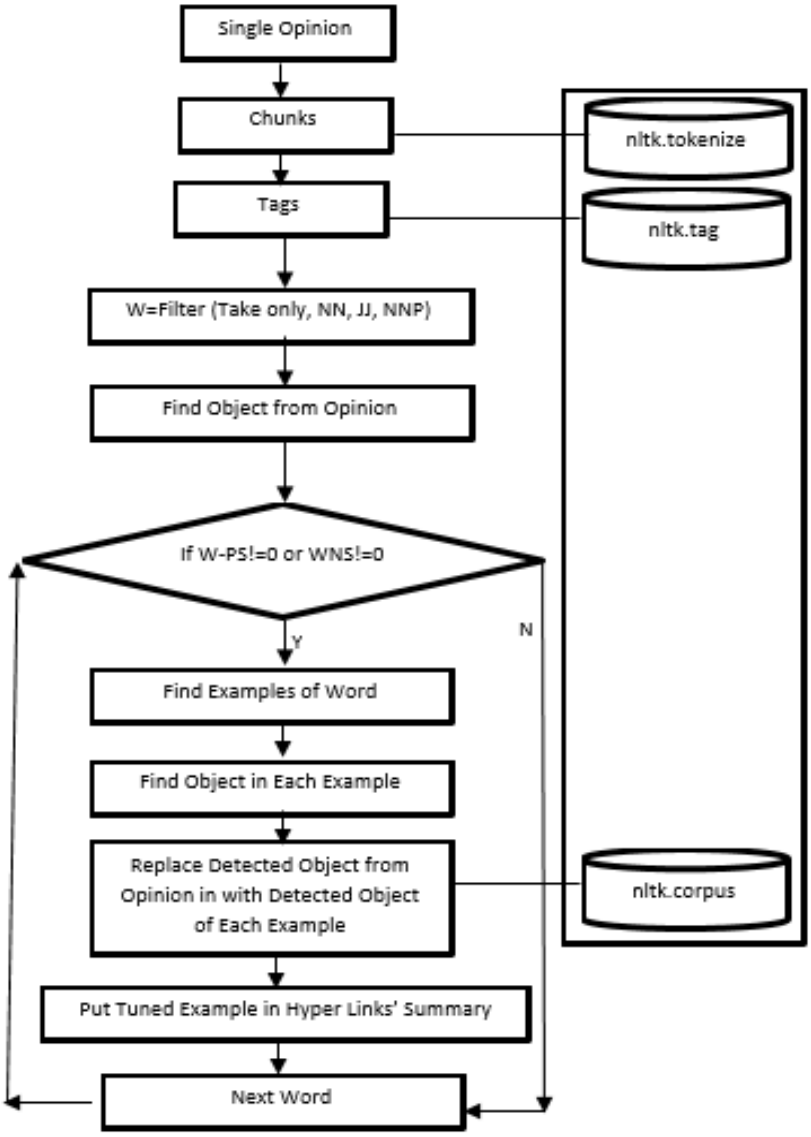


Fig-1: Flow Chart of Proposed Work

Methodology

In order to derive different senses/meanings out of a single opinion, it is necessary to take into consideration the bases on which the machine makes the decision of deriving those meanings. For this purpose, then, it seems reasonable to focus in an opinion those main words which signify or qualify an object as 'good' or 'bad.' The commonsense also demands the use of those main words into different sentences, in order to achieve accurate results. So those words need to be separated from the opinions. Usually, the adjectives (JJ or JJS) show the orientation of a sentence. For this, first we need to find adjectives in a sentence. For example, "It is the best phone at midrense", in this sentence, the word "best" is JJS from nitk.tag. While in some cases it is also observed that the word "best" is used as NNP. For instance, "J7 is the best smartphone.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Superbbbbb…", in this example, the word "best" is NNP from nltk.tag. Therefore, NN or NNP are needed to be taken alongside JJ. Now the problem is that NN or NNP do not show the orientation of a sentence. As in, "J7 is the best smartphone. Superbbbbb…," J7 is NNP from nltk.tag. But it is also evident that it is not able to give any orientation about the sentence, it is only an object. Moreover, in order to resolve this issue, the authors have included it in the methodology that, those words are taken which are not neutral. It means that their positive or negative score should not be zero. They should either have a positivity or a negativity.

The next step is to find different possible meanings, senses or aspects of those words. WordNet of nltk.corpus contains definitions, examples, lexemes of each word. Next we need to determine different interpretations of each word. These meanings or interpretations would have their own respective contexts. In order to relate these interpretations with the opinion (which we mean to find the signifieds of), we shall extract the object (the thing talked about) out of the given opinion. This object will then be used to replace the other object within the given interpretations/examples. So far these signifieds remain non-intelligent. It is likely that they happen to convey a sense slightly removed from the one originally intended in a given opinion. We shall, by means of different experiments, show in the conclusion section that how far these signifieds are able to satisfy an original statement. Extracting a lot of text from a single opinion may seem awkward, but sometimes one is obliged to do that in order to understand all the possible aspects of an otherwise single line.

It is fair enough that the machine would get you a lot of text. But the point lies in how to display that. Signifieds of each opinion would be hidden. Whenever required, all the identifiers would be displayed with a single click. For this purpose, html file has been kept in the display container. From within that container, signifieds of each opinion will be automatically filtered, and links will also be created for each opinion. The authors have used 'webbrowser' package for this purpose. The complete functioning of the process has been illustrated in the following table:

Table-1: Working of Proposed Model

Given Opinion	PX2 has high battery
Object from give Opinion	Object of this opinion is 'Battery'
Tagging	[('PX2', 'NNP'), ('has', 'VBZ'), ('high', 'JJ'), ('battery', 'NN')]
NNP,NN,JJ with Positive (PS) and Negative (NS) Scores	PX2 PS: 0.0 NS: 0.0 High PS: 0.125 NS: 0.0 Battery PS: 0.0 NS: 0.0
Only those Words which have non zero PS or NS	High PS: 0.125
Find all examples of this extracted word, then find object from each example	Extracted Example: a lofty level or position or degree Replace level with PX2 Tuned Example: a lofty PX2 or position or degree ----------

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

and replace it with the object of Given Opinion.	Extracted Example: an air mass of higher than normal pressure Replace air with PX2 Tuned Example: an PX2 mass of higher than normal pressure ---------- Extracted Example: a state of sustained elation Replace state with PX2 Tuned Example: a PX2 of sustained elation ---------- Extracted Example: a state of altered consciousness induced by alcohol or narcotics Replace state with PX2 Tuned Example: a PX2 of altered consciousness induced by alcohol or narcotics ---------- Extracted Example: a high place Replace place with PX2 Tuned Example: a high PX2 ---------- Extracted Example: a public secondary school usually including grades 9 through 12 Replace school with PX2 Tuned Example: a public secondary PX2 usually including grades 9 through 12 ---------- Extracted Example: a forward gear with a gear ratio that gives the greatest vehicle velocity for a given engine speed Replace forward with PX2 Tuned Example: a PX2 gear with a gear ratio that gives the greatest vehicle velocity for a given engine speed ---------- Extracted Example: greater than normal in degree or intensity or amount Replace degree with PX2 Tuned Example: greater than normal in PX2 or intensity or amount ---------- Extracted Example: used of sounds and voices; high in pitch or frequency Replace sounds with PX2 Tuned Example: used of PX2 and voices; high in pitch or frequency ---------- Extracted Example: at a great altitude Replace altitude with PX2 Tuned Example: at a great PX2 ----------

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

	Extracted Example: in or to a high position, amount, or degree Replace position with PX2 Tuned Example: in or to a high PX2, amount, or degree ---------- Extracted Example: in a rich manner Replace manner with PX2 Tuned Example: in a rich PX2 ---------- Extracted Example: far up toward the source Replace source with PX2 Tuned Example: far up toward the PX2 ----------

In the above given example, "PX2 has high battery," our algorithm detected 'PX2' as the object; while the word 'high' was detected as JJ; and 'battery' as NN. The word 'battery' was skipped because it was a neutral expression, with both its positive and negative scores being zero. On the other hand the score of the word 'high' was found as non-zero. Our algorithm found 13 examples or uses of the word 'high.' Then the object in each of the examples was detected, and was used to replace the object in the given opinion i.e. 'PX2.' Whole of this summary was stored in an html file. And it was linked to the given opinion. Now whosoever wants, can see different possible signifieds/meanings/senses of the opinion by simply clicking on the opinion. In this way each opinion will be linked with its respective set of signifieds.

Table-2: Algorithm of Proposed Model

Input Module

```
docs=[]
d1="Battery life of PX2 is high"
d2="PX2 has beautiful shape"
docs.append(d1)
docs.append(d2)
noun=""
tunedAll=[]
```

Find Object and Definition of JJ and NN with NON-Zero +ve or -ve Scores

```
for d in docs:
  docToken=(word_tokenize(d))
   textTag=pos_tag(docToken)
   noun="",  examples="",  defi=[]
    for t in textTag:
        if (t[1]=='NNP' or t[1]=='NN' or t[1]=='NNPS' or t[1]=='NNS'):
           noun=t[0]
        if (t[1]=='NNP' or t[1]=='NN' or t[1]=='NNPS' or t[1]=='NNS'):
            sw=sentiwordnet.senti_synsets(t[0].lower())
            defi.append(sw.synset.definition())
```


https://sites.google.com/site/ijcsis/
ISSN 1947-5500

```
Replace Object of given openion with object of Each Extracted Example
   tuned=[]
   for df in defi:
      dfToken=(word_tokenize(df))
      dfTag=pos_tag(dfToken)
      for t in dfTag:
         if (t[1] =='NNP' or t[1]=='NN' or t[1]=='NNPS' or t[1]=='NNS') and i==1:
           df=df.replace(t[0],noun)
         tuned.append(df)
   tunedAll.append(tuned)
Create an HTML files all Opinions linked with their own Summary message=message + """<a
href=#p""" + str(tg) + """>""" + d + """</a><br>"""
for tu in tunedAll:
   message=message + """<p id=p""" + str(tg) + """>"""
   for t in tu:
      message=message + t + """<br></p>"""
message=message + """</body> </html>"""
f.write(message)
```

Conclusion:

We implemented this algorithm in Python, and applied it on hundreds of opinions. The signifieds of 80% of the opinions were found, there were no signifieds in case of rest of the 20% opinions. The mandate or function of this model so far was to generate the signifieds. This model will be enhanced in future, to find that how far the identified signifieds match the original opinion. In order to understand the proposed work, the following table presents the signifieds of some opinions:

Table-3: Some Extracted Signifieds from Signifiers

Opinion	No of Signified	Signified
PX2 has high battery	13	[a lofty PX2 or position or degree', an PX2 mass of higher than normal pressure', a PX2 of sustained elation', a PX2 of altered consciousness induced by alcohol or narcotics', a high PX2', a public secondary PX2 usually including grades 9 through 12', a PX2 gear with a gear ratio that gives the greatest vehicle velocity for a given engine speed', greater than normal in PX2 or intensity or amount', u"PX2literal meaning) being at or having a relatively great or specific elevation or upward extension PX2sometimes used in combinations like `knee-high')", used of PX2 and voices; high in pitch or frequency', at a great PX2', in or to a high PX2, amount, or degree', in a rich PX2', far up toward the PX2']
PX2 has beautiful shape	1	[delighting the PX2 or exciting intellectual or emotional admiration']

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

J7 is the Best Smartphone. Superbbbbb.. .	23	[the J7 effort one can make', the J7 who is most outstanding or excellent; someone who tops all others', Canadian J7 (born in the United States) who assisted F. G. Banting in research leading to the discovery of insulin (1899-1978)', J7 the better of', u"J7superlative of `good') having the most positive qualities", having desirable or positive J7 especially those suitable for a thing specified', morally admirable', in a most excellent J7 or manner', it would be sensible', from a J7 of superiority or authority', u"J7often used as a combining form) in a good or proper or satisfactory manner or to a high standard J7`good' is a nonstandard dialectal variant for `well')", thoroughly or completely; fully; often used as a J7 form', indicating high J7; in all likelihood', J7used for emphasis or as an intensifier) entirely or fully', to a suitable or appropriate J7 or degree', favorably; with J7', to a great J7 or degree', with great or especially intimate J7', with J7 or propriety', with J7 or in a pleasing manner', in a J7 affording benefit or advantage', in financial J7', without unusual J7 or resentment; with good humor']
PX2 is cheap Mobile	1	[relatively low in PX2 or charging low PX2s']
it has efficient performance	6	[being effective without performance time or effort or expense', a dramatic or musical performance', the performance of presenting a play or a piece of music or other entertainment', the performance of performing; of doing something successfully; using knowledge as distinguished from merely possessing it', any recognized performance', performance or manner of functioning or operating']
J7 processing is well	8	[preparing or putting through a prescribed J7', J7 to a process or treatment, with the aim of readying for some purpose, improving, or remedying a condition', J7 with in a routine way', J7 mathematical and logical operations on (data) according to programmed instructions in order to obtain the required information', J7 legal proceedings against; file a suit against', J7 in a procession', J7, form, or improve a material', J7 a warrant or summons to someone']

References

[1] Bing Liu. Sentiment Analysis and Opinion Mining, Morgan & Claypool Publishers, May 2012.

[2] Zhang, Lei and Bing Liu. Identifying noun product features that imply opinions. in Proceedings of the Annual Meeting of the Association for Computational Linguistics (ACL-2011). 2011b.

[3] Greene, Stephan and Philip Resnik. More than words: Syntactic packaging and implicit sentiment. in Proceedings of Human Language Technologies: The 2009 Annual Conference of the North American Chapter of the ACL (NAACL-2009).

[4] Li, Binyang, Lanjun Zhou, Shi Feng, and Kam-Fai Wong. A Unified Graph Model for Sentence-Based Opinion Retrieval. in Proceedings of Annual Meeting of the Association for Computational Linguistics (ACL-2010).

[5] Pantel, Patrick, Eric Crestan, Arkady Borkovsky, Ana-Maria Popescu, and Vishnu Vyas. Web-scale distributional similarity and entity set expansion. In Proceedings of Conference on Empirical Methods in Natural Language Processing (EMNLP-2009).

[6] Lee, Lillian. Measures of distributional similarity. in Proceedings of Annual Meeting of the Association for Computational Linguistics (ACL- 1999).

[7] Blei, David M., Andrew Y. Ng, and Michael I. Jordan. Latent dirichlet allocation. The Journal of Machine Learning Research, 2003.

[8] Griffiths, Thomas L. and Mark Steyvers. Prediction and semantic association. in Neural information processing systems 15. 2003.

[9] Steyvers, Mark and Thomas L. Griffiths. Probabilistic topic models. Handbook of latent semantic analysis, 2007.

[10] Shi-Heng Wang, Yijun Ding, Weizhong Zhao, Yung-Hsiang Huang, Roger Perkins, Wen Zou,corresponding author and James J. Text mining for identifying topics in the literatures about adolescent substance use and depression. BMC Public Health. 2016; 16: 279. Published online 2016 Mar 19. doi: 10.1186/s12889-016-2932-1

[11] Long, Chong, Jie Zhang, and Xiaoyan Zhu. A review selection approach for accurate feature rating estimation. in Proceedings of Coling 2010

[12] Blair-Goldensohn, Sasha, Kerry Hannan, Ryan McDonald, Tyler Neylon, George A. Reis, and Jeff Reynar. Building a sentiment summarizer for local service reviews. in Proceedings of WWW-2008 workshop on NLP in the Information Explosion Era.

[13] Qian Liu, Zhiqiang Gao, Bing Liu and Yuanlin Zhang. A Logic Programming Approach to Aspect Extraction in Opinion Mining. 2013 IEEE/WIC/ACM International Conferences on Web Intelligence (WI) and Intelligent Agent Technology (IAT)

[14] A.Jeyapriya, C.S.Kanimozhi Selvi. Extracting Aspects and Mining Opinions in Product Reviews using Supervised Learning Algorithm. IEEE SPONSORED 2ND INTERNATIONAL CONFERENCE ON ELECTRONICS AND COMMUNICATION SYSTEMS (ICECS '2015)

[15] SiddharthBatraandDeepakRao. EntityBasedSentimentAnalysisonTwitter. Jul 31, 2009

[16] Nikos Engonopoulos, Angeliki Lazaridou, Georgios Paliouras, Konstantinos Chandrinos. ELS: a word-level method for entity-level sentiment analysis. Proceedings of the International Conference on Web Intelligence, Mining and Semantics Article No. 12 ACM New York, NY, USA ©2011 doi: 10.1145/1988688.1988703

[17] D. K. Kirange1, Ratnadeep R. Deshmukh. ASPECT BASED SENTIMENT ANALYSIS SEMEVAL-2014 TASK 4. Asian Journal of Computer Science And Information Technology 4 : 8 (2014) 72 - 75.

[18] CarolineBrun,DianaNicoletaPopa,ClaudeRou. XRCE: HybridC lassification for Aspect-based Sentiment Analysis. Proceedings of the 8th International Workshop on Semantic Evaluation (SemEval 2014), pages 838–842, Dublin, Ireland, August 23-24, 2014.

[19] Aspect-Based Sentiment Analysis. SemEval-2016 Task 5

[20] AbdulazizAlghunaim, MitraMohtarami, ScottCyphers, JamesGlass. A Vector Space Approach for Aspect Based Sentiment Analysis. Proceedings of NAACL-HLT 2015, pages 116–122, Denver, Colorado, May 31 – June 5, 2015.

[21] Fangtao Li, Minlie Huang, Yi Yang and Xiaoyan Zhu, Learning to Identify Review Spam, Proceedings of the Twenty-Second International Joint Conference on Artificial Intelligence, 2011

[22] Myle Ott, Yejin Choi, Claire Cardie and Jeffrey T. Hancock, Finding Deceptive Opinion Spam by Any Stretch of the Imagination,Proceedings of the 49th Annual Meeting of the Association for Computational Linguistics, pages 309–319, Portland, Oregon, June 19-24, 2011

[23] Savita Teli, Santoshkumar Biradar. Effective Spam Detection Method for Email, IOSR Journal of Computer Science (IOSR-JCE) e-ISSN: 2278-0661, p-ISSN: 2278-8727, PP 68-72, 2014

[24] Ding, Xiaowen and Bing Liu. Resolving Object and Attribute Coreference in Opinion Mining. In Proceedings of International Conference on Computational Linguistics (COLING-2010). 2010.

[25] Aitor Garcia-Pablos, Montse Cuadros, Se´an Gaines, German Rigau. V3: Unsupervised Generation of Domain Aspect Terms for Aspect Based Sentiment Analysis Proceedings of the 8th International Workshop on Semantic Evaluation (SemEval 2014), pages 833–837, Dublin, Ireland, August 23-24, 2014.

[26] Vijay B. Raut et al,"Survey on Opinion Mining and Summarization of

User Reviews on Web",(IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (2) , 2014, 1026-1030

[27] Lerman, Kevin and Ryan McDonald. Contrastive summarization: an experiment with consumer reviews. In Proceedings of NAACL HLT 2009.

[28] Michael J. Paul, ChengXiang Zhai and Roxana Girju. Summarizing contrastive viewpoints in opinionated text. In the proceedings of the 2010 Conference on Empirical Methods in Natural Language Processing (EMNLP 2010), pages 65-75, MIT, Cambridge, Massachusetts. October 2010.

Taking Frames Out of (News) Videos

Pooja
PhD Research Scholar
B R Ambedkar National Institute of Technology
Jalandhar, Punjab, India
poojachoudhary80@gmail.com

Renu Dhir
Associate Professor
B R Ambedkar National Institute of Technology
Jalandhar, Punjab, India
dhirr@nitj.ac.in

***Abstract*— Videos are an integral part of today's life. Our daily life is dependent on videos. You want to learn new technology, open a video tutorial; you want to cook something new, open a video online; internet cloud is full of video data these days. Accordingly, the need of extracting out the relevant information from the videos has increased, may be in the area of forensic science, video annotation, indexing, video text extraction, object detection to name a few. So, detecting informative part out of video has become an active research area these days. The foremost requirement of any such application is to take the frames out of video to further process them. This paper highlights such techniques and tools, with the help of which frames can be pulled out of video sequence. Also, this paper presents a snippet for taking clear and exact frames from the video in various ways.**

Keywords-Video, Video image, Frame, Frame extraction.

I. INTRODUCTION

Images walking sequentially create a video. Videos have become an essential part of everybody's life. Our daily life is dependent on videos. You want to learn new technology, open a video tutorial; you want to cook something new, open a video online; internet cloud is full of video data these days. Accordingly, the need of extracting out the relevant information from the videos has increased, may be in the area of forensic science, video annotation, indexing, video text extraction, object detection to name a few. So, detecting informative part out of video has become an active research area these days. The foremost requirement of any such application is to take the frames out of video to further process them. This paper highlights such techniques and tools, with the help of which frames can be pulled out of video sequence.

A. *Area of applications where study of frames is required*

- In computer video display technology, a frame is the picture that is sent to the exhibit image rendering procedure. It is constantly rationalized or revived from a frame buffer, a very reachable part of video RAM.
- Sports and wildlife photographer give careful consideration to FPS since it can truly create the variation when trying to capture an image.
- Text digs out of video permits automatic indexing and summarization, which is very supportive for online searching and content.
- Video Classification and Retrieval: Video investigation and recovery from collection of videos is a complex job. One might want to portray the video in terms of various types and styles, comprehend what stuff are in the video, segregate it into camera shots and clustering those into coherent scenes. Eventually one may want to make video as tractable and 'searchable' as current text collections that are indexed throughout the network. Video analysis is orders of size more complex than speech recognition, where the information stream is only a one-dimensional signal and appropriate intermediate level demonstration such as sentences, words, and phonemes allow a divide-and-conquer approach utilizing machine learning.
- Video Annotations: When there is a requirement of adding little pop-ups, or speech bubbles to your videos, annotations are used. Even links can be added to them. They prove to be useful now and again for pointing out things in the video like an arrow.
- Compression: Video compression assumes an imperative part in numerous advanced video applications such as digital libraries, video on demand, and high definition television. A video series of duration only 1 minute 03 seconds, running at the frame rate of 29 frames per second, with frame size of 480 X 360 pixels and 24 bits per pixel makes 5,518,601 bytes, transmitting such a huge amount of bits over the internet/telephone lines seems impractical. It is evident that videos are required to be compressed. Efficient video compression can be reached by minimizing both spatial and temporal redundancy. A video sequence consists of a series of frames. In order to compress the video for efficient storage and transmission, the temporal redundancy among adjacent frames must be exploited. Temporal redundancy implies that adjacent frames are similar whereas spatial redundancy implies that neighboring pixels are similar.

II. FRAMES PER SECOND

Frame rate, (expressed in frames per second or fps) is the recurrence (rate) at which successive images called frames are displayed. The term applies evenly to film and video cameras, computer graphics, and action capture systems. Video files are group of images, audio and other data. Study exposes that a small video clip of say 4 - 5 MB size may have more than 3000 frames in it.

Frame rate:- the amount of tranquil pictures per division of time of video. Frame rate may likewise be known as the frame

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

frequency, and be expressed in hertz. Frames per second allude to the speed at which a camera can capture photos.

Digital video comprises of video frames that are shown at a recommended frame rate. A frame rate of 30 frames per seconds is utilized in NTSC video. The frame format indicates the dimension of individual frames in terms of pixels. The Common Intermediate Format (CIF) has 352 x 288 pixels, and the Quarter CIF (QCIF) format has 176 x 144 pixels. Some of the frequently used video formats are given in Table 1 Each pixel is represented by three components: the luminance component Y, and the two chrominance components Cb and Cr.

Table 1 Video Frame Format(2)

Format	Luminance Pixel Resolution	Typical Applications
Sub-QCIF	128 X 96	Mobile Multimedia
QCIF	176 X 144	Video conferencing and Mobile Multimedia
CIF	352 X 288	Video conferencing
4CIF	704 X 576	SDTV and DVD-Video
16CIF	1408 X 1152	HDTV and DVD-Video

Video processing technology has transformed the world of multimedia with products such as Digital Versatile Disk (DVD), the Digital Satellite System (DSS), high definition television (HDTV), digital still and video cameras. A video file format is a type of file format for storing digital video data on a computer system. Video is almost always stored in compressed form to reduce the file size.

In a digital format, a video file is comprised of two sections, a container and a codec.

A container is a set of files that stores information about the digital file; it consists of the video and audio codecs along with other information, such as subtitles and chapters. The trendy containers are AVI, MP4 and MOV.

Types of Video File Formats: .avi, .mpeg, .mpeg4 etc. The last three or four digits of a file name after the period indicate the type file format it is or the file container.

A codec is mandatory to compress and decompress the file. Study discloses that a petite video clip of say 4 - 5 MB range may encompass more than 3000 frames. Such a massive video file will be too time-consuming if downloaded over the Internet. Consequently, video files are compressed so that they can be handled easily. A codec is used to accomplish this task. The codec choose the player on the machine and the file type to see if it able to play the video on your screen. There are numerous codecs available and a few containers, so each container holds more than 100 codecs within them. A few popular types of codecs are FFMpeg, DivX, XviD, and x264.

The encoded video data needs to be decoded to 2-dimensional arrays of pixel values(x, y) and presented to the user (or perhaps transcoded to a different format).

All of these frames look complete to the user. Yet, the frames often can't remain independent from anyone else. They more often need information from other frames in order to make their presentation complete. There is the intraframe and interframe which are also known as a keyframe. An intraframe is one that can stand on its own. It do not requires other frames. It carries with it all the information needed to be decoded. Intraframe implies that there is a frame type that does depend on another type of frame. An interframe is a frame that has a data dependency on another frame. Generally the interframe depends on the preceding frame.

There are 3 frame types:

I-frame: This is an intraframe, coded totally independent from anyone else.

P-frame: This is a predicted frame which requires information from the preceding I-frame or P-frame, which may or may not be the frame directly preceding it

B-frame: This is a bidirectional forecasted frame and requires information from the adjoining I- and P-frames

MPEG videos include frame sequences of the following sort:

0 1 2 3 4 5 6 7 8 9
I B B P B B P B B I...

Take note of that those initial 2 B-frames (1 and 2) essentially need information from the future (frame 3) as well as from the past (frame 0). This is accomplished by transmitting the P-frame before transmitting B-frames:

0 3 1 2 6 4 5 7 8 9
I P B B P B B B B I ...

In this way, the decoder decodes frame 0 (I-frame) first and has it ready to display. It decodes frame 3 (P-frame) next and keeps it handy for decoding frames 1 and 2 (the B-frames). Data from frames 0 and 3 are used for decoding frame 1 and 2. Frames 1 and 2 are now ready for display followed by frame 3. Frame 6 (another P-frame) is decoded next since it and frame 0 (the last I-frame) are both required for decoding frames 4 and 5. And on it goes.

Frames among two consecutive ‘I’ frames, as well as the leading ‘I’ frame, are collectively called as group of pictures (GOP). The GOP is illustrated in figure 1. The illustrated figure has one ‘I’ frame, two ‘P’ frames and six ‘B’ frames.

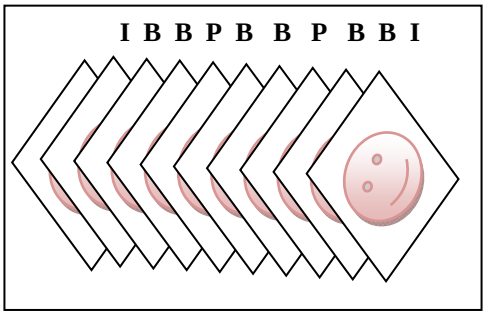


Figure 1 Group of pictures

Typically, multiple ‘B’ frames are inserted between two consecutive ‘P’ or between ‘I’ and ‘P’ frames. The existence of GOPs smooth the progress of implementation of features such as random access, fast forward or fast and normal reverse playback. Resolution of video: Video resolution is generally expressed as width × height, with the value given in pixels.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

There are two types of video resolution: Standard Definition (SD) and High Definition (HD). The most popular standard resolutions are 640 x 360 and 640 × 480 for video, and 720 × 480 and 720 × 576 for DVD. HD video usually has a resolution of 1280 × 720 (720p) or 1920 × 1080 (1080p, also called Full HD).

III. EXTRACTING FRAMES

Before Set of frames together running at particular speed become a video and to know more about the video these frames are required to be extracted out of video as individual images so that further image processing can be done for information retrieval. There are various tools and applications available to take out frames. Most of the applications/online tools available usually store print screen/still images of video as frames. This section of paper will put more light on various such tools available and other frameworks which can be utilized for the purpose of frame extraction.

A. DVDvideosoft: Video to JPG converter

There are a lot of online facilities available to convert the video into images. DVDvideosoft is one such portal for conversion between various formats. However, This provides user with the flexibility of choosing the count of frame/image or time span, this means user can decide which frame number he/she wants to capture viz. every 10th frame or say every 20th frame. Once you download the .exe file of DVD video converter and install it on your machine, the screen as shown in Figure 2 appears on opening the software to start with conversion.

Figure 2 Starting screen of DVD Video Soft

To start the process, Click on the “Add Files” button and select the input video file from your machine and then you must select the location where you want to save the frames extracted. As seen in the Figure 2 , in the box titled ‘Extract’, there are options available viz. Every .. frame, Every .. second and total number of frames from the video. User can set the frequency of frames to be extracted. Once chosen , click on the ‘Convert’ button.

B. Frame Grabber

Frame grabber is a software application developed in OpenCV, below is the coed snippet of the same:-

```
FrameGrabber g = new OpenCVFrameGrabber("videoname");
      g.start();
      IplImage frame = null;

      int frame_counter = 1;
      while (true)
      {
         frame = grabber.grab();
         if (frame == null)
         {
            System.out.println("!!! Failed grab");
            break;
         }
             frame_counter++;
        }
```

C. Dot Net Framework

In dotnet, various namespaces are available. To work on images System.Drawing and System.Windows.Forms are required. Code Snippet developed for frame extracting in dotnet is as follows:-

To start the time when video starts playing:-

```
progressBar1.Visible = true;
this.timer.Start();
```

To input the video through dialog box:-

```
OpenFileDialog ofd = new OpenFileDialog();
ofd.ShowDialog();
string _videopath = ofd.FileName;
SaveFileDialog ofd2 = new SaveFileDialog();
ofd2.ShowDialog();
string _videopath2 = ofd2.FileName;
```

To grab frames from the video:-

```
int len = (int)md.StreamLength;
for (float I = 0.0f; I < 1; I = I + interval)
{
   string name = j + “.jpg”;
   string _imagepath = ext + name;
   Bitmap bmp = FrameGrabber.GetFrameFromVideo(_videopath, i);
   bmp.Save(_imagepath, System.Drawing.Imaging.ImageFormat.Gif);
   FrameGrabber.SaveFrameFromVideo(_videopath, I, _imagepath);
```


https://sites.google.com/site/ijcsis/
ISSN 1947-5500

```
 j = j + 1;
  }
  this.timer1.Stop();
  progressBar1.Visible = false;
  MessageBox.Show(" Image extracted ");
  this.Hide();
  frmIndex fs1 = new frmIndex();
  fs1.Show();
}
private void timer1_Tick(object sender, EventArgs e)
{
  this.progressBar1.Increment(1);
} }}
```

D. MatLab

MatLab is a widely used simulation tool, when it comes to research. Many scholars rely on MatLab for simulating their methodologies and proposed work. Following code is written for frame extraction for our research work:-

Initializing:-

```
vidObj = vid;
vidObj = VideoReader(vid);
```

Finding the properties of the input video:-

```
frameRate = vidObj.FrameRate;
duration = vidObj.Duration;
nFrames = vidObj.NumberOfFrames;
[nrow, ncol, nclr] = size(read(vidObj, 1));
vidHeight = xyloObj.Height;
vidWidth = xyloObj.Width;
```

Calculating the start and end frame indices and the number of frames to skip each time:-

```
startF = round(frameRate*startt)+1;
endF = round(frameRate*endt);
stepF = round(frameRate*step)+1;
disp(['Extracting frames from ',vidObj.Name]);
disp(['starting at frame no.', num2str(startF), ...
    ' (at second ', num2str(startt), '),']);
disp(['stopping at frame no.', num2str(endF), ...
    ' (at second ', num2str(endt), '),']);
disp(['and by every other ', num2str(stepF), ' frames (', ...
    num2str(step), ' seconds).']);
disp(['Output folder: "', savetodir, ""']);
```

To Allocate the memory for storing the frames:-

```
imgs = uint8(zeros(nrow, ncol, nclr, floor((endF-startF)/stepF)+1));
```

read one frame at a time.

```
count = 0;
for k = startF:stepF:endF
  count = count+1;
  imgs(:,:,:,count) = read(vidObj, k);
end
```

Writing images to files:-

```
if exist('savetodir','var')
  if (~exist(savetodir,'dir'))
    mkdir(savetodir);
  end
  count = 0;
  padding = power(10,size(num2str(max(startF, endF)),2));
  for k = startF:stepF:endF
    count = count+1;
    padded_k = num2str(padding+k);
    img = imgs(:,:,:,count);
    imwrite(img, [savetodir,'\frame',padded_k(2:end),'.jpg'], 'JPG');
  end
end
End
```

IV. Experimental results and Discusion

For carrying out the experiment and to create the dataset, 20 number of Punjabi news videos are collected. As, there are a lot of news channels available these days, more than one channel can be considered to collect the videos. (DD Punjabi, PTC News, Day and Night news, ABP Sanjha etc). The study of the literature shows that at most 10 videos have been experimented for research purposes so far. For this paper work, 15 news videos of two Punjabi news channels are downloaded (freely available) from the internet. These channels are 'Day and Night News', 'Punjabi News' and 'ABP Sanjha'. With 15 videos considered, approximately 13K frames are gathered using MatLab platform. Table 2 shows the statistics of different types of videos collected viz. frame rate, time gap between two frames extracted out of these videos. Table 3 represents the details of five videos out the whole dataset of 20 videos.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

TABLE 2 STATISTIC OF VIDEOS (.MP4) USED

Video Frame ate	Time gap for every 81st frame	Time gap for every 11th frame	Time gap for every 6th frame	Time gap for every 4th frame
29	2.68 sec	0.344 sec	0.172 sec	0.86 sec
25	3.19 sec	0.39 sec	0.20 sec	0.12 sec

A. Temporal Information

Temporal characterization occurs when you have a series of images taken at different time. Correlations between the images are often used to monitor the dynamic changes of the object.

With every 81st frame, these frames are found to be far away. As the text line in between two frames is broken i.e. text extraction will not be a continuous. This leads to information loss. With every 11th frames extraction, text lines seem more continuous, without any significant loss of textual information. With 6th frame extraction, Lines seem more continuous with negligible loss. It was observed that the full sentence (covering screen width approx.) to be displayed as flash news on the screen took 10-20 frames (depending upon the speed of animation adopted in the video) consecutively, for full appearance. And news stays on the screen for hundreds of frames.

So, considering every 6th frame lead to good enough results and speeding up the task. The output images of these are then fused together for the final text detection. Thus, Fusion results obtained are more informative when every 6th frame is fused together.

REFERENCES

[1] http://searchnetworking.techtarget.com/definition/frame
[2] https://imagenevp.com/top-10-video-formats/
[3] https://en.wikipedia.org/wiki/Frame_grabber
[4] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1839476/
[5] https://filmora.wondershare.com/video-editing-tips/how-to-extract-frames-from-video.html
[6] https://en.wikipedia.org/wiki/Video_file_format
[7] https://wiki.multimedia.cx/index.php/Frame_Types
[8] http://www.bretl.com/mpeghtml/picture.HTM
[9] .http://www.dvdvideosoft.com/guides/free-video-to-jpg-converter.htm
[10] .https://pdfs.semanticscholar.org/277b/a650965e7efaa92a6e16326659d59630d106.pdf
[11] .http://stackoverflow.com/questions/20818230/whats-the-difference-between-spatial-and-temporal-characterization-in-terms-of

AUTHORS PROFILE

Ms. Pooja has received her Diploma in Electronics and Communication Engineering from Government Polytechnic for Women, Jalandhar, Punjab, India in 1998, Bachelors in Electronics and Communication Engineering from Adesh Institute of Engineering and Technology (AIET), Faridkot, Punjab in the year 2001 and Masters in Information Technology from Punjabi University Patiala, Punjab and pursuing her PhD in Pattern Recognition and Image Processing from National Institute Technology, Jalandhar Punjab, India.

Dr. Renu Dhir is an Associate professor in the department of Computer Science and Engineering at National Institute of Technology, Jalandhar. She has published numerous reseaarch papers in various International and National journals. Also she has delievered expert talks session at various workshops and FDP held in reputed institutions/organisations.

TABLE 3 DETAILS OF 5 VIDEO OUT OF THE DATASET CREATED.

Video name (.mp4) (Channel)	Duration of video In Seconds	Duration considered for extracting frames	Frame rate In fps	Total number of frames	Number of frames (every 81st)	Number of frames (every 11th)	Number of frames (every 6th)	Number of frames (every 4th)	Frame size
Video 1 (ABP Sanjha)	101.953	0-101	29	3027	38	256	**505**	757	480x360
Video 2 (ABP Sanjha)	70.1233	0-70	29	2098	27	191	**350**	525	480x360
Video 3 (ABP Sanjha)	121.7883	0-121	29	3531	45	330	**605**	907	480x360
Video 4 (Punjabi News)	9420.08	0-100	25	235502	31	455	**417**	628	1280x720
Video 5 (Day and Night)	1238.76	0-100	25	30969	31	228	**417**	628	1280x720

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Digital Watermarking Scheme for Ensuring Information Security and Authentication

Dr. T Hemalatha, Dr.Fahad Khan Azeez, Wajiha Rehman , Sumaira Idrees

Department of Health Information Management and Technology, Faculty of Public Health and Tropical Medicine, Jazan University, Jazan, Kingdom of Saudi Arabia

Abstract

In this technologically competitive world it is very important to protect the data against piracy. Past few years there is an enormous growth in accessing of internet data without knowing the originality of the information, authorization, authentication and accessing rights. The data uploaded in internet will be safe is a big question mark. To ensure that data is authenticated and secured and have legal access there are many techniques used. The most powerful technique which is used to protect the information from unauthorized users is Digital Watermarking. Digital watermarking is very efficient in Data security and robustness. Digital water marking is the promising solution for safeguard the information.

Keyword: Authentication, Authorization, Digital Watermarking, Data Security.

I.INTRODUCTION

Now a day's most of the information is shared and fetched through the internet. The information may be a text, audio, video. To protect the data from unauthorized users there are many techniques used such as Cryptography, steganography, Digital watermarking is used. In cryptography, encryption and decryption is used for sending and receiving the data. If the secret key is known to the hackers they can easily hack the data and in steganography the message is hiding inside the image. If it comes to know that message is hidden in the image the interceptors crack the image and hack the information. To overcome this, a technology which is used to protect data is Digital Watermarking. The information which is hidden using digital watermarking can be known to all. Once the information is watermarked it is not possible to remove or modify the secret information. Hence Digital Watermarking provides data security, copyright, authentication etc.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

II.DIGITAL WATERMARKING

Among the various security techniques, Digital watermarking plays a vital role in the protection of data from inceptors .Digital water marking is widely used now a days for hiding information. Digital watermarking is the practice of embedding extra information within digital content, also called host data, in a manner that does not interfere with the normal usage of data. An example is Google Maps images that are obtained from satellites used for applications such as urban planning, environmental protection, and defense, S. Chong et.al (2010). The "digital watermarking" of covert communication technology has the capacity to meet these requirements, because it not only protects the content of the communicating information, but more important it hides the existence of communication facts, and thus confuse interceptors Li Qiuyan et.al(2012).

III.DIGITAL WATERMARKING WORKING PROCESS

Digital watermarking is an important branch of information hiding technology research. By embedding confidential information ,watermarking in original data, it affirms the ownership of the data, verifies integrity of data, tracks the source of data, controls usage of data and delivery of confidential information. According to goal and requirement of covert information, digital watermarking should have the following basic characteristics:

1. Hide: watermark information and source data integrate together, without changing the data storage space; besides the source data must not has obvious change phenomenon.
2. Robustness: It means that embedded watermarking data after going through various processing operation and against operation, which avoid losing or damage the watermarking information.
3. Security: it refers the now location and content of watermarking information is unknown, which needs to apply covert arithmetic and take measures like adopting pretreatment (for example, encryption) to watermarking.

All digital watermarking systems compose two essential parts: watermarking embedding system and watermarking detection system. Fig. 1 and Fig. 2 respectively represent the general process of watermarking embedment and watermarking detection

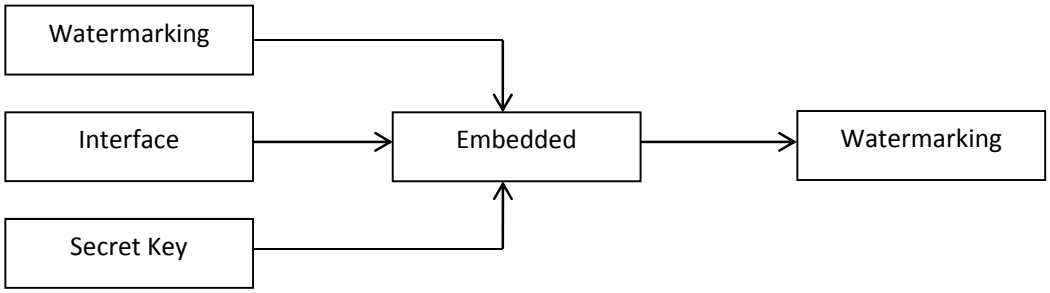


Fig 1. Watermark Embedding Process

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

In the process of watermarking embedment, the first step is t produce watermarking. The information you want to embed in can be all kinds of nature, such as number, image and text so forth. The use of password is to enhance the security by protecting non-authorized people from reading messages. The output of watermarking embedding process is image works with embedded watermarking.

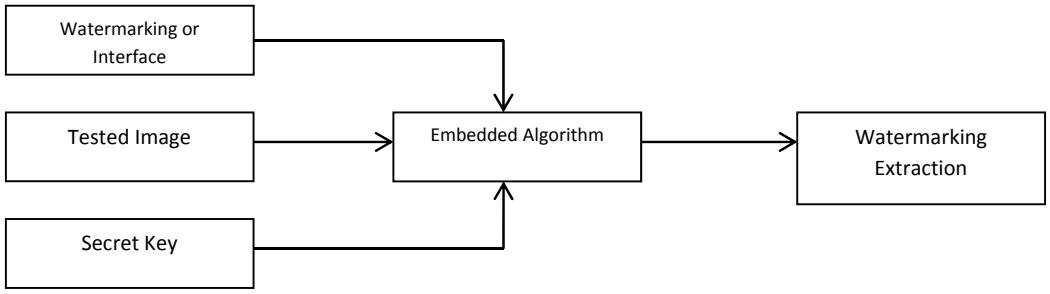


Fig 2. Watermarking Detecting Process

The input of the watermarking detection process is the image be tested, it may not be watermarking embedded, or it may be images been watermarking embedded and then attacked. Because of different watermarking algorithm, the input of watermarking detection process can also be password, intact face and so on. The Input of the watermarking detection process may be the watermarking been detected, or a confidence value about whether watermarking is involved in the detected signals. When the radios transfer confidential information, they embed confidential information as watermarking in a carrier which can be put in public. The carrier can be digital signals like text, picture and sound. In radio watermarking encryption scheme, it should use double or multiple watermarking mechanism: in carriers except for embedding robustness watermarking in order to hide information, it also embeds half fragile watermarking unrelated to contents, fragile watermarking, in the use of distinguishing from enemy and recognizing if the information are attacked or distorted. Once we can't detect the watermarking, we can judge the original contents are attacked or they are not from our party, which can be effectively prevent statistical attack which robustness watermarking can't resist.

IV. TYPES OF DIGITAL WATERMARKING TECHNIQUES.

Digital Watermarking Techniques is mainly classified into two types they are

a. Spatial domain watermarking

b. Frequency domain watermarking

a. Spatial domain watermarking

The term spatial domain defines an aggregate of pixels composing an image. This technique directly modifies the intensity or color values of the selected pixels. This is an earliest and the simplest watermarking technique. Spatial domain method is denoted by the expression,
$g(X,Y)=T[f(X,Y)]$.This can be further classified into two namely LSB and SSM.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

- **Least Significant Bit (LSB)**

The earliest work of digital image watermarking is the least significant bit (LSB) which embeds the watermarks in the LSB of the selected pixels.

- **SSM Modulation Based Technique**

Spread-spectrum techniques are in which energy generated at one or more discrete frequencies is deliberately spread or distributed in time.

b. Frequency domain watermarking

The frequency domain technique first transforms an image into a set of frequency domain coefficients. This frequency technique includes Discrete cosine transformation (DCT), Discrete Fourier transformation (DFT) and Discrete wavelet transformation (DWT)

- **Discrete Fourier Transformation (DFT)**

The Fourier transform is a most popular technique for signal analysis, signal study and synthesis to identify the cause of various factors on signal. Sometimes the Fourier transform is used to make over the signal from time domain to frequency domain or from frequency domain to time domain.

- **Discrete Cosine Transformation (DCT)**

A DCT is a Fourier related transform only uses real numbers. The DCT is a very popular transform function used in manipulating the signals. It transforms a signal from spatial domain to frequency domain. Owing to good performance, it has been used in JPEG standard for image compression. DCT has been useful in many fields such as data compression, pattern recognition, and image processing, and so on. The DCT manipulate the original image into the smallest low frequency coefficient and also it can ground the image blocking effect which can realize the high-quality concession between the information centralizing and the computing complications

DCT-based watermarking is based on two essentials. The first is that most of the signal energy lies at low-frequencies sub band which contains the most imperative visual parts of the image. The second is that high frequency components of the image are usually detached through compression and noise attacks. The watermark is therefore implanted by changing the coefficients of the middle frequency sub band so that the visibility of the image will not be exaggerated and the watermark will not be isolated.

- **Discrete Wavelet Transformation (DWT)**

The Discrete Wavelet Transform (DWT) is a contemporary technique currently used in an extensive range of applications in signal manipulation, such as audio and video compression, inference of noise in audio, and the replication of wireless antenna distribution. Wavelets have their liveliness in time and are apt for the scrutiny of transient and time-varying signals. Since most of the real life signals are time varying in nature, the Wavelet transform suits best for many applications. The main scenario of the

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

watermarking is to achieve a better tradeoff between robustness and perceptivity. Robustness can be targeted by escalating the potential of the embedded watermark.

V. RELATED WORK ON DIGITAL WATERMARKING

Nasir et al. (2008) proposed a novel and robust colour image watermarking technique in spatial domain based on embedding four identical watermarks into the blue component of the host image. In the extraction process, the original image is available and five watermarks can be extracted from different regions of the watermarked image and only one watermark is detected or constructed from the five watermarks according to the highest value of normalized cross correlation (NCC). The experimental results show that their proposed scheme is robust for several attacks. Their proposed technique is also secure, and has the correct key to extract the watermark.

Kallel et al. (2010) applied a multiple watermarking technique in the wavelet field to preserve the traceability and the record of the medical image diagnosis made by doctors. Their technique is to hide information in the medical image and at the same time to ensure its imperceptibility. Their diagnosis made by the practitioner is the data inserted in the image. The fundamental challenge of their paper is how to hide the full diagnosis of each practitioner in the image ensuring a good quality of the image at the same time.

The segmented watermarking method performs segmentation of the original image so that each watermark has its own separate embedding area. In the proposed work, one watermark is embedded into odd-numbered rows and columns and another watermark is embedded into even-numbered rows and columns in colour image of Lena. Anew rotation and scaling invariant image watermarking scheme is proposed (Nantha Priya and Lenty Stuwart, 2010).

Wheeler et al. (2004) introduced the notion of weighted segmented digital watermarking, and generalized work on cropping-resistance in segmented watermarking to provide performance measures for the weighted case. Segmented watermarking of still images in which segments are formed by dividing the image into square blocks, each of which contains one contributor’s watermark. If a watermark is present in one or more segments of their work, the owner of that watermark is reported to be an owner of the work as a whole by an arbiter. Their work compared performance measurement of watermark embedding patterns in the presence of cropping attacks.

Yang et al(2004). proposed a high capacity companding technique for image watermarking in discrete cosine transform domain. Whereby, twice-try based block discrimination structure is incorporated to overcome overflow/underflow
problem.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

The latest proposals for patchwork-based systems are proposed in I. Natgunanathan et al(2012), where very sophisticated embedding and extraction schemes are investigated. The procedure stopper form watermark embedding consist of(i)equally divide a time domain frame x (n) into two parts, termed as front and rear parts respectively;(ii) perform DCT to each part and select low-to-middle frequency components for embedding;(iii)further divide the selected components into sub-frames of equal size;(iv)for each sub-frame, selected two channel so coefficients according to random indices; (v) perform watermark embedding

VI.CONCLUSION

Digital watermarking will be more authenticated, expedient in sending the data in a secured way.Since most of the data is sent through internet digital watermarking is the powerful tool to avoid illegal hacking of data.There are different types of digital watermarking techiques are used in not only in protecting the data but also hiding information for security issues. Thus in future digital watermarking will be used in many applications of internet of things, Mobile Computing etc.

REFERENCES

[1]. S. Chong, C. Skalka, and J. A. Vaughan, ``Self-identifying sensor data," in *Proc. 9th ACM/IEEE Int. Conf. Inf. Process. Sensor Netw.*, Apr. 2010, pp. 82_93.

[2]. Li Qiuyan , Du Chunmei , Meng Qinghua,Zhang Lei,Gao Wenju," Applied Research in Communications Encryption Technology Based on the Integration of Digital Watermarking"AASRI Procedia 1 (2012) 498 – 504.

[3].Nasir, I., Weng, Y., Jiang, J., 2008. Novel multiple spatial watermarking technique in color images. In: IEEE Fifth International Conference onInformation Technology: New Generations, Las Vegas, NV, pp. 777–782.

[4].Kallel, M., Bouhlel, M.S., Lapayre, J.C., 2010. Use of multi-watermarking schema to maintain awareness in a teleneurology diagnosis platform.Radio Engg. 19 (1), 68–73.

[5].Nantha Priya, N.R., Lenty Stuwart, S., 2010. Robust feature-based image watermarking process. Int. J. Comp. Appl. 4 (5), 13–16.

[6].Wheeler, G.E., Sheppard, N.P., Safavi-Naini, R., 2004. Weighted segmented digital watermarking. In: Third International Workshop on Digital Watermarking, Seoul, South Korea, pp. 89–100.

[7] B. Yang, M. Schmucker, W. Funk, C. Busch, S. Sun, Integer dct-based reversible watermarking for images using companding technique, in: E.J. Delp III,
P.W. Wong (Eds.), in: Proceedings of the SPIE, Security, Steganography, and Watermarking of Multimedia Contents VI, 2004, pp. 405–415.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

[8]. I. Natgunanathan, Y.Xiang,Y.Rong,W.Zhou,S.Guo,Robustpatchwork- based embedding and decoding scheme for digital audio watermarking, IEEE Trans.Audio,Speech,Lang.Process.20(8)(2012)2232–2239.

[9].Y.Xiang,I.Natgunanathan,S.Guo,W.Zhou,S.Nahavandi,Patchwork-based audio watermarking method robust to de-synchronization attacks, IEEE/ ACMTrans.Audio,Speech,Lang.Process.22(9)(2014)1413–1423.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Precision Based Rough Set Hybrid Recommender for Scalable Top-K Drugs

K.A.Vidhya
Department of Computer Science
Anna University
Chennai
avidhya06@gmail.com

T.V.Geetha
Department of Computer Science
Anna University
Chennai
tv_g@hotmail.com

Abstract— **The exponential growth of information on healthcare in current years, steered to the mining of unstructured and structured health data, putting information about drugs and their adverse effects (in relation to particular symptoms and diseases) into the hands of pharmacists, doctors and patients, information that can be applied to make appropriate recommendations. Current health recommendation systems opt either for a collaborative recommendation or content-based recommendation where the recall is higher, compared to the precision of the drugs recommended. A scalable hybrid recommendation system has been proposed which uses the rough set for pruning the decision tree to improve precision without comprising much on recall. This work aims to assist healthcare practitioners to recommend drugs to patients based on review ratings provided by similar patients with similar illnesses. Patients allergic to certain drugs can refer to the drug toxicity level for medications recommended by the system using the same user-mined review ratings from health care blogs. Based on patients' personal symptoms, drugs are mined through a large knowledge base for extracting all the possible ones, including synonymous drugs, using linked open data. However, in content-based filtering, forming rules using decision trees for the complete linked open data from large, connected graph structures requires proper scalability using MapReduce framework. The decision tree is converted to a set of rules further pruned by the rough set pruning method, the rough set theory being a soft computing technique that deals with uncertainty in data. The resulting rules are further pruned using the rough set theory, and the precision improved by 99.4% more than state-of-the-art methods.**

Keywords- Rough set theory, Linked Open Data (LOD), Big Data, Recommender System

I. INTRODUCTION

The availability of online health resources, such as electronic health records and drug related features - like drug-drug interaction, drug-toxicity level, drug rating, adverse drug effects and information on the most frequently used drugs - calls for an advanced health care recommendation system. Adequate familiarity and acquaintance in the field of medicine and the ever-increasing growth of online purchases of (over-the-counter) drugs have led to increasing numbers of patients or persons related to the patients trying to buy drugs through e-purchase in pharmacies. One of the examples we knew is Drugstore [9]. However, there are issues in buying medication through e- shopping even though it is very easy and comfortable to buy. With respect to the date of expiry or the strength of the drugs in question, the issue of risk factor might be higher of purchasing non-effective medicine due to the unethical and exaggerated information on the website/s concerned. These factors have paved the way for the development of personalized healthcare systems using the recommender system.

The chief issues pertaining to medical datasets have to do with identifying the number of drugs available in the market; analyzing the exact dosage level for the selected drug, ascertaining the adverse effects of the selected drug and, finally, going through the molecular combination in the drug (drug discovery). The future of the semantic web infrastructure includes both linked open data [23] and big data where enormous amount of data are connected and linked by a Uniform resource identifier (URI). This work aims to present the general public, including practitioners and pharmaceutical companies, information on drug dosage, adverse drug effects, and drug side effects. Interaction with the system helps one 9on effectiveness and toxicity level. The ratio depends on the drug's composition, i.e., the set of molecules as well as contraindications. The ultimate function of the system is to provide a drug database, arrived at after years of study in the fields of medicine and pharmacology, which helps describe drug characteristics in plainly-written text easily understood by the average layman for its simplicity.

The proposed work fetches similar drugs and looks at their side effects in terms of toxicity levels so they can be identified and recommended to medical practitioners. For examining drug-drug interaction, drug toxicity, drug indication, and adverse drug effects, existing standard, linked open terabyte-sized datasets have been used alongside linked graphs, matched or aligned with four biomedical ontologies [4]. To address the issues above, a hybrid recommendation system has been proposed which advocates top-k related drugs from a user-rating matrix and content-based recommendation exploiting numerous bio-medical ontologies and the available web of data. The flow of the paper is as follows: Section 2 discusses the related work. Section 3 discusses in detail the pruning technique involved in the proposed system. In Section 4, the recommendation system to handle uncertainties in large datasets has been presented. In Section 5, implementation details are offered, followed by Section 6 that provides various

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

experimental results and discusses the evaluation of the system. Finally, the conclusion and future work have been presented in Section 7.

II. RELATED WORK

The era of big data analytics was set in motion because of the continuing digitization of health records, together with the (EHR) Electronic Health Record provide novel ways and means to analyze many clinical problems and administrative issues. Clinical decision support has been a popular area of research where there is a need for big data technologies that address a significant aggregate of information to identify, to segregate, to gain knowledge, and foresee the outcomes or to suggest an alternate way for curing to the professionals and the patients . Predictive data mining process of personalized health care and the diagnostic result can influence personalized health care in real time for the effective treatment of patients.

Several recommendation methods have been implemented in healthcare applications to provide healthcare services. In [10], Duan et al. proposed a nurse care recommender system. Kim et, al., [11], in their work, developed a personalized health care service system to suggest item recommendation with reference model based on the context-aware scenario. Chen, et. Al., [12], in their study, proposed a diet recommendation system based on domain experts about certain chronic illness and recommended diet food chart for the user with the facts on their fitness. Although these studies illustrate the value of healthcare personalization, most suggest treatments tailored from just raw data, primarily pharmaceutical and commercial. Yin Zhang et al. [34] proposed a novel cloud-based medicine recommendation (COMER) which intends to find the appropriate medication from the online store. Public health records need big data analytic solutions that can mine web-based and data to predict outbreaks of flu: based on consumer searches, social content [1] and query activity. To provide personalized healthcare services, extensive data should be mined using machine learning techniques intended to develop useful healthcare applications. Using various methods, many recommendations that have come within reach are developed for sophisticated use.

The personalized recommendation technologies generally make use of similarities based on users or items recommended obviously there should be a collaborative environment to decide on the collective similarity measure. In COMER [34], collaborative filtering is used with the Tucker tensor decomposition algorithm to recommend medicines. Yin Zhang et al. proposed a cloud-based medical recommendation system which can suggest top-N related medicines to users, in accordance with their symptoms. Firstly, drugs are clustered into several groups in line with functional description information and recommendations made based on user-collaborative filtering. The results arrived are enriched by modelling and thereby constructions the user-symptom-medicine tensor matrix with the help of tensor decomposition. A major drawback of the collaborative filtering is data sparsity, leading to problems with cold starts.

In context-aware recommender systems [16], the HOSVD [32] is applied to eliminate the difficulty of sparsity and exact recommendations that have very few available non-zero context based user selection alleviating problems with excessive sparsity are generated using the higher-order singular value decomposition (HOSVD) technique. At the end point, the process is checked and calculated each contextual influence coefficient that every single type of context factor that is influencing user selection and then built a new N-order tensor with the help of the weighted linearization process to suggest positive recommendations. The recommendation usually needs a foundation of knowledge in the specific attribute related to the facts, which can be named as knowledge recommendation systems. During the process of data analysis transaction, the association rule based recommendation quiet often appears that helps to discover links to recommended objects by creating personalized recommendation. In a diabetes medication recommendation system [24], Chen et al. proposed domain ontology for diabetes that predicts the corresponding symptoms and efficiently chooses the most suitable drug from the given pool of drugs.

Content-based recommendation discerns user interest based on physiognomies of the user's past history, and makes recommendations owing to the degree of the user's interest and the items to be anticipated can be matched. In 2014, a web-based system [8] was proposed by Y.Chang et al. that not only recommends alternative drugs to the user but also avoids certain drugs with a high level of toxicity when combined with others. The authors use both semantic web and data mining technologies for feature generation from user inputs and drug datasets, followed by an analysis of interactions using rule-mining. In recently times, the use of the semantic web to solve the problem of recommendation is becoming increasingly popular [2]. It is, however, necessary to understand what linked open data is, in tandem with work related to the integration of linked data and linked data feature extraction [14]. The use of ontological approaches [26] in healthcare is an evergreen research area. As new drugs come in, and the purpose of a drug‘s use differs somewhat from its use earlier, brand new areas of work come into play for researchers. In semantic information integration with linked data mashup approaches [5], a detailed investigation of semantic mashup research and application approaches in information integration are given, and an application is presented as an illustration of the proposed method.

Though many strategies are being in existence, a comparison of various strategies [10] for generating proportional characteristics such as; numeric, binary, or nominal from linked open data had been presented in the year 2014 comprising binary element creation, count feature creation, relative count feature selection, and tf-idf feature selection. A novel approach in the use of recommender systems in the medical domain has

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

been proposed in OpenSelfMed [26], a web application that keeps people better informed while treating the medical ailments which are not diagnosed by the physicians a.k.a over-the-counter drugs, i.e., self-medication.

III. PROPOSED SYSTEM

A host of medical databases is available with a large mass of information for scholars, doctors and medical practitioners to explore. The explosion of data in such incremental ratios is of little help to people looking for quick and accurate references, so semantic-based knowledge discovery offering intelligent, and quick references are needed. Such knowledge-based, intelligent medical healthcare systems will help practitioners and lay users diagnose possible ailments and select an appropriate combination of drugs for the patient concerned. For data processing, with the help of a single data model, the operations are being carried out with the application logics for mashup developers. The RDF model is being carried out using the vocabulary that brings about a general perception between the domain experts, users and machines. It is usually considered that a linked data MashUp is comprised of various pieces of technology.

Terabyte-sized medical linked open data like Sider [5], drugbank [9], and dailymed are mashed up or integrated using a silk workbench. Standard biomedical ontologies like the FMA, NCIT and SNOMEDCT are used to extract similar drugs, drug-drug interaction, drug-allergy interaction using the toxicity level, and additional parameters contributing to the result. FMA, DOID, SNOMEDCT, NCIT, and UMLS are the various ontologies used. The number of rdfs is of size 19982 triples. The ontologies are given to the FalconAO tool to be matched, and the tool generates alignments and matchings and gives the output in the RDF format. The output of FalconAO tool has to be parsed in order to be used. The file in the RDF format is given to an XML-like parser which extracts classes and labels. Standard biomedical ontologies like the FMA, NCIT and SNOMEDCT are used to extract similar drugs, drug-drug interaction, drug-allergy interaction using the toxicity level, and additional parameters contributing to the result. For example, if the user inputs “heart attack,” the synonym “myocardial infarction” is retrieved from the linked open data.

Example: Heart attack → Myocardial Infarction.

QUERYING LINKED OPEN DATA

```
SELECT DISTINCT ?drug_uri ?drug ?drug-type ?name ?drug-interaction ?dosage
 FROM <http://linkedlifedata.com/resource/drugbank>
 WHERE {
   ?drug_uri a drugbank:drugs .
   ?drug_uri rdfs:label ?label .
   OPTIONAL { ?drug_uri drugbank:drug ?drug . }
   OPTIONAL { ?drug_uri drugbank:drug-type ?drug-type . }
   OPTIONAL { ?drug_uri drugbank:name ?name . }
   OPTIONAL { ?drug_uri drugbank:synonym ?synonyms . }
   OPTIONAL { ?drug_uri drugbank:dosage ?dosage . }
   {{FILTER regex(?label, "Acetaminophen", "i")}
    UNION
   {FILTER regex(?brandName, "Acetaminophen", "i")}
   }
}
```

A. Content-Based Recommendation

Drug dataset resources available on the linked open data cloud are utilized in designing a recommender system [10] to create an integrated drug database. The recommender system also uses content-based filtering with machine learning techniques to suggest drugs to patients based on their illnesses. The C4.5 algorithm is used to form rules for retrieving similar drugs as the data size is huge.

The MapReduce framework is used for drugs A-Z, splitting them into {A-G , J-M , N-R and S-Z} four mapper classes. A decision tree is formed in an individual mapper class and the rules converted into attributes and class tables for decision tree-pruning using a rough set theory. As the rules are converted into a decision tree, the left, and the right child of a node which does not contribute to the information system are pruned using the rough set theory concept. In the following sections, modules detailing content-based filtering and addressing the issue of linked open big data have been presented.

B. MapReduce Framework

The input data is segregated into suitably sized splits and the map method generally considers a sequence of key or sequence of value pairs. The value pairs or processed key are sent to a specific reducer in which some portion functions a little bit later, soon after the querying lod the features are sorted and shuffled. Now the Reduce process iterates all the way through the values which associate with exact keys and turns out either some more outputs or zero.

Querying linked open data and profiling records from biomedical datasets require a highly scalable framework. The disease, symptoms, drugs, drug-drug interaction, gene ID, PharmaKB and so on are chosen attributes directly queried using four mapper classes, and the building of the individual profile is done in the reducer phase with de-duplication. The testing dataset consists of a random sampling of records from the training dataset, and the system performance tested using the test records. Based on the profile above, identifying a particular drug for a given symptom from the content requires processing of the entire attribute list to fetch the matched drugs.

C. Decision Tree

To construct a decision tree from linked open dataset profiles which have a very large list of attributes, and identifying the correct set of attributes for the requested query can be done using a threshold value. However, an optimal threshold value for a decision tree to branch is hard to decide. The decision tree is allowed to grow recursively succeeding to the algorithm, for pruning the tree soon after to produce an excessive consistent tree by abandoning a single or more sub-

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

trees by substituting them by the leaves, or replacing the sub-tree with one of its most frequently used branches.

When considering for an attribute choice of selection calculation is a heuristics for choosing the splitting criterion for splitting the attributes, which effectively divides the data provided for the partition, 'D' from the class , labelled as training tuples into separate unique classes. The attribute with best score, is the splitting attribute for the given tuples. Partition 'D' is labelled that is framed out of the tree node with the assistance of the splitting creation. The segregation as branches developed for every output of the criteria, as a result, the partitions have been done on the tuples accordingly. The C4.5 utilise the gain ratio according to the attribute selection measure. Inspite of utilising the information gain as in the case of ID3, the information gain ratio goes away with a dilemma of attribute selection for many values. The count of the classes exists is denoted by 'C' and the ratio of the instances "I" which are assigned to nth class is given by p(I, n). Therefore, the entropy of attribute 'S' from literature [2] is calculated as:

$$\text{Entropy}(S) = -\sum_{n=1}^{c} p(I,n) * \log(p(I,n)) \quad (1)$$

$$\text{Gain} = \text{Entropy}(s) - \sum_{v \epsilon values(T_s)} \frac{|T_{S,v}|}{|T_S|} * \text{Entropy}(I_V) \quad (2)$$

where $T_S$values T is the set of values of I in T , T_S the subset of T induced by S , and $T_{S,V}$ the subset of T in which attribute I has a value of v. Therefore, the information gain ratio of attribute I is defined as:

$$\text{GainRatio}(I,T) = \frac{\text{Gain}(I,T)}{\text{SplitInfo}(I,T)} \quad (3)$$

$$\text{SplitInfo}(S,T) = -\sum_{v \epsilon values(T_I)} \frac{|T_{I,v}|}{|T_I|} * \log \frac{|T_{I,v}|}{|T_I|} \quad (4)$$

Using this, the rough set (U,A,S,f) is used to prune such rules in order to further reduce the 'm' classes for a set of data in which number 'n,' with 'nc' being the class 'c' with the highest number of data. If it is forecasted that all upcoming examples will be in class c, the following equation is identified for predicting the expected error rate 'Em' where, 'm' is the number of classes for all data and $E_k$is the expected error.

$$E_m = (n - nc + m - 1) / (n + E_k) \quad (5)$$

The other way is transforming the final decision tree to a collection of decision rules, where one rule for each leaf in the tree can easily be rewritten, otherwise the actual set of rules raises with the leaf nodes of the tree. T_s / t_o ‰ t_o is the number of postivie instances handled by rule T_s. The following rule set apparently dont address the negative instances as fast as possible and generate special rules which can handle the noisy instances.

Information gain: T_s ($\log(T_s / t_o) - \log(P/N)$) ‰ (6)

T and N are the positive and total numbers apparently before adding the new condition. Information gain accentuates positive instances in the pool of attributes.

D. Rough Set for Decision Tree Pruning

Decision tree rules are pruned using a rough set theory that applies the rule-generation algorithm for pruning the rules necessary. Thereafter, using the query string, all the retrieved drugs connect information across multiple linked open data and the tree structure is visualized using a number of rules that vary, based on the information in the knowledge base. The rules formed are pruned using the rough set minimum rule generation algorithm. The minimal subset of the original dataset is the reduct set. The definition of positive region, discernibility measure between the attributes and their significance are used for the computation of reduct set.

From the literature, the reduct $R_{\min}$ is modelled as a minimal subset R which is the reduct set of the initial attribute set C such that for a given set of decision attributes. The degree of discernibility is maintained and hence, a minimal subset by this definition may not be the global minimum. A given dataset may have many reduct sets, and the collection of all reducts is denoted by

$$R_{all} = \{X \mid X \subseteq C, \gamma_X(D) = \gamma_C(D)_{\gamma X - \{a\}}(D) \neq \gamma_X(D) \forall a \in X\} \quad (7)$$

The intersection of all sets in $\boldsymbol{R_{all}}$ is called the *core*, the elements of which are those features that cannot be eliminated without introducing more contradictions to the representation of the dataset [2]. For many tasks, a reduct of minimal cardinality is ideally searched for attempts to locate a single element of the reduct set $\boldsymbol{R_{min} \subseteq R_{all}}$:

$$R_{\min} = \{X \mid X \in R_{all} \forall Y \in R_{all}, \mid X \mid \leq \mid Y \mid\} \quad (8)$$

The core set is retained, and the reduct set from the upper approximation can be applied for the pruning method, wherein the data in the boundary can be rejected or neglected.

E. Collaborative filtering

The recommender system uses a collaborative filtering technique to recommend top-N related medicines to patients, according to their symptoms. Collaborative filtering is done using a patient database created using data crawled from health and social circles.

RSDP- Rough Set-based Decision Tree Pruning Process

1. Query from the end user (User, disease, and symptom)
2. Form an alignment with ontologies and linked data (L1,L2,L3.....Ln).
   Input: UMLS, LOD dataset, and SNOMED
   Find OWL: same as terms {S1, S2, S3, S4, S5…} for the given disease
   Group all the synonyms and find the different drugs prescribed {D1, D2, D3, D4 and D5}.
3. The Mapper takes {M1.....M4} linked open data as input.
   a. Pre-processing of LOD data

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

b. SPARQL query on Sesame reports. Retrieve features of selected drugs using labels.
c. <Mapper and Shuffler> Rule determination
Input: Given drugs and retrieved drugs
Output: Drug with interaction rules
Get interaction between every pair of drugs from the drug: interaction parameter.
Eg:
drug 1, drug 2 , effect 1 > toxic
drug 1, drug 2, effect 2 > not toxic
drug 1, drug 3, effect 1 > toxic
d. <Reducer> Reduced pool
Input: Pool of drugs
Output: Final reduced drug pool
Compare interaction of the given drug to the set of interaction rules. Remove from HashMap drugs with toxic on RHS.
<HashMap> ={D1,D2,D3,,,,,Dn}
Compare side effects with a set of severe side effects and remove from the set. Compare with user input and remove the directly allergic and those already taking drugs.

4. A decision tree construction with the input above.
a. Convert into attributes and table structure with the set of rules {R1,R2.....Rn}.
b. Prune rules using rough set rule pruning algorithm where the rules are not significant (identified using entropy calculation). Use this as information gain criteria for the rule pruning method. p ($\log(p_s / t_o) - \log(P/T)$)

By taking in to account of the inadequacies of the collaborative filtering, like expensive computing with cold starts, and data sparseness, another approach is considered where medication is suggested by modelling and representing the user-symptom-medicine using tensor matrix. Drugs are clustered using the K-means clustering to check the drug's molecular combination and the description of drug information, following which the user rating (previous history) is applied to rate drugs for a particular symptom. Given that collaborating filtering has been used to achieve this, every time a user inputs symptoms of an illness, the nearest drug matching is obtained as a top-k drugs, most suited to the user's needs. From the said drug list, the user score of the drug is retrieved, processed and saved as a user-drug-rating tensor matrix.

User drug rating matrix construction is done by creating a file with a user_id, drug_id, symptoms, rating and constructing a matrix using Hashmap. The similarity measure is calculated using the Pearson correlation coefficient taking the input as a user_id (existing user) or a symptom (new user) and calculating similarity, that is among the two variables X and Y there exists a linear correlation (dependence). The positive correlation is indicated as 1, the negative correlation is indicated by -1 and 0 signifies there is no correlation between the two similarity measures. Drugs are recommended using the compute weighted sum applying the similarity matrix, and top N drugs are returned as recommended. The list of recommended drugs, drug ids and symptoms are sent to the Sesame triple store, just as links for the given drug_ids, as well as drugs for given symptoms, are retrieved.

The clustering of drugs is done according to the efficacy of the patient's treatment, the traditional K-means clustering algorithm has been implemented to achieve better clustering results. The output of the algorithm is clusters of drugs, with symptoms as a tag of the clusters. Features extracted from LOD are converted to feature vectors. Features are symptoms the drug can cure with its efficacy. The features are extracted using the vector space model. Feature vectors and the number of clusters are given as inputs to the K-means clustering algorithm, used to obtain drug clusters based on features (symptoms).

F. Tensor decomposition

A tensor, can be portrayed as an N-dimensional vector. The user-drug-symptom matrix can be represented as 3-order tensor, each co-ordinate can represent a particular representation [16]. This can be termed as higher-order tensor which gains accurate results for predicting the personalized recommendation. The hierarchical structure of the XML documents has to be exploited using the multidimensional representations, such as those offered by tensor objects which is much desired by the medical web pages available today. Instead of the standard singular vector decomposition method for term document matrix representation, a tensor decomposition matrix method has been used which represents the drug-symptom-allergy as a 3-dimensional tensor. The tensors are represented as the multi-dimensional array for the given problem. In this paper, tensor vectors are denoted by 'v.' Matrices for these two-dimensional tensor are denoted by '**V.**' Higher-order tensors are denoted by ***T***.

During the process, either the order or the rank of the tensor is determined by the count of indices required to select from the dimension of the array. The order 2 tensor can be depicted as $\boldsymbol{T}_{ij}$ where i and j are the dimension of the related vector space. A real p-th order tensor Aϵ $\bigotimes_{i=1}^{p} R^{n_i}$ is the member of the tensor product of Euclidean spaces $R^{n_i}, i\epsilon[p]$. The general restriction to the case where $n_1 = n_2 = n_3 = \cdots \ldots = n_p = n$ is simply written Aϵ $\bigotimes^{p} R^{n}$ to denote its p-order tensor.

Collaborative Algorithm for TopK-Drug Selection

Input: Crawled medical documents Output: Top-KDrugs with features

1. Calculate the similarity calculation among users using the Pearson co-efficient

$$\mathrm{sim}(x,y) = \frac{\sum_{i\epsilon I}(S_{x,i} - \bar{S_x})(S_{y,i} - \bar{S_y})}{\sqrt{\sum_{i\epsilon I}(S_{x,i} - \bar{S_x})^2 * \sum_{i\epsilon I}(S_{y,i} - \bar{S_y})^2}}$$

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

where 'í' is the set of all drugs and $S_{x,i}$ and $S_{y,i}$ represent the rating 'i'of the drug from user x and user y respectively. $\bar{S_x}$ and $\bar{S_y}$ represent user x,y average rating of drugs.

2. Identify features using the VSM algorithm.

3. Model drug-user-rating matrix using tensor factorization as {d1-u1-r1,d1-u2-r3,……..}. Given the users and a set of similar users $U_n=\{u_1,u_2 \ldots u_n\}$, the preference of u for an unseen rating of a drug can be predicted using the predicted degree of adverse effects, rating or preference from the user U_n. R is the predicted degree of interest and 'sim' the similarity between the users.

$$R(u, d_i) = \sum_{j=1}^{n} sim(u, u_j) R(u_j, d_i)$$

4. The drug with top ratings is clustered using the K-Means algorithm.

The first step is tensor modeling, which takes drug clusters with the symptom tag as input and produces the User-Drug-Rating 3D tensor as output. Using the threshold weight for each drug which has to be multiplied with the rating given by the user, the weight is designed to perform tensor modeling. Thus, the rank-3 tensor matrix is constructed with the user, drug, and rating which reduces sparseness in the matrix. The next step is the actual tensor decomposition using the Tucker tensor decomposition algorithm, where certain elements change from zero to non-zero by higher order singular value decomposition (HOSVD).

The weights of the new elements obtained represent the predicted scores that the users give to the drugs, according to the rating. The module analyses interactions between drugs that can be recommended and drugs that have already been administered, and identifies interactions that cause adverse side effects, toxicity or allergies. These drugs are eliminated from the pool of drugs that can be recommended, with the input given by the patient also considered for their elimination. The first step is retrieving the base pool of drugs. All drugs related to user inputs are retrieved from the integrated drug database, along with the drugs that interact with them. From this, the interaction of each drug with other drugs from the pool is observed, the toxicity parameter retrieved and drugs that cause these interactions removed from the HashMap. Next, the side effect label is retrieved and drugs that cause severe allergic side effects are eliminated. Further, drugs that are already being taken by the patient are eliminated along with drugs that contain molecules the patient is allergic to. Consequently, we obtain a reduced set of drugs for the recommendation.

IV. Implementation Details

As the first step in implementation, ontologies are aligned for feature extraction. There are five different biomedical ontologies used to create new alignments and mappings, presented in Table 1. The final mapped ontologies RDF file is of size 19982 triples. The tool used is FalconAO tool which utilizes the LMO and GMO to align ontologies, satisfying the demands of the linguistic matching of ontologies (LMO). Here, the input is ontologies and the output matched entities, and the process carried out through string similarity (SS), edit distance of entity names, document similarity, and Tf-IDF F with cosine similarity for the LMO method. In the case of graph matching of ontologies (GMO), the input is matched entities and the output additional matched entities, and the process rather like structural mapping using built-in properties (OWL, RDFS, RDF).

A. Linked Open Data MashUP

The first step is the pre-processing stage, wherein the Sesame workbench is downloaded and dependencies configured. New repositories are created and RDF triple dumps of LOD datasets added. The next step is link generation, where actual links between datasets are generated and established. The SPARQL end points of datasets are added to the silk workbench, along with the RDF output file of the ontology mapping module. The source dataset and target dataset are specified in the link task, with the link specification language (LSL) being used to generate same-as links between datasets. Finally, the silk mapping files generated are converted to actual links between datasets using the PHP. Scripts are written to connect to a D2R server, retrieve mappings, match URIs and generate actual links. The updated URIs are also added to the Sesame triple store.

The final mappings done are sider-DBpedia, drugbank-DBpedia, sider-drugbank, diseasome-DBpedia, dailymed-DBpedia, sider-dailymed, diseasome-dailymed [17] and diseasome-drugbank. Drug data extraction creates a database of patients, symptoms and ratings of drugs for patients by crawling and extracting data from various health websites. This patient database is used to find similar users to perform collaborative filtering. The necessary websites are identified and their page structure analysed. These websites are specified as seed URLs from which all the links are extracted using the JSoup library.

Inessential links such as Contact Us, or Twitter, are stripped and the remaining links explored recursively using JSoup. Drug ratings, symptoms and diseases are obtained by parsing the HTML page and, finally, text processing done to eliminate irrelevant words and retain only the drug with its symptoms/diseases and ratings. Two major websites like walgreens.com and druglib.com are crawled to retrieve patients' drug ratings. The largest drug retailing chain in US is the Walgreen Company. Drugstore.com, a part of Walgreens, contains drugs with consumer ratings. 20,000 records have been retrieved. The most comphrehensive drug database is owned by druglib.com with relevance to specific drugs. 19,835 records have been retrieved. JSoup parser returns to extract information from the seed URL and the link. Tensor decomposition is implemented in Java and the sparse

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

matrix constructed to outwit problems with the collaborative filtering's cold starts.

III. EXPERIMENTS AND EVALUATION

For evaluating the performance of top-K drugs recommendation systems, the most popular metrics used is precision and recall. When the user ratings are considered, it has to be split up in to a training set and a test set, the train algorithm applied on where the user ratings are calculate, split them into a training set and a test set, train the algorithm on the training set, and thereafter predict the top N items from that particular user's test set. The precision is called the number of retrieved instances, while recall is the fraction of relevant instance that are retrieved. Metrics and accuracy are calculated as follows,

$$Precision = \frac{\sum_{i=1}^{M} \frac{User\ Rated\ \ drug_i \cap Lod\ drug_i}{N}}{M} \quad (9)$$

where M is the number of users, recommended medicine$_i$ the predicted rating, and N the number of drugs recommended. The recall rate calculation function is shown below:

$$Recall = \frac{\sum_{i=1}^{M} \frac{user\ rated\ d_i \cap LOD\ drug_i}{H_i}}{M} \quad (10)$$

where M is the number of users, hitmedicine i the predicted rating, N the number of drugs recommended, and Hi the real rating given by the user. The 10 most similar users are selected to calculate all the ratings of drugs not scored by the given user, following which the top-N drugs with the highest predicted score are recommended. In content-based filtering, the average score of the user is utilized with association rule mining to predict ratings for drugs similar to the ones already rated by the user. For different lengths of the recommendation list, namely, 1, 3, 5, 10, 15, 20, 25, and 30.

we get a comparison of the experimental results of collaborative filtering (CF), collaborative filtering (CF) with tensor decomposition (tensor), and content-based filtering (content) and combination of both content-based, as well as collaborative filtering techniques, improves the performance of the system in recommending relevant drugs, Figure 2 depicts the precision rate chart and the recall rate chart and the F1 measure chart. The experimental results make clear that the cold start problem in recommendation is solved using the tensor decomposition when compared with the normal collaborative system. For implementing the content-based filtering system, a decision tree using the C4.5 algorithm is initially constructed, given the infeasibility of constructing one for the entire linked open drug that has been aligned. Consequently, the map-reduce framework is used for parallelizing the work and the drug-symptom-disease kind of relation rules constructed using a distributed file system.

The construction of rules is done in each map task; likewise, the work is carried out in 2 clusters, based on the alphabetical order of the drugs. There are two master nodes and 10 data nodes, each of five, connected to a single name node. Since the default block size 4MB cannot support the decision tree for rule construction (attribute) and final decision attribute, the block size is changed to 64MB. The shuffle phase of the Map Task combines all decision values and sets of attributes and, finally, the reducer removes the pruning of redundant rules using the rough set theory. In the reduce phase, along with the removal of recurring rules, the removal of the reduct set is computed using the Quickreduct from the literature reviewed.

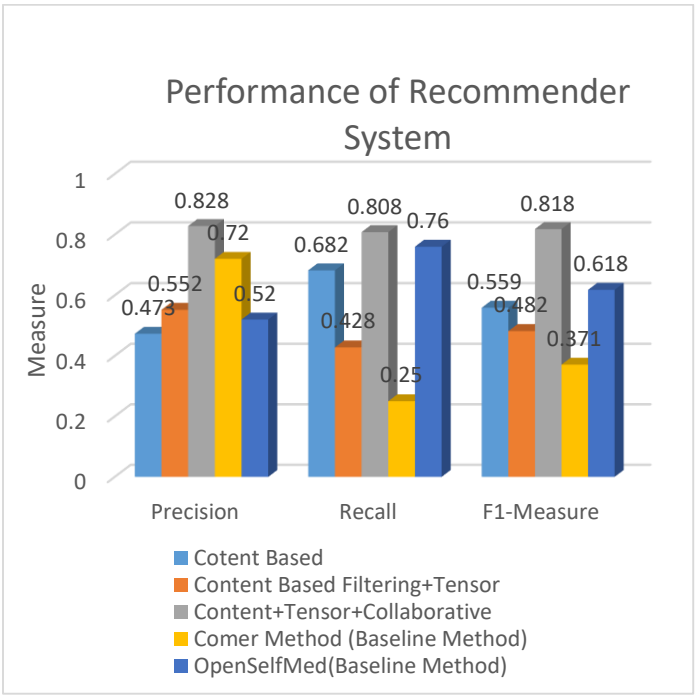


Fig1: Precision, Recall and F1-Measure Metrics for the Designed System Chart for Collaborative, Content-based and Collaborative with Tensor Decomposition

The construction of rules is done in each map task; likewise, the work is carried out in 2 clusters, based on the alphabetical order of the drugs. There are two master nodes and 10 data nodes, each of five, connected to a single name node. Since the default block size 4MB cannot support the decision tree for rule construction (attribute) and final decision attribute, the block size is changed to 64MB. The shuffle phase of the Map Task combines all decision values and sets of attributes and, finally, the reducer removes the pruning of redundant rules using the rough set theory. In the reduce phase, along with the removal of recurring rules, the removal of the reduct set is computed using the Quickreduct from the literature reviewed.

The dataset for testing consists of a random sampling of records from the training dataset. The dataset comprises about a million evaluation records chosen randomly and excluded from the training dataset. The system's performance is tested using the test records, and the results summarized below. The drug dataset created from the linked open is of a size approximating 5 million, out of which the decision tree is formed using the procedure above.

Since the efficiency of the C4.5 is theoretically and empirically proved, the concern in the study is with the time efficiency of a parallel version of the C4.5 in a big data environment. In the

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

linked open dataset, there are 120 attributes, the class label is diseases, and the decision yes or no for the set of drugs for the corresponding symptoms.

Fig 3 shows the execution time of different sizes of sample datasets where the x-axis denotes the numbers of instances in training data. Moreover, Fig 4 provides the speed-up performance of miscellaneous numbers of training instances as the number of nodes escalates, where speedup is a popular

TABLE 1: QUERYING LOD DRUG-DISEASE TARGET

Query	Chemical Component	Diseases Targeted	Precision	Recall	F-measure
Q1	Fumarate clobazam progabide	Epilepsy	0.782	0.892	0.833
Q2	Enalkiren	Hyperproteinemia	0.632	0.832	0.718
Q3	Estriol	Migraine	0.784	0.845	0.813
Q4	Amiodarone pindolol Arbutamine esmolol	Congestive heart failure.	0.872	0.863	0.867
Q4	Cyanocobalamin	Methylmalonic aciduria	0.765	0.856	0.808
Q5	Pindolol chloroquine	Asthma	0.876	0.876	0.876
Q6	Mianserin	Schizophrenia	0.932	0.756	0.835
Q7	Docetaxel Azathioprine Sunitinib	Leukemia	0.786	0.695	0.738
Q8	Fluvastatin	Attenuated cholesterol lowering	0.654	0.856	0.741
Q9	Nitroarginine Deserpidine	Alzheimer's Disease	0.759	0.945	0.842
Q10	Phenmetrazine	Brunner_Syndrome orthostatic intolerance	0.653	0.763	0.704
Q11	Chloroquine norgestimate	Migraine	0.765	0.856	0.808
Q12	Rofecoxib	Williams-Beuren Syndrome	0.876	0.776	0.823
Q13	Vasopressin	Diabetes_insipidus	0.932	0.856	0.892

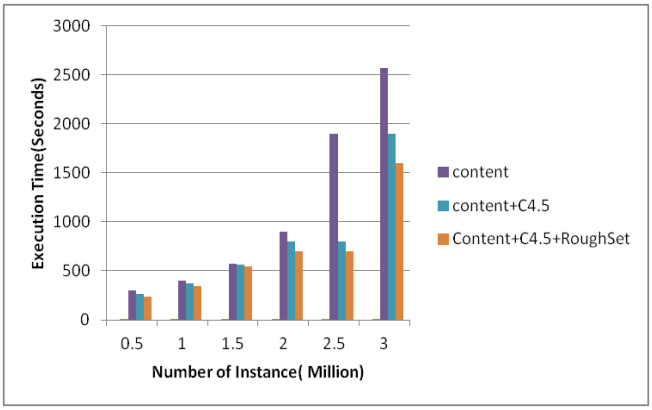


Fig 2: Performance of Map-Reduce on a Single Node

measurement of all the task tracker has been defined as the ratio of the execution time to that of specific numbers datanodes. From Figures 2 and 3, the observations are made: the larger the training dataset used, the more the cost of the execution time; the more nodes used, the shorter the execution time; and if enough nodes are leveraged, even if the size of the dataset is big, performance can be close to optimal. Thus the hadoop infrastructure maintains an implicit control over the execution time for all the number of nodes

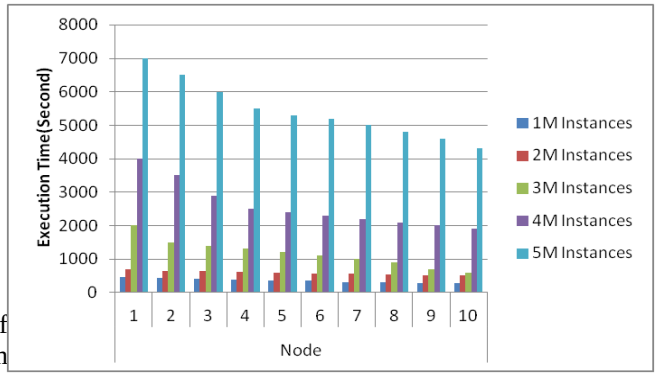


Fig 3: Performance of Map-Reduce on 10 Nodes

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

IV. [1]Conclusion and Future Work

A scalable hybrid recommendation system has been proposed for handling large medical datasets to meet the challenges of efficiently suggesting top k-drugs. The tensor recommendation overcomes the shortage of collaborative filtering when dealing with massive and sparse medical data. Furthermore, the system positively provides effective medication recommendation to satisfy the demands of versatile requests even though linked open data processing is time-consuming. Queries pertaining to drug-drug interaction, drug-allergy analysis, drug adverse effects, gene-diseases association and user ratings of a particular drug are obtained from the semantic web using the MapReduce framework and rough set decision pruning method. Patient-specific drugs tailored to treat a particular disease are suggested using the proposed system. Linked open data has been processed to increase the efficiency of selecting user-appropriate drugs, and also exploit its vastness, structure and detail. For future work, we are planning to develop a treatment recommendation system which suggest the latest treatment based on the patient review and the topological details which can be done by exploiting the clinical trials data.

Acknowledgment

I am greatly thankful for UGC in supporting this study, which was funded by DST PURSUE UGC, NEW DELHI, INDIA (9500/PD2/2014-2).

References

[1] P. Lops, M. de Gemmis, and G. Semeraro, “Content-based recommender systems: State-of-the-art and trends,” in Recommender Systems Handbook. Springer, pp. 73–105, 2011.

[2] Dipti D. Patil, V.M. Wadhai, and J.A. Gokhale, "Evaluation of Decision Tree Pruning Algorithms for Complexity and Classification Accuracy," International Journal of Computer Applications (0975 – 8887) Volume 11– No.2, December 2010.

[3] Prudhommeaux, E. and Seaborne, A. (2008) Sparql Query Language for RDF, W3C Recommendation. (2014) Sustainment Guide for Adverse Drug Events, Partnership for Patients Compaingn, Healthcare Government.

[4] Ceusters, W., Capolupo, M., Moor, D. and Devlies, J. (2008) Introducing Realist Ontology for the Representation of Adverse Events. Proceedings of the 2008 Conference on Formal Ontology in Information Systems (FOIS 2008), 237-250.

[5] Jentzsch, A. (2013) Sider. http://datahub.io/dataset/fu-berlin-sider/resource/e84dd6f3-f22e-4d4d-9ee8-e5b004eb654c

[6] A. B. Barrag´ans-Mart´ınez, E. Costa-Montenegro, J. C. Burguillo, M. Rey-L´opez, F. A. Mikic-Fonte, and A. Peleteiro, “A hybrid content-based and item-based collaborative filtering approach to recommend tv programs enhanced with singular value decomposition,” Information Sciences, vol. 180, no. 22, pp. 4290–4311, 2010.

[7] W. Carrer-Neto, M. L. Hern´andez-Alcaraz, R. Valencia-Garc´ıa, and F. Garc´ıa-S´anchez, “Social knowledge-based recommender system: Application to the movies domain,” Expert Systems with Applications, vol. 39, no. 12, pp. 10 990–11 000, 2012.

[8] Y. Zhang and E. Cheng, “An optimized method for selection of the initial centers of k-means clustering,” in Integrated Uncertainty in Knowledge Modelling and Decision Making. Springer, pp. 149–156, 2013.

[9] Jentzsch, A. (2013) Drugbank. http://datahub.io/dataset/fu-berlin Drugbank/resource/8fc23108-81d0-45f2-81ec-22ea41485f49

[10] L. Duan, W. N. Street, and E. Xu, “Healthcare information systems: Data mining methods in the creation of a clinical recommender system,” Enterprise Information Systems, vol. 5, no. 2, pp. 169–181, 2011.

[11] J. Kim, and K. Y. Chung, “Ontology-based healthcare context information model to implement ubiquitous environments,” Multimedia Tools and Applications, pp. 1–16, 2013.

[12] R.-C. Chen, Y.-D. Lin, C.-M. Tsai, and H. Jiang, “Constructing a Diet Recommendation System Based on Fuzzy Rules and Knapsack Method,” Recent Trends in Applied Artificial Intelligence, pp. 490–500, 2013.

[13] A. Jøsang, G. Guo, M. S. Pini, F. Santini, and Y. Xu, “Combining recommender and reputation systems to produce better online advice,” in Modeling Decisions for Artificial Intelligence. Springer, pp. 126–138, 2013.

[14] Y. S. Cho, S. C. Moon, S.-p. Jeong, I.-B. Oh, and K. H. Ryu, “Clustering method using item preference based on rfm for recommendation system in u-commerce,” in Ubiquitous Information Technologies and Applications. Springer, pp. 353–362, 2013.

[15] J. Liu, P. Musialski, P. Wonka, and J. Ye, “Tensor completion for estimating missing values in visual data,” Pattern Analysis and Machine Intelligence, IEEE Transactions on, vol. 35, no. 1, pp. 208–220, 2013.

[16] Middleton, E., Shadbolt, N. and Shadbolt, D.C. (2004) Ontological User Profiling in Recommender Systems. Proceedings of ACM Transactions on Information Systems (TOIS), 22, 54-88.

[17] X. Cai, M. Bain, A. Krzywicki, W. Wobcke, Y. S. Kim, P. Compton, and A. Mahidadia, “Collaborative filtering for people-to-people recommendation in social networks,” in AI 2010: Advances in Artificial Intelligence. Springer, pp. 476–485, 2011.

[18] A.J.G. Gray, P. Groth, A. Loizou, S. Askjaer, C. Brenninkmeijer, K. Burger, C. Chichester, C.T. Evelo, C. Goble, L. Harland, S. Pettifer, M. Thompson, A. Waagmeester, and A.J. Williams, Applying linked data approaches to pharmacology: Architectural decisions and implementation, Semant. Web J. (2012).

[19] Adomavicius, G. and Tuzhilin, A. (2005) Toward the Next Generation of Recommender Systems: A Survey of the State-of-the-Art and Possible Extensions. Proceedings of IEEE Transactions on Knowledge and Data Engineering, 17,734-749. http://dx.doi.org/10.1109/TKDE.2005.99

[20] Matthias Samwald, Anja Jentzsch, Christopher Bouton, Claus Stie Kallese, Egon Willighagen, Janos Hajagos, M. Scott Marshall, Eric Prudhommeaux, Oktie Hassenzadeh, Elgar Pichler, and Susie Stephens, Linked open drug data for pharmaceutical research and development, J. Cheminform. 3 (19) (2011).

[21] Peter Bloem and Gerben KD de Vries, “Machine learning on linked data: A position paper,” Linked Data for Knowledge Discovery, p. 69, 2014.

[22] R Celebi, O Gumus, and Y Aydin Son, “Use of open linked data in bioinformatics space: A case study,” In Health Informatics and Bioinformatics (HIBIT), 2013 8th International Symposium on, pp. 1–5. IEEE, 2013.

[23] Rung-Ching Chen, Yun-Hou Huang, Cho-Tsan Bau, and Shyi-Ming Chen, “A recommendation system based on domain ontology and swrl for anti-diabetic drugs selection,” Expert Systems with Applications, vol. 39, num. 4, pp. 3995–4006, 2012.

[24] Olivier Cure,´ “On the design of a self-medication web application built on linked open data,” Web Semantics: Science, Services and Agents on the World Wide Web, vol. 24, pp. 27–32, 2014.

[25] Yin Zhang, Long Wang, Long Hu, Xiaofei Wang, and Min Chen, “Comer: Cloud-based medicine recommendation,” In Heterogeneous Networking for Quality, Reliability, Security and Robustness (QShine), 2014 10th International Conference on, pp. 24–30. IEEE, 2014.

[26] Salvatore Alaimo, Rosalba Giugno, and Alfredo Pulvirenti, “Recommendation Techniques for Drug–Target Interaction Prediction and Drug Repositioning”, Data Mining Techniques for the Life Sciences, Methods in Molecular Biology, vol. 1415, DOI 10.1007/978-1-4939-3572-7_23, © Springer Science+Business Media New York.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Comparative Analysis of Image Depth estimation Techniques with AFM(Adaptive focus measure) - B-spline polynomial

K.Kanthamma [(1)] ,Research schloar,Department of Electronics and Communication Engineering, Rayalaseema University,Kurnool,A.P,INDIA,
E-Mail:kantha.srinivas@yahoo.in
Dr.S.A.K.Jilani [(2)], professor, Department of Electronics and Communication Engineering, Madanapalle Institute of Technology, Madanapalle, A.P, INDIA,
E-Mail: jilani_s_a_k@yahoo.com

Abstract— Shape from focus (SFF) techniques every now and again utilizes a solitary focus measure to get a depth map. Basic focus measures are settled and spatially invariant. In this paper we display a work depth estimation techniques using different focus measure operators and different interpolation techniques for better depth map. In this paper we developed three methods for image depth estimation. In the first method we are using Gray level variance as a focus measure operator for depth estimation. In Second method we developed chebysheve moments as focus measure operator along with Bezier-Bernstein polynomial for depth estimation. In the third method we use (AFM) adaptive focus measure operator along with B-spline polynomial for constructive 3D shape retrieval. It is tested on various image sequences of distinct focus images.

I. INTRODUCTION

Estimating depth is an integral part in computer vision, astronomical imaging, and microscopy [1-4]. In the process of projecting 3D real object in to 2D image one dimension is lost. It is impossible to project light model. Image depth can be estimated by using stereo imaging system or by taking sequence of images with a single camera whose external or internal settings are changed for every fabric [5]. Shape from focus is a passive method by which depth of the object can be recovered; we can estimate 3D shape [6]. Consider object distance u, focal distance f and image distance v the relation between u, v is $1/u + 1/v = 1/f$. the supreme focus will be reach when there is exact correspondence in to the focal plane location v and object distance u. So assessment of focal level is demand in shape from focus.

Recouping the 3D structure of a scene from multiple images is one of the principles investigate area of machine vision. Shape from focus is the customary methodologies which utilize the concentration as a cue for depth extraction of a scene. The SFF gauges the depth via hunting down the best focused scene from images set brought with various focus settings. For every image in the succession, the nature of focus is figured and the best focused image in the arrangement is resolved for every pixel.SFF can be acted like an issue of measuring the focus quality of image pixels. Although there are distinctive SFF approaches, such as every one of them utilize local windows to gauge the focus quality since it is extremely hard to quantify the focus quality utilizing a solitary pixel.

The local window approach expects that the surface of the articles in the scene can be approximated surface patches parallel to the image plane. This supposition not generally legitimate in this present reality since question protest surfaces can have extremely complex structure including depth discontinuities and non-equifocal surfaces. As an outcome the ordinary SFF strategy neglects to yield accurate outcomes about around depth discontinuities and inclined surfaces. Another issue with SFF strategy is edge bleeding, edge bleeding can be decreased by expanding focus measure window size. However using huge window sizes in focus measure produces mixed up results around depth discontinuities. Focus measure is a local property, normally assessed in a little 2D window around the purpose of intrigue.

In this paper we first recommend Gray Level Varience(GLV) as a versatile focus measure that can specifically bring about enhanced Depth maps. Shape from focus methods use isolated focus measure. Numerous elements, including window size, illumination, and noise level infect the rendering of focus. Focus measure is an amount which calculates quality of an image. When the image is best focused then the focus measure is high, and it decreases as the blurring increases.

In the second method the important interpretative properties of an image can be captured by using chebyshev moments. The image data stored in each moment is independent and the data redundancy between the moments is minimal. In the proposed method the depth map is calculated through Bezier-Bernstein polynomial [9] as an interpolation process applied on the chebyshev moment focus measure. The results are demonstrated.

In third method we use Adaptive focus Measure (AFM) as a non-linear filtering in the focus volume by adaptively changing the kernel size and weights. At long last the depth extraction can be performed by setting the depth values at

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

each indicate concurring the greatest focus level. Surface guess strategies scarcely adapt up to sharp depth discontinuities because of the smoothness imperatives. In this we employ B-spline interpolation for depth estimation.

II METHOD

A) GRAY LEVEL VARIANCE (GLV)

GLV focus measure computes the focus value by taking the variance of gray level values with in a small window. The difference of each gray level from the mean μ is amplified by the power function. This is applied on sequence of images to estimate best focused image. (26)

$$F_{VAR} = \frac{1}{N^2}\sum_{N}\sum_{N}(g(x,y) - \mu)^2 \text{ ----------(1)}$$

(B) CHEBYSHEV MOMENTS WITH BEZIER-BERNSTEIN POLYNOMIAL

The chebyshev moment applied as focus measure operator in sequence of synthetic images to obtain the depth maps of different scenes, to get best focus levels of image. Secondly apply the interpolation polynomial for the reconstruction of depth map. In this method Interpolation is performed by cubic Bezier-Bernstein polynomial.

The chebyshev moment of order for an image with intensity function $f(x,y), x \in \{0,1,..,M-1\}, y \in \{0,1,...,N-1\}$ is defined as[10,11]

$$T_{mn} = \sum_{x=0}^{M-1}\sum_{y=0}^{N-1} t_m(x;M)t_n(y;n)f(x,y) \text{ ----------(2)}$$

Where $t_n(x;N)$ and $t_n(y;N)$ are the normalized chebyshev polynomials defined by

$$t_m(x;M) = \frac{t_m(x;M)}{\sqrt{\rho(m;M)}}, t_n(x;N) = \frac{t_m(y;N)}{\sqrt{\rho(n;N)}} \text{ ------(3)}$$

The new focus measure is based on the chebyshev moments. Given an *MXN* image *f(x,y),* we normalize it by defining

$$f(x,y) = \frac{f(x,y)}{\sqrt{\sum_{x=0}^{M-1}\sum_{y=0}^{N-1}[f(x,y)]^2}} \text{ ----------(4)}$$

so that $\sum_{x=0}^{M-1}\sum_{y=0}^{N-1}[f(x,y)]^2 = 1$

If we denote the set of low and high-order chebyshev moments with *L(f:P)* and *H(f:P)* respectively, we have

$$L(f;P) = \{T_{kl} | k + l \le P\},$$

$$H(f;P) = \{T(f) | L(f;P)\}$$

a chebyshev moments-based focus measure:

$$M_T = \frac{\|H(f;P)\|}{\|L(f;P)\|} \text{ ---------- (5)}$$

The focus measure is the ratio of the energies in the high-pass band to the low pass band. For practical implementation we can write

$$M_T = \frac{\|f\| - \|L(f;P)\|}{\|L(f;P)\|} \text{ ---------- (6)}$$

We know that $\|f\| = \|L(f;p)\| + \|H(F;P)\|$ -------(7)

We implement cubic Bezier polynomial to evaluate perfect depth by interpolating neighboring frames of the beginning depth. In Bezier curve we need to concentrate more about the selection of proper controlling points, range vector (parameter for the polynomial curve), and input curve and input curve. we select four control points $(bb_{k-a} bb_k bb_{k+a} bbk+2a)$ The Bezier curve B (t) then in matrix form will be as [9,11]

$$B(t) = (t^3 t^2 t1)\begin{bmatrix} -1 & 3 & -3 & 1 \\ 3 & -6 & 3 & 0 \\ -3 & 3 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}\begin{bmatrix} bb_{k-a} \\ bb_k \\ bb_{k+a} \\ bb_{k+2a} \end{bmatrix} \text{ ------- (8)}$$

Where 0 *t* 1 is the polynomial parameter. By using the Bezier curve we can calculate the position of the maximum value. Then obtain the clear depth by adjusting the difference with respect to k_{th} position.

(C) AFM WITH B-SPLINE INTERPOLATION

The focus measure for an image pixel is figured over a limited support window in customary SFF [32][33] with the supposition that depth of the scene ought not change inside the window. To be free from edge bleeding and to deal with noise and homogeneous picture parts. The extent of the window must be sufficiently huge. Nonetheless, bigger bolster windows situated on depth discontinuities contain pixels from different depths which disregard the equifocal surfaces presumption. Subsequently, depth estimation around these districts would be in precise.

So as to recoup depth of surfaces around homogeneous and uproarious districts as well as around depth discontinuities, a legitimate bolster window ought to be chosen for every pixel adaptively. Expecting that image attributes contains signals about scene structure, it is conceivable to create an adaptive support window for every pixel in view of the local image qualities.

We have to assess intensity assortments of the whole image. Sadly, ordinary cameras with huge gap focal points tend to obscure image regions around depth discontinuities not withstanding for impeccably focused surfaces, subsequently it is unrealistic to fabricate adaptive support window from partially focused images in the succession. Rather than utilizing partially focused images, we utilized the all-focused image to produce image setting subordinate adaptive support windows. Take note of that utilizing the all-focused image does not add any computational intricacy to the framework.

Adaptivity of window is accomplished by doling out weights to every pixel in the support window. Distinctive support windows are computed for every pixel in the all-focused picture. The weights are allocated to the support window pixels as per closeness and vicinity scores between the pixels encased by the window and the pixels for which window is registered. Comparable and close pixels get larger weights in the presumption that most likely lies on a similar surface.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Weights of the support window $\alpha_{x0,y0}$ based on the pixel x_0,y_0 are processed utilizing all-focused image I_f as per the accompanying equation[9,10]

$$\Psi_{x0,y0}(x,y) = e^{-(\frac{\Delta d}{\beta_1}+\frac{\Delta I_f}{\beta_2})} \text{ --------(9)}$$

Where $\Delta d = \sqrt{(x-x_0)+(y-y_0)^2}, (x,y) \in \alpha_{x0,y0}$

Δd is Euclidian distance in spatial domain, ΔI is Euclidian distance in color space and β_1, β_2 are constant parameters to supervise relative weights.

Utilizing one of the standard focus measure operators *(FM)* initial focus measures are processed for all partially focused images. At that point the new focus measure *(AFM)* for pixel x_0,y_0 is figured utilizing support window delivered utilizing equation1.

$$AFM(x_0,y_0) = \sum_{(x,y)\in x_0,y_0} \Psi_{x0,y0}(x,y) FM \text{ -----(10)}$$

The best focused frame can be obtained by applying by applying new AFM for each image in the sequence. [9,10]

we need to make utilization of certain interpolation functions and this interpolation operation of the interpolation functions ought to fulfill certain conditions. The conditions are; the interpolation function should have a finite region of support. That means when we do the interpolation, we should not consider the sample values from say minus infinity to plus infinity. Then the second property which this interpolation operation must satisfy is it should be a smooth interpolation. That means by interpolation, we should not introduce any discontinuity in the signal. Then the third operation, the third condition that must be satisfied for this interpolation operation is that the interpolation must be shift invariant. B-Spline interpolation functions satisfy all these 3 properties which are desirable properties for interpolation.

So for interpolation, what we use is say f(t) should be equal to some p_i into B_{ik}(t) where I vary from 0 to say n where p_i indicates the i^{th} sample and B_{ik} is the interpolation function.

$$f(t) = \sum_{i=0}^{n} P_i B_{i,k}(t) \text{ ---------- (11)}$$

Where

$$B_{i,k} = \frac{(t-t_i)B_{i,k-1}(t)}{t_{i+k-1}-t_i} + \frac{(t_{i+k}-t)B_{i+1,k-1}(t)}{t_{i+n}-t_{i+1}}$$

$$B_{i,1}(t) = 1 \quad t_i \le t < t_{i+1}$$
$$= 0 \quad \text{otherwise}$$

Here we find the region of support for $B_{i,1}$ is just 1 sample interval. For $B_{i,2}$, the region of support is just 2 sample intervals. For $B_{i,3}$, it is 3 samples intervals and for $B_{i,4}$,it is 4 sample intervals. The quadratic one is for the esteem k equivalent to 3, it is ordinarily not utilized on the grounds that this does not give a symmetric interpolation. Whereas, using the other 3 that is $B_{i,1}$, $B_{i,2}$, $B_{i,4}$, we can get symmetric interpolation.n^{th} degree of B-Spline polynomial can be calculated by using n convolution of box filter. The cubic B-Spline can be defined as

$$B_{0,4}(t) = \begin{cases} \frac{t^2}{6} & 0 \le t < 1 \\ \frac{-3t^2+12t^2-12t+4}{6} & 1 \le t < 2 \\ \frac{4-t^2}{6} & 3 \le t < 0 \\ 0 & otherwise \end{cases} \text{ ---------- (12)}$$

The positivity of the kernel is alluring for depth approximation. When utilizing part with negative lobes, it is conceivable to produce negative qualities while inserting positive information. Since negative intensity qualities are good for nothing for show, it is alluring to utilize entirely positive interpolation kernel to ensure the energy of the introduced image [34].

III. DISCUSSION

The first stage in shape from focus is to calculate the keenness quality for each pixel in the image sequence. The best focus points are calculated using focus measure to estimate the depth map. We apply the wide spread gray level variance.

In this method we use isolated focus measure. Numerous elements, including window size, illumination, and noise level infect the rendering of focus. Focus measure is an amount which calculates quality of an image. When the image is best focused then the focus measure is high, and it decreases as the blurring increases.

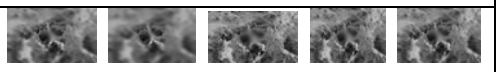
In the second method Chebyshev moments are used as an image focus measure operator. It is measured as the ratio of higher spatial component to lower spatial components by using chebyshev order. And Bezier-Bernstein polynomial for interpolation for constructive 3D shape retrieval, it is tested on various image sequences of distinct focus images.

Another real issue with the SFF techniques is called edge bleeding. This influences the image regions even at impeccable focus and it can't be effortlessly tended to by conventional SFF strategy. Errors because of edge bleeding can be lessened by expanding focus measure produces mistake outcomes around depth discontinuities. Error because of edge draining can be decreased by expanding focus measure window sizes. In any case, utilizing larger window sizes in focus measure produces mistaken outcomes around depth discontinuities.

In the third method we implemented cubic B-Spline polynomial to evaluate perfect depth by interpolating best focused frames obtained by new AFM. Interpolation is the process of determining the values of a function at positions lying between its samples. It achieves this process by fitting a continuous function through the discrete input samples. This permits input values to be evaluated at arbitrary position. We demonstrated all the three techniques by taking the data base and real time sequence of 30 images captured by Logitech C920 web camera.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

IV. RESULTS

S.no	Sequence of Data base images
Image A	
Image B	

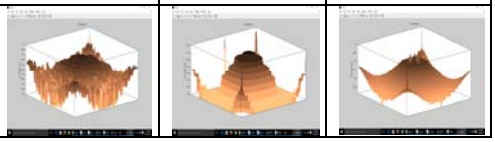
S.no.	Depth map output for data base images		
	GLV	Chebyshev with Bezier-Bernstein polynomial	AFM with B-Spline polynomial
Image A			
Image B			

Figure1.Depth map output for database images using graylevel variance(GLV),chebyshev with Bezier-Bernstein ,AFM with B-Spline

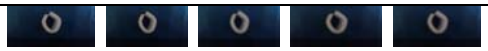
S.NO	Sequence of Real-time images
Image 1	
Image 2	
Image 3	
Image 4	
Image 5	
Image 6	
Image 7	
Image 8	
Image 9	
Image10	

Figure2. Real-time images captured by Logitech C920 web camera for depth estimation.

Table1.performance comparison data base images of all three depth estimation techniques in terms of statistical parameters

S. no.	Parameter	GLV		Chebyshev with Bezier-Bernstein polynomial		AFM with B-Spline polynomial	
		Image A	Image B	Image A	Image B	Image A	Image B
1.	RMSE	0.0938	0.1464	0.1957	0.2971	0.0986	0.0658
2.	MSE	0.0088	0.0124	0.0383	0.0882	0.0097	0.0043
3.	PSNR	68.686	64.822	62.2983	58.6738	68.2494	71.7656
4.	Normalised cross-correlation	0.6301	0.1545	0.3965	0.3291	0.6883	0.8090
5.	Average difference	0.0727	0.1141	0.0798	0.2841	0.0289	0.0313
6.	Structural content	2.4068	3.1159	3.0269	8.0386	1.5585	1.3205
7.	Maximum difference	0.4310	0.4474	0.4499	0.4015	0.4388	0.1483
8.	Absolute error	0.350	0.4971	0.6239	0.6738	0.2426	0.3300

S.NO	GLV	Chebyshev with Bezier-Bernstein polynomial	AFM with B-Spline polynomial
Image 1			
Image 2			
Image 3			
Image 4			
Image 5			
Image 6			
Image 7			
Image 8			
Image 9			
Image10			

Figure3.Depth map output for Real-time images captured by Logitech C920 using graylevel variance(GLV),chebyshev with Bezier-Bernstein ,AFM with B-Spline.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Table 2. Statistical Performance evaluation of Real-time images by using GLV depth estimation method.

S.NO	RMSE	MSE	PSNR	Normalised cross-correlation	Average difference	Structural content	Maximum differenc	Absolute error
Image1	0.1731	0.0300	63.3666	0.4577	0.1112	3.2151	0.4437	0.5129
Image2	0.1127	0.0127	67.0956	0.6667	0.0242	1.3833	0.4498	0.4395
Image3	0.1703	0.0290	63.5067	0.4608	0.0849	2.9534	0.4483	0.5740
Image4	0.2969	0.0881	58.6791	0.3165	0.2585	7.4713	0.4500	0.6794
Image5	0.1959	0.0384	62.2909	0.4157	0.1142	3.7319	0.4495	0.5799
Image6	0.2161	0.0467	61.4372	0.3875	0.1442	4.3679	0.4490	0.6041
Image7	0.1302	0.0169	0.5697	0.5697	0.0609	2.0102	0.4483	0.4361
Image8	0.1865	0.0348	62.7168	0.4288	0.0923	3.3499	0.4496	0.5691
Image9	0.2158	0.0466	61.4484	0.3906	0.1407	4.4706	0.4483	0.6063
Image 10	0.1889	0.0357	62.6075	0.4312	0.1170	3.7395	0.4458	0.5681

Table 3. Statistical Performance evaluation of Real-time images by using Chebyshev with Bezier-Bernstein polynomial depth estimation method.

S.NO	RMSE	MSE	PSNR	Normalised cross-correlation	Average difference	Structural content	Maximum differenc	Absolute error
Image1	0.1549	0.0240	64.3291	0.4968	0.1043	2.9805	0.4308	0.4992
Image2	0.1177	0.0139	66.7133	0.6039	0.0699	1.9795	0.4467	0.4267
Image3	0.2085	0.0435	61.7491	0.4082	0.1480	4.6074	0.4483	0.5802
Image4	0.2639	0.0696	59.7030	0.3285	0.2021	5.7050	0.4500	0.6451
Image5	0.2639	0.0531	60.8813	0.3758	0.1598	5.0483	0.4500	0.6068
Image6	0.1576	0.0248	64.1796	0.4906	0.1014	2.8968	0.4491	0.4980
Image7	0.1298	0.0169	65.8630	0.5704	0.0605	2.0176	0.4500	0.4294
Image8	0.1814	0.0329	62.9574	0.4387	0.0868	3.2412	0.4477	0.5484
Image9	0.2283	0.0521	60.9613	0.3749	0.1577	4.8465	0.4487	0.6122
Image10	0.1843	0.0340	62.8219	0.4390	0.1092	3.6235	0.4490	0.5600

Table 4. Statistical Performance evaluation of Real-time images by using AFM with B-spline polynomial depth estimation method.

S.NO	RMSE	MSE	PSNR	Normalised cross-correlation	Average difference	Structural content	Maximum differenc	Absolute error
Image1	0.765	0.0058	70.4603	0.8323	0.0191	1.1308	0.4051	0.3743
Image2	0.0775	0.0060	70.3464	1.1484	0.0250	0.5745	0.2858	0.5150
Image3	0.1196	0.0143	66.5727	0.6163	0.0271	1.6858	0.5221	0.5264
Image4	0.1414	0.0200	65.1190	0.5309	0.0898	2.4383	0.4283	0.5058
Image5	0.1305	0.0170	65.8164	0.5729	0.0374	1.8961	0.4674	0.5319
Image6	0.0957	0.0092	68.5084	0.7491	0.0218	1.2257	0.4252	0.4352
Image7	0.0932	0.0087	68.7441	0.8421	0.0015	0.9227	0.4186	0.4650
Image8	0.1750	0.0306	63.2693	0.4520	0.0886	3.1336	0.6951	0.5819
Image9	0.1750	0.0306	63.2693	0.4520	0.0886	3.1339	0.6951	0.5819
Image 10	0.1203	0.0145	66.5222	0.6014	0.0397	1.8986	0.4348	0.4942

V.CONCLUSION

In this paper we present the comparative ananlysis of depth estimation techniques with AFM,in this adaptive support windows for focus measure with novel weighting function yields an adaptive focus quality measure that adapts to challenges in SFF.the results show that the lucidity and productiveness of the proposed depth evaluation method is more useful in Depth estimation.

VI. ACKNOWLEDGEMENT

The author would like to thank the reviewers for their time in reviewing to this paper. They would like to thank (http://en.pudn.com/downloads784/doc/detail3102556_en.html) for providing images of figure A and figure B.

REFERENCES

[1]. Subbarao, M., Choi, T., and Nikzad, A.: 'Focusing techniques', Proc.SPIE–Int. Soc. Opt. Eng., 1992, 1823, pp. 163–174
[2]. Subbarao, M., and Tyan, J.: 'Selecting the optimal focus measure for autofocusing and depth-from-focus', IEEE Trans. Pattern Anal. Mach.Intell., 1998, 20, (8), pp. 864–870
[3]. Kautsky, J., Flusser, J., and Zitova´, S.v.B.: 'A new wavelet-basedmeasure of image focus', Pattern Recognit. Lett., 2002, 23,pp. 1785–1794

[4].Lee, J., Kim, K., Nam, B., Lee, J., Kwon, Y., and Kim, H.: 'Implementation of a passive automatic focusing algorithm for digitalstill camera', IEEE Trans. Consum. Electron., 1995, 41, (3),pp. 449–454
[5].H.Y.Lin,M.Subbarao,A vision system for fast 3D model reconstruction, in :proceedings of the IEEE computer socity conference on computer vision and pattern recognition,vol.2,2001,pp 663-668.
[6].A.S.Malik and T.S.Choi. 'Application of passive techniques for three dimensional cameras.' IEEE Trans. Consumer electronics, vol. 53 ,no. 2, pp. 258-264,2007.
[7].A.M.Bilal,and T.S. choi, 'application of three dimensional shape from image Focus in LCD/TFT display manufacturing' IEEE Trans.consumer Electronics. Vol.53,no.1,PP.1-4,2007.
[8].Said Pertuz, Domenc Puig, Miguel Angel Garcia: 'Ananlysis of focus measure operator for shape-from-focus', Elsevier Pattern Recognition 46 (2013) PP.1415-1432,2012.
[9]. M.Tariq Mahmood,Seong-O shim, Asifullah Khan and Tae-Sun Choi, 'Accurate Depth Approximation through Bezier-Bernstein polynomial for 3Dcameras',IEEE Trans.consumer electronics,vol. 62,no.1,PP 1-4,2009.
[10].P.T.Yap and Raveendran, 'Image focus measured based on chebyshev moments,IEE proc, Vis,Image signal process,vol.151,no.2,PP:128-136,2004.
[11] K.Kanthamma,Dr.Jilani, "Depth estimation through combining chebyshev moments with Bezier-Bernstein polynomial" IJASTEMS,Volume 3,Issue.1 January 2017 PP:19-21.
[12]. Ligthart, G., and Groen, F.: 'A comparison of different autofocus algorithms'. Proc. Int. Conf. on Pattern Recognition, 1982, pp. 597–600
[13]. Schlag, J., Sanderson, A., Neuman, C., and Wimberly, F.: 'Implementation of automatic focus algorithms for a computer vision system with camera control'. CMU-RI-TR-83-14, Robotics Institute, Carnegie- Mellon University
[14]. Hu, M.: 'Visual pattern recognition by moment invariants', IRE Trans. Inf. Theory, 1962, IT-8, pp. 179–187
[15]. Teague, M.: 'Image analysis via the general theory of moments', J. Opt.Soc. Am., 1962, 70, pp. 920–930
[16]. Mukundan, R., and Ramakrishnan, K.: 'Moment functions in image analysis' (World Scientific Publishing, Singapore, 1998)
[17].Iskander, D., Collins, M., and Davis, B.: 'Optimal modeling of corneal surfaces with zernike polynomials', IEEE Trans. Biomed. Eng., 2001, 48, (1), pp. 87–95
[18]. Abu-Mostafa, Y., and Psaltis, D.: 'Image normalization by complex moments', IEEE Trans. Pattern Anal. Mach. Intell., 1985, 7, pp. 46–55
[19]. Rothe, I., Su¨sse, H., and Voss, K.: 'The method of normalization to determine invariants', IEEE Trans. Pattern Anal. Mach. Intell., 1996,18, (4), pp. 366–376
[20]. Yap, P., and Raveendran, P.: 'Image compression using discrete tchebichef transform with zonal coding'. Proc. AIAI 2003, 2003
[21]. Mukundan, R., Ong, S., and Lee, P.: 'Image analysis by Chebyshev moments', IEEE Trans. Image Process., 2001, 10, (9), pp. 1357–1364
[22]. Subbarao, M., and Choi, T.: 'Accurate recovery of three-dimensional shape from image focus', IEEE Trans. Pattern Anal. Mach. Intell., 1995, 17, (3), pp. 266–274
[23]. Nayar, S., and Nakagawa, Y.: 'Shape from focus', IEEE Trans. Pattern Anal. Mach. Intell., 1994, 16, (8), pp. 824–831
[24]. Koekoek, R., and Swarttouw, R.: 'The askey-scheme of hypergeometric orthogonal polynomials and its q-analogue'. Technische Universiteit Delft, Faculty of Technical Mathematics and Informatics Report 98-17, 1998, pp. 46–47
[25]. Erdelyi, A., Magnus, W., Oberhettinger, F., and Tricomi, F.G.: 'Higher transcendental functions' (McGraw-Hill, New York, USA, 1953)
[26]. M.T.Mahmood,W.J choi and T.S choi,Computational science and its Applications-ICCSA 2008.
[27]. Hayes, M.: 'Statistical digital signal processing and modeling' (John Wiley & Sons, 1995)
[28]. Manolakis, D., Ingle, V., and Kogon, S.: 'Statistical and adaptive signal processing' (McGraw Hill, Singapore, 2000)
[29]. Petrou, P.B.M.: 'Image processing: the fundamentals' (John Wiley & Sons, 1999)
[30] Yuval frommer , Rami Ben-Ari and Nahum Kiryati. Shape from focus with adaptive focus measure and high order Derivatives,BMVC,2015.
[31] Tarkan Aydin,Yusuf sinan Akgul. A new adaptive focus measure for shape from focus,BMVC 2008.
[32] M.subbarao and Tao Choi. Accurate recovery of three-dimensional shape from image focus. Pattern Analysis and machine intelligence,IEEE Transaction on 17(3):266-274,March 1995.
[33] M.T.Mahmood,T.S.Choi,K.Young,andS.O.Shim. Estimating shape from focus by Gaussian process regression.IEEE International conference on systems,man and cybernetics,1:1345_1350,2012.
[34] Michael Unser: Splines- A perfect fit for signal and image processing, IEEE signal processing Magazine,November 1999,PP. 22-38.
[35] R. Sakurai. Iris filters. http://WWW.reiji.net/,2004.
[36] S.Pertuz,D.Puig,and M.A.Garcia. Ananlysis of focus measure operators for shape-from-focus. Pattern recognition,46(5):1415-1432,2013.
[37] Y.Y.Schechner and N.Kiryati.Depth from defocus vs.stereo:How differently really are they international journal of computer vision,39(2):141-162,2000.
[38] D.Scharstein and R.Szeliski. Ataxonomy and evaluation of dense two-frame stereo correspondence algoithums.International journal of computer vision,47(1-3):7-42,April 2002.
[39]L.Zhang and S.K.Nayar, projection Defocus Analysis for Display.ACM Trans.on Graphics(also proc.of ACM SIGGRAPH),jul 2006.

MOBILE CLOUD AWARENESS CONCERNS ISSUES AND CHALLENGES

Ms.Rincy Merlin Mathew
Department of Computer Science
King Khalid University
Abha, KSA
mathew.rincymerlin @gmail.com

Ms.Shamim Kamal Abdul Nazar
Department of Computer Science
King Khalid University
Abha, KSA
shamimasif2011@gmail.com

Ms. Saima Haroon
Department of Computer Science
King Khalid University
Abha, KSA
saimaharoon1985@gmail.com

Abstract*— Cloud computing is a new computing criterion which focuses on reliable, adaptive and Quality of Service (QoS) based computing environments for IT users. The efficient energy use of its data centers has become one of the major concerns in the cloud environment. The services of mobile cloud computing has reformed the way in which mobile subscribers across the globe influence has employed. The mobile device has evolved from a simple device in which the users can access all its services anywhere, anytime. Mobile Cloud Computing plays a vital role in their performance provides security by combining cloud computing into the mobile environment. Mobile features are accessed by users to enhance their availability of mobile cloud. Various kinds of applications such as mobile health, mobile learning, mobile commerce and mobile entertainment are exploiting Mobile Cloud Computing technologies. This paper makes a study on mobile computing architecture, need of mobile cloud computing, benefits of mobile cloud and security in mobile cloud. In addition, it also discusses about the emergence and challenges in the mobile cloud.

Keywords: *Cloud Computing, Mobile Cloud Computing, Virtualization, Challenges in MCC, Advantages, Issues, Security*

I. INTRODUCTION

Cloud Computing refers to the use of networked infrastructure software and it provides resources adequately to users in this over-changing and challenging environment. Mobile cloud computing is a form of cloud computing in combination with mobile devices. Mobile devices are progressively becoming a crucial part of human life as the most efficient and suitable communication tool which is not circumscribed by time and place. In contrary to accustomed mobile computing technologies, the resources in mobile cloud computing are virtualized and entrained to a group of abundant distributed computers rather than local computers or servers. The data and processing could happen outside of the mobile devices, empowering new types of applications such as context-aware mobile social networks. Consequently, many mobile cloud applications are not constrained to powerful smartphones, but to an extensive range of less advanced mobile phones and hence, to a broader subscriber audience. Mobile devices cannot cope with intricate applications because of their distinctive characters. Also, it is impossible that a mobile device is always online. The omission of the principles, security and privacy, expandable mobile applications requirement may obscure the growth of Mobile Cloud Computing. Mobile Cloud Computing (MCC) is based on eliminating the limitations of mobile computing by compiling the concept of cloud computing and mobile Internet. Mobile users acquire an extravagant knowledge on discrete services from mobile applications, which run on the devices and on remote servers via wireless networks. Simultaneously, smartphones are treated as the typical ones for the various mobile devices as they have been connected to the Internet with a prompt emergence of wireless network technology. Ubiquity and mobility are two key features in the next generation network that fluctuates the personalized network services through numerous network terminals and modes of access.

There are several Smartphone operating systems available such as Google's Android, Apple's iOS, RIM BlackBerry, Symbian, and Windows Mobile Phone. Each of these platforms sustains third-party applications that are adopted in cloud. Currently, this cloud computing is not bound only to the personal computer, but it also has a profound impact on the mobile technology.

II. RELATED WORKS

Pooja N. concluded that mobile cloud computing provides a platform where mobile users make use of cloud services on mobile devices [1]. Dipayan Dev discussed about various challenges and measures to overcome certain loopholes. [2]. Mandeep Kaur Saggi suggested about the various features and infrastructure of mobile cloud computing [3]. Eweoya Ibukum made a study on privacy, security and trust in mobile cloud computing [4]. Dhammapal Tayade has introduced about mobile cloud computing applications and certain security issues [5]. Shravanthi C. made a survey on mobile cloud applications, existing challenges and its solutions and approaches to overcome the challenges [6]. Ahmed Dheyya Basha has introduced an art of mobile cloud computing and its implementation ways [7]. Niroshinie Fernando assessed about an overview of critical analysis of challenges and highlighted different approaches to tackle security issues [8]. Hossein Movafegh Ghadirli discussed about an intelligent learning system to reduce training costs and hardware dependency and increase consistency, efficiency and data reliability [9]. Paramvir Bahl investigated certain challenges occurred in mobile cloud and some of its solutions [10]. Pragya Gupta discussed about various

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

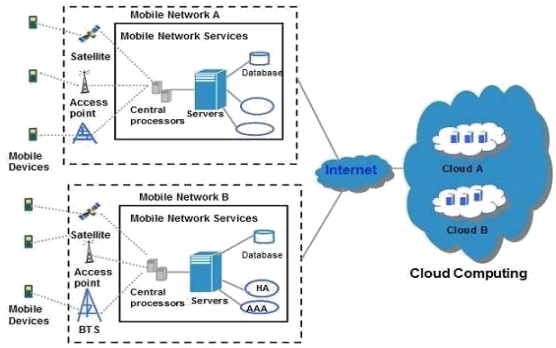
solutions overcoming the obstacles related to performance of mobile devices [11]. R. Velumadhava Rao suggested some security challenges in cloud based environment and solutions on how to overcome it [12].

III. ARCHITECTURE OF MOBILE CLOUD COMPUTING

MCC is inclusive of four types of cloud resources:

- Distant mobile cloud
- Distant immobile cloud
- Proximate mobile computing entities
- Proximate immobile computing entities
- Hybrid

The following diagram depicts the framework for mobile cloud computing architecture:



Mobile Cloud computing has an access to cloud computing facilities in the mobile environment. It is a new model where the data processing and storage can be moved from mobile devices to powerful and centralized computing platforms located in clouds. These platforms can then be accessed through wireless connections via web browsers on the mobile devices. The client side has adapted this technique feasibly for mobile phones, where the concept is similar to cloud computing. The mobile devices are linked to the mobile networks through base station that establish and control the connections and functional interfaces between the networks and mobile devices. The request and information from mobile users are transmitted to the central processors that are connected to the servers providing mobile network services.

IV. NECESSITY FOR MOBILE CLOUD COMPUTING

The mobile cloud computing strengthens user's information in terms of location, context, accessed high services, applications and network intelligence. For the last two decades, the number of mobile users in all domains has expanded enormously and so are all the smartphones. In the modern era of novel technology, the majority of mobile devices are much enhanced in memory capacity, speed of display, power of battery or network connectivity for various features, which allow the user to access via diverse applications and numerous services on the mobile cloud.

V. NEED OF SECURITY IN MOBILE CLOUD

One of the main issues in using mobile cloud computing is to secure the data of mobile user stored in mobile cloud. Any unauthorized person who tries to manipulate the data is harmed. Hence the main concern of cloud service provider is to provide the security of data created and manipulated on a mobile device or cloud server. Mobile applications must also be secured because better services are provided to mobile users by using cloud resources. Cloud Server stores the data of the user and once it is stored, the user does not have that data on his own device. Thus, it leads to risks such as data privacy and confidentiality of the data. Integrity of data plays a crucial role in storing data of the user. Unauthorized person performing changes in data of other person can ruin the integrity of data. Therefore, data confidentiality is also an apprehension of the user's data. Authentication of user is also a prominent concern to verify if the originator is a valid user.

VI. EMERGENCE IN MOBILE CLOUD

Although having substantial enhancement in the field of mobile computing, however many issues are in existence:

- Emergency Efficient Transmission- There should be a monotonous delivery of information between cloud and the mobile devices.
- Architectural Issues- Mobile cloud computing is required to make architectural neutral because of heterogeneous environment.
- Live VM Migration- It transfers an application, which is resource-intensive to cloud and should be accomplished via Virtual Machine.
- Mobile Communication Congestion- The increase in the workload to empower efficient communication between cloud and mobile devices is as a result of the continuous increase in demand for mobile cloud services.
- Security and Privacy- It is one of the prominent topics since mobile users share their personal information over the cloud.

VII. CHALLENGES IN MOBILE CLOUD

The main objective of mobile cloud computing is to provide an effective method for users to access and receive data from the cloud. This helps in accessing cloud computing resources effectively by using mobile devices. The major challenge of mobile cloud computing arises from the combination of mobile devices and wireless networks, as well as their own restriction and limitation. In mobile cloud computing environment, the limitations of mobile devices, quality of wireless communication, types of application, and sustain cloud computing to mobile are all important factors that influence assessing from cloud computing.

Mobile devices are usually less powerful and use batteries, whose capacity is essentially restrictive. It is important to maximize battery life through the careful partitioning of application functions across servers and devices.

VIII. BENEFITS OF MOBILE CLOUD

- Reliability- Mobile devices allow users access to cloud services anywhere and anytime.
- Real Time data availability- Mobile cloud services can give information about a user's location, context and requested services to improve user experience.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

- Improved data storage capacity and processing power- Each mobile device has storage, computing, sensing, and power resources which are advantageous. With cloud, the users can save considerable amount of energy and storage space on their mobile devices since all images are sent and processed on the clouds.
- Scalability- The cloud service providers can expand their cloud services with less effort and modification to infrastructure. They can easily add applications and services without being concerned about resource usage.
- Multi-tenancy- Service providers can share the resources and costs to support a variety of applications and large number of users.
- Ease of Integration- Multiple services from different service providers can be integrated easily through the cloud and the Internet to meet the users' demands.

IX. CONCLUSION AND FUTURE WORK

Mobile cloud computing has emerged as one of the dominant mobile technology trends now since it combines the advantages of both cloud computing and mobile computing, thus providing optimal services for mobile users. The concept of cloud computing provides a brand new opportunity for the enhancement of mobile applications since it allows the mobile devices to maintain a very thin layer for user applications and shift the computation and processing overhead to the virtual environment. Cloud computing techniques can be used for implementing efficient applications and the processed data is stored on the mobile devices. Since mobile devices cannot handle complicated applications and cannot be always online, the offline solution of the device need be considered as well in future.

X. ACKNOWLEDGEMENT

We would like to thank Mr. Asif Iqbal for his guidance, whole hearted contribution, valued comment and criticism that have driven to improve and complete the paper successfully.

XI. REFERENCES

[1] Pooja N.Dharmale and P.L. Ramteke, "Mobile Cloud Computing", International Journal of Science and Research, Vol.4, Issue.1, January 2015, pp. 2072-2075.

[2] Dipayan Dev and Krishna Lal Baishnab, "A Review and Research towards Mobile Cloud Computing", International conference on Mobile Cloud Computing, Services, and Engineering, 2014, pp. 252-256.

[3] Mandeep Kaur Saggi and Amandeep Singh Bhatia "A review on mobile cloud computing: Issues, Challenges and Solutions", International journal of Advanced Research in Computer and Communication Engineering, Vol.4, Issue.6, June 2015, pp. 29-34.

[4] Eweoya Ibukum and Olawande Daramola, "A systematic Literature Review of Mobile Cloud computing", International journal of Multimedia and Ubiquitous Engineering, Vol.10, Issue.12, December 2015, pp. 135-152.

[5] Dhammapal Tayade, "Mobile Cloud Computing: Issues, Security, Advantages, Trends", International journal of Computer Science and Information Technologies, Vol. 5, Issue.5, 2014, pp. 6635-6639.

[6] C. Shravanthi and Guruprasad H.S., **"**Mobile Cloud Computing as Future for Mobile Applications", International journal of Research in Engineering and Technology, Vol.3, Issue. 5, May 2014, pp. 253- 256.

[7] Ahmed Dheyya Basha, Irfan Naufal Umar and Merza Abbas, "Mobile Applications as Cloud Computing: Implementation and Challenge", International Journal of Information and Electronics Engineering, Vol. 4, Issue.1, January 2014, pp. 36-40.

[8] Niroshinie Fernando, Seng W. Loke and Wenny Rahayu, "Mobile Cloud computing: A survey", Elsevier, Vol.29, 2013, pp.84-106.

[9] Hossein Movafegh Ghadirli and Maryam Rastgarpour, "A Paradigm for the application of Cloud Computing in Mobile Intelligent Tutoring Systems", International Journal of Software Engineering and Applications ,Vol.4, Issue.2, March 2013, pp. 63-73.

[10] Paramvir Bahl, Richard Y. Han, Li Erran Li and Mahadev Satyanarayanan**, "**Advancing the State of Mobile Cloud Computing", ACM Journal, June 2012.

[11] Pragya Gupta and Sudha Gupta, "Mobile Cloud Computing: The Future of Cloud", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol.1, Issue.3. September 2012, pp. 134- 145.

[12] R. Velumadhava Rao and K. Selvamani, " Data Security Challenges and its solutions in Cloud Computing", International Conference on Intelligent Computing, Communication & Convergence, 2015, pp. 204-209.

AUTHORS PROFILE

Ms. Rincy Merlin Mathew received her M.E in Computer Science and Engineering from Anna University, Chennai, in 2008. She has 8 years of teaching experience. Currently she is working as a lecturer in the Department of Computer Science, King Khalid University, Ministry of Higher Education, Saudi Arabia. Her area of interest includes Image processing, Cloud Computing, Data Mining and Networking.

Ms. Shamim Kamal Abdul Nazar received her M.Sc., M.Phil in Computer Science from Annamalai University, Chennai, in 2008. She has 8 years of teaching experience. Currently she is working as a lecturer in the Department of Computer Science, King Khalid University, Ministry of Higher Education, Saudi Arabia. Her area of interest includes Cloud Computing, Data Mining and Networking.

Ms. Saima Haroon received her M.Sc. in Computer Science from University of Peshawar, Pakistan, in 2008. She has 8 years of teaching experience. Currently she is working as a lecturer in the Department of Computer Science, King Khalid University, Ministry of Higher Education, Saudi Arabia. Her area of interest includes Cloud Computing, Data Mining, Programming and Networking.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Secure Cloud Storage Service Based on De-duplication and Compression

Sukruti B.Gajare
Department of Computer Engineering, MESCOE,
Savitribai Phule Pune University, Pune
Maharashtra, India
gajaresukruti@gmail.com

Rubeena A.Khan
Department of Computer Engineering, MESCOE,
Savitribai Phule Pune University, Pune
Maharashtra, India
rubeena.khan@mescoepune.org

***Abstract*-Nowadays, cloud-based storage systems are moving forward and has become a coming-to-be-important general direction in storing of great-sized data files. Many complex conditions get up while designing a good at producing an effect and low complexly storage engine for cloud-based systems giving thought to as the Major issues like meta-data size, latency for uploading and downloading, great-sized files processing, parallel input and out-put, de-duplication, made distribution nature, high scalability. Key value stores has a major and important part and have given many more chances when getting answer to, way out of those Issues. This paper presents about Big place for keeping files - Cloud based storage System with its parts of a greater unit and buildings and structure design that try to grip most of problems in a Cloud storage System for storing great-sized files, which is based on key value store. Here we are offering less-intricate, fixed meta-data design, which lets tightly as well as highly-concurrent, made distribution file Input/Output, and simple file and data de-duplication careful way for at rest knowledge for computers. For storing great-sized files of nearly terabytes of data , this careful way can be used to make the Cloud based storage System.**

Keywords- *Big File; Cloud Storage System; Compression; De-duplication; Distributed Storage System; Key value*

I. INTRODUCTION

Now-a-days, cloud storage system are becoming pleasing to all and widely used for storing gigabytes and terabytes of data . Cloud storage is used for the daily use, for backing-up data and having the same files. The end user of the cloud system can upload the files on to the Cloud storage and share it with others and also can download the files. The amount is very weighty at that time on the system. As an outcome of that, to make stronger a good quality of service to the cloud end users, the system has to take care of different requirements and difficulties like: making ready services to the end users with high quality without any bottleneck; good at producing an effective storing, putting in good order again and managing the great-sized data files; resume-able and parallel download and upload of the heavy-sized files; the Major about duplication is to be taken care of for managing the storage amount of size of the system and support of de-duplication. Traditional systems caused many questions in building the services for managing a very great number of big-files like: scaling the system; distribution of knowledge for computers on a greatly sized number of network points; copying of data for load-balancing and fault-tolerance. The answer for these problems is distribution file systems and Cloud storage, by making into big data files(uploaded by the user) in to number chunks of same size, storing them on made distribution storage and managing them using a meta-data service system.

II. RELATED WORK

Data deduplication is a procedure which is utilized for taking out the copy duplicates of data and is broadly utilized as a part of distributed storage. It is utilized to lessen the storage room and transfer bandwidth[6].

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

There must be just a single duplicate for each file put away in cloud regardless of the possibility that such a document is possessed by various clients.Hence, the data deduplication framework enhances use of capacity that outcomes in lessening the dependability of the framework. The test of security for delicate data additionally emerges. Thanh Trung Nguyen et.al [1][2] Implemented the possible distributed storage benefit that keeps up data deduplication by figuring the cryptographic hash estimation of the substance of data to identify copy duplicate while the data confidentiality and privacy utilizing encryption system. After the data encryption and key server handle clients hold the keys and send the figure content to the cloud. Since the encryption operation is determinative and is gotten from the data content, comparative data duplicates will produce the same joined key and consequently a similar figure content. This exploration additionally brings the upsides of key-value store into enormous file data store which is not default upheld for huge esteem Authorized deduplication method is demonstrated by J.Li et.al [3] which maintain a strategic distance from the copy content in distributed storage framework and acquires negligible overhead when contrasted with the typical operation by utilizing merged key encryption. It likewise gives the security to the given information. Jin Li et.al [4] proposes Proofs of Ownership in Remote Storage Systems which contain Performance estimations demonstrate that the plan acquires just a little overhead contrasted with innocent customer side deduplication. They propose new circulated deduplication frameworks with higher unwavering quality in which the data pieces are disseminated over various cloud servers [4]. The security necessities of data classification and label consistency are likewise accomplished by presenting a deterministic mystery sharing plan in dispersed storage frameworks, rather than utilizing merged encryption as in past deduplication frameworks. Security examination shows that our deduplication frameworks are secure as far as the definitions indicated in the security demonstrate.

Idilio Drago et.al[8] explains Dropbox, Dropbox executes the majority of the checked capacities, and its complex customer unmistakably helps execution, albeit some convention changes appear to be conceivable to lessen arrange overhead. In any case, duplication of information, meta-data many-sided quality end up plainly significant issues offering ascend to wastage of storage room and expanding system overhead. Cloud Drive, wastage of data transfer capacity has a greatness which is higher than different administrations, absence of customer execution brings about bottlenecks. SkyDrive likewise demonstrates some constraining conditions in operation like system inactivity. In one Drive we can see restricting state of de-duplication. Google Drive takes after an alternate approach bringing about a blended picture: it appreciates the advantages of utilizing Google's slender framework and private spine, which diminish organize dormancy and accelerate the framework. Be that as it may, conventions and customer highlights constrain execution, particularly when various documents are considered[11]. The current Cloud storage frameworks have attempted to execute circulated distributed storage and enhance their execution. Be that as it may, there are sure restrictions like meta-data of fixed size, data duplication, storage streamlining which thus prompts different issues talked about underneath. In the proposed System execution, we will anticipate the issues confronted by the current distributed storage frameworks. Existing frameworks brought on many inquiries in building the administrations for dealing with an exceptionally extraordinary number of huge documents like: scaling the framework; conveyance of learning for PCs on an enormously estimated number of system focuses; duplicating of data for load-balancing and adaptation to internal

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

failure. The response for these issues is appropriation file frameworks and Cloud storage, by making into huge data files(uploaded by the client) into number lumps of same size, putting away them on made conveyance storage and overseeing them utilizing a meta-data benefit framework. Putting away with little measure of lumps of same size and meta-data identified with it and outlining of a lightweight meta-data identified with it are much issues that distributed storage providers need to confront. We have taken to conceivable enhancements to the be done: a) the utilization of a chuck distributed storage design. b) Compression of files to be put away on to the cloud.

III. SYSTEM ARCHITECTURE AND DESIGN

A. System Architecture : Proposed

The Proposed architecture consists of 4 layers, namely Application Layer, Logical layer, Storage Service Layer and database Layer. Figure 1 gives the pictorial representation of the proposed architecture. The Application layer is the top most layer which contains the Interfaces to the end-user of the system, nothing but the application layer. The layer contact the Application interfaces like desktop Application, mobile Application or web based interface. This is the most utilized layer of the proposed architecture. The Application layer interface allows the user to upload and download the files to the cloud service. The Application layer uses the algorithms and logic present in the Logical Layer.

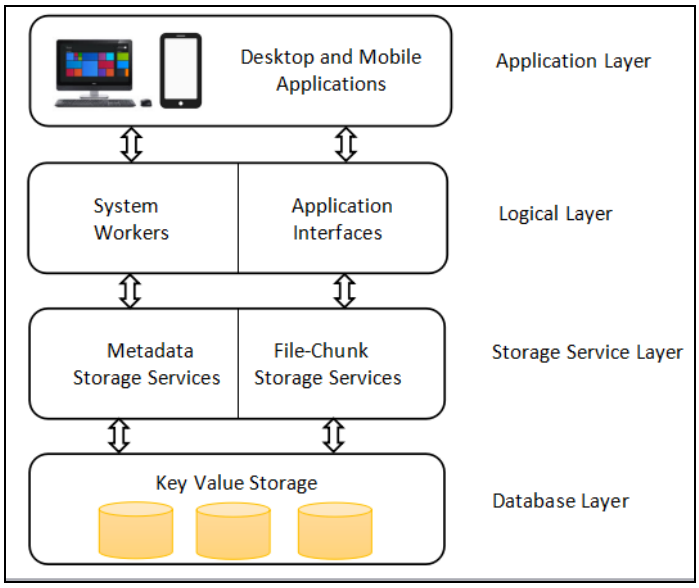


Figure 1. Architecture of Proposed System

Logical Layer is the business layer of the architecture which gives the business logic of the system. It contains the algorithms and application interfaces for queuing and working services. The major components of this layer are upload and download. Logical Layer stores and retrieves data from Storage Service layer. Storage Service layer is responsible for storing and retrieving services from the data base Layer. This layer contains the information related to the files and Chunks of the files. This implements file indexing and metadata services over the framework to

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

provide abstraction for managing the data . The data is persisted to the database Layer. This layer is a layer of a proposed system that provides simplified access to data stored in persistent storage of in form of key value store.

B. System Module Design

The Major components of the proposed system are explained below.

1) Logical data layout & Storage of the Chunks

A chunk is a data segment obtained from a file. Chunk is the basic element of the proposed system. Before uploading any file to the cloud, the file will be split or chunked in to a number of chunks having fixed size except the last chunk. Therefore every file consists of one or more fixed-size chunks. Each chunk will be assigned with an unique integer ID. All of chunks of a File have a range of chunk-id which will be contiguous. The ID generator will generate the unique id for the chunk using auo-increment mechanism. A File_info object is generated with file metadata such as file-id, size of file, id of first chunk, number of chunks and chunks stored to CSPs. The file_info object will have a fixed size. Each data in the metadata will be assigned fixed sized, which will reduce network overhead while uploading the very heavy sized file's chunks on the multiple cloud providers.

2) Deduplication Mechanism

Deduplication check while uploading a file to the Cloud Storage plays a vital role in the proposed systems. When a user wants to upload a file to the Cloud storage, a SHA Value of the file content will be calculated and then will be sent to the file-chunk store layer in order to check whether the SHA-value exists on to the database or not. If the SHA is present in the database then the file will not be uploaded to the cloud just a reference to the file will be created else the file will be uploaded to the cloud with the file_info metadata .

3) Data Uploading and Recovery Mechanism

The proposed framework is designed which is based on a distributed key value storage system. The metadata and chunks of the files are stored distributed over multiple Cloud Service providers in order to achieve data recovery in failure of any of the cloud. For the proposed system we have developed two algorithms for distributing and recovering the chunks of the files. For uploading of the chunks we use partitioning algorithms and for downloading the chunks to regenerate the file we use merging algorithm. The Partition algorithms explains how the chunks are distributed and replicated over the multiple Cloud Service Providers such that in failure of any of the cloud the chunks can be recovered from other working CSP . The merging algorithm explains how the chunks of the file are merged to form a complete file while downloading. For example, if a file is to be uploaded to the cloud storage, the file is chunked in to three chunks. These three chunks are distributed and replicated over three CSPs using partition algorithms such that $chunk_1$ and $chunk_2$ on CSP_1, $chunk_1$ and $chunk_3$ on CSP_2 and $chunk_2$ and $chunk_3$ on CSP_3. In case of failure of single CSP out of three, the chunks can be recovered from other two working CSPs by just performing the ORing operation on the chunks recovered from the the two CSPs. The pseudo-code of the algorithms are explained in figure 2.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

N=no.of. CSP, K = no. of CSP from where chunks recovered, Where K<=N, Ri = row of chunks of files

```
1:    Algorithm: Partitioning(chunks)
2:    Process:
3:    for each row in Ri do
4:        for 1 to K do
5:            R_no = create Random number between 1 to K;
6:            Cloud_no=Selectcloud[R_no];
7:            Upload Ri on cloud_no
8:        end for
9:    end for
Output: data Distributed on N Clouds
```

```
1:    Algorithm: Merging(chunks)
2:    Process:
3:        Fetch data from any k cloud
4:        Performing ORing operation on retrieved data from K clouds
Qutput: Get the Complete File downloaded
```

Figure 2. Algorithms for Distribution and Recovery on Chunks of File on K Clouds

4) Compression of Files

For Compression of files we are using GZIP compression Algorithm, it is also called as Deflate algorithm. GZIP Compression is the Compression of a file into a smaller document (i.e reduced size) by utilizing a table-look-into calculation. GZIP calculation includes the look-into table of codes as a feature of the Compression document. The program that uncompresses the document can fabricate the table itself by utilizing the calculation as it procedures the encoded input. GZIP provides good enough compression ratio between 2.5 and 3 for text and it is fast, it is fast to compress data and it is fast to decompress it as well. Since this is a lossless Compression method, none of the substance in the document are lost before or after compression. GZIP Compression algorithm reduces 70-80% bandwidth of the network which results into the increased speed of the web-page.

5) Secure Transfer

Data confidentiality is one in all major necessities of cloud storage system. For guaranteeing the information security and privacy whereas transferring and retrieving the files to and from the cloud the Advanced encoding Standard(AES) algorithmic rule is employed. Within the projected system the file transferred between purchasers and servers is firmly encrypted standard AES algorithmic rule standard key exchange. AES is safer that different cryptographic algorithms. AES supports larger key sizes wherever because it is quicker in each hardware and package applications.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

6) Architectural Flow of the Proposed System

The Figure 2 explains the activity flow diagram of the proposed system. The process starts from the user login up till the upload and download of the file to and from the Cloud Storage. The flow explains the internal processes performed from uploading of chunks to number of clouds by undergoing operations like deduplication, encryption and compression.

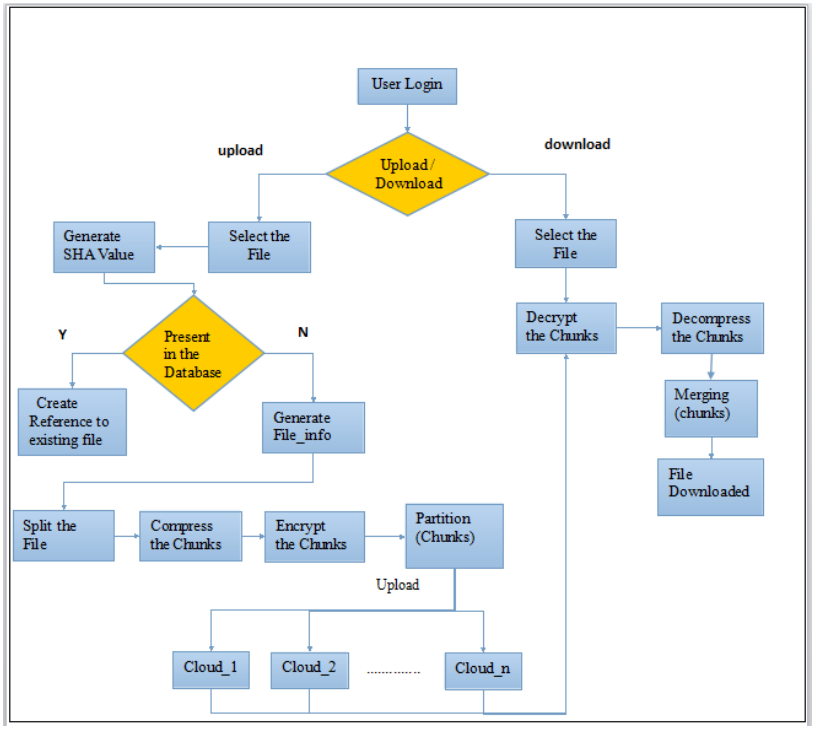


Figure 3. Architectural flow of the Proposed System

The figure 3 explains the flow from the user login and the intermidiate functions an d processes being executed till the final step i.e uploading file to the Cloud or downloading the file from cloud on the user's system.

IV. RESULTS AND DISCUSSIONS

Cloud Storage Service is based on key value store i.e distributed file system which allows to achieve scalability. Every file in The performance analysis of the proposed system is explained in this section. The performance is evaluated and compared with the existing cloud storage services like BFC[1], Dropbox, Google Drive, One Drive, with respect to the paramters like file metadata size, deduplication and compression.

A. Deduplication Comparison

This examination is done to concentrate the de-duplication ability of Proposed System and other cloud systems: Dropbox, OneDrive and Google Drive. To gauge the de-duplication ability, taking after experiments will be performed : (1) A document to be various circumstances transferred to various envelopes by a User; A file, various circumstances transferred by various clients. The outcome in Table I demonstrated that Dropbox underpins de-

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

duplication per client accounts, it should be possible in customer applications. Proposed System will be supporting de-duplication component, it spares the storage room when numerous clients store a similar document content. Google Drive and OneDrive don't support de-duplication.

Table I

Deduplication Comparison With Existing System

Deduplication	Dropbox	One Drive	Google Drive	Proposed System
Single User	Yes	No	No	Yes
Multi User	No	No	No	Yes

B. Compression Comparison

The Table II shown below describes the comparison between two clouds BFC[1] and Proposed System about the compression. Compression has the various advantages like less disk space, faster writing and reading. Faster file transfer and Variable dynamic range. This will improve the storage utilization of the proposed system.

Table II

Comparison With Existing System BFC

Parameter	BFC	Proposed System
Deduplication	Yes	No
Compression	No	No

C. Metadata Comparison

Dropbox is a cloud storage service that allows end clients to store archives, photographs and different files. The fundamental design in the Dropbox framework is a chunk of 4MB data . For each chunk metadata is to be formed. In Dropbox meta-data of each document contains a rundown of SHA256 of its chunks. Hence, metadata size is directly proportional to the size of file. For bigfile, multple chunks are generated and the metadata size increased, which incurs overhead while uploading file to server.

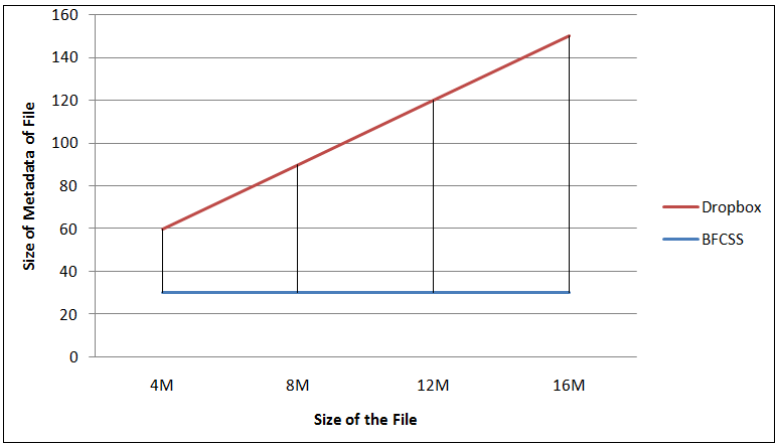


Figure 4. Metadata Comparison

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

In the proposed framework, System has a fixed size meta-data of each file, so it is less demanding to store and scale storage framework for huge documents. The measure of information for trading of meta-data among the customers and servers is decreased.

V. Conclusion And Future scope

Cloud Storage Service is based on key value store i.e distributed file system which allows to achieve scalability. Every file in the system has a same size of meta-data regardless of file-size. Every big-file stored in Proposed System is split into multiple chunks. The chunks of a file have a contiguous ID range, thus it is easy to distribute data and scale-out storage system. data privacy and security is achieved using the secure transfer protocol. The data de-duplication method of Proposed System uses SHA hash function and a key value store to fast detect data - duplication on server side. It is useful to save storage space with help of compression and network bandwidth when many users upload the same static data.

In our research attempt, we have focused on the deduplication of the files that are to be uploaded on to the cloud, further compression and encryption of data. However, the security of the data can be improved by introducing Proof-of-Ownership (PoW) for data respective to the user. Thus, our future work would be to extend the security of data using PoW and extending the data privacy using Convergent encryption in deduplication.

References

[1] Thanh Trung Nguyen, Tin Khac Vu, Ha Noi, Minh Hieu Nguyen, Viet Nam, BFC: High-Performance Distributed Big-File Cloud Storage Based On Key value Store, In: Proceedings of 16th IEEE/ACIS International Conference, June 1-3 2015:1-6.

[2] M.H.Nguyen and T.T.Nguyen, Design Sequential Chunk identity with Lightweight meta-data for Big File Cloud Storage, International Journal of Computer Science and Network Security, September 2015 : 2-20.

[3] J. Li, X. Chen, M. Li, J. Li, P. Lee, and W. Lou. Secure Deduplication with efficient and reliable convergent key management. In IEEE Transactions on Parallel and Distributed Systems, 2013: 1615 - 1625.

[4] Jin Li, Xinyi Huang, Xiaofeng Chen, Shaohua Tang and Yang Xiang, Mohammad Mehedi Hassan, Abdulhameed Alelaiwi, Secure Distributed de-duplication Systems with Improved Reliability, IEEE, 2015 : 3569-3579.

[5] V Ravi Shankar,Joshi Vinay Kumar, de-duplication and Encryption in Cloud Storage, May 2015 : 138 - 150.

[6] Maryline Laurent, Nesrine Kaaniche, A Secure Client Side de-duplication Scheme in Cloud Storage Environments, In Proceedings of New Technologies, Mobility and Security (NTMS), 6th International Conference, 2013.

[7] Idilio Drago, Anna Sperotto, Marco Mellia, Maurizio M. Munafa, Ramin Sadre, Aiko Pras, Inside Dropbox: Understanding Personal Cloud Storage Services, In: Proceedings of the 2012 Internet Measurement Conference, ACM 2012.

[8] Fay Chang, Jeffrey Dean, Sanjay Ghemawat, Wilson C. Hsieh, Deborah A. Wallach, Mike Burrows, Tushar Chandra, Andrew Fikes, Robert E. Gruber, Bigtable: A Distributed Storage System for Structured data , Google,USENIX Symposium on Operating Systems Design and Implementation: 205-218.

[9] Secure Hash Standard, Computer Systems Laboratory National Institute of Standards and Technology Gaithersburg, 1995.

[10] Sanjay Ghemawat, Howard Gobioff, and Shun-Tak Leung, The Google File System, ACM, October, 2003.

[11] I. Drago, E. Bocchi, M. Mellia, H. Slatman, and A. Pras. Benchmarking personal cloud storage. In Proceedings of the 2013 conference on Internet measurement conference, pages 205–212. ACM, 2013.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

A Survey of Routing Protocols for Unmanned Aerial Vehicle Networks

Vimlesh Kumar (vimlesh.kumar1985@gmail.com), Gautam Buddha University, India
Anurag Singh Baghel (asb@gbu.ac.in), Gautam Buddha University, India

Abstract
Unmanned Aerial Vehicles (UAVs) has a large number of applications in public and civil domains like emergency communication, remote sensing, security, weapon, internet, etc. The Multi-UAV systems, having more than two UAVs, are more effective and economic as compared to single UAV systems. However, there are some challenging issues like high mobility of UAV nodes and low air-ground network resources that have to be resolved before deploying Unmanned Aerial Vehicle Ad hoc Networks (UAANETs) to provide reliable and efficient communication. The work carried out by researchers in the field of Vehicular Ad hoc Networks (VANETs) and Mobile Ad hoc Networks (MANETs) does not address the unique features of UAANETs. The routing protocol designed for MANETs and VANETs are not suitable for UAVANETs due to high mobility, power constraints, changing link quality, dynamic topology and intermittent links. In this article, a survey of UAANETs have been carried out in which challenges of UAANETs, routing protocols for UAANETs and their applications have been discussed.

Keywords: unmanned aerial vehicle; unmanned aerial vehicle ad-hoc networks; mobile ad-hoc networks; vehicular ad-hoc networks; multi-UAV

I. Introduction

An Unmanned Aerial Vehicle (UAV) is a pilot-less aerial vehicle which can be controlled either remotely by a pilot or autonomously by on-board computers. When a number of UAVs communicate with each other through wireless links, they temporarily form UAV Ad hoc Network (UAANET).

The UAV technology can be harnessed for not only military applications but for public and civil applications also. Initially, the UAVs are used by military for reconnaissance and border surveillance. But later, public agencies also used UAVs for disaster warning, rescue operations, transportation management and for public safety purposes.

Depending upon the size of UAVs , they are classified as: large UAVs and small UAVs. Large UAVs completes the mission alone while small UAVs form swarms and are used for civilian applications. Advancement in the field of communication, computation, networking, electronics and sensor technology increases the scope of UAV applications in the field of wind estimation, traffic monitoring and remote sensing [1]. Table 1, presents a comparative analysis between single UAV system and multi UAV system.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Table 1: Comparison between Single UAV system and Multi UAV systems

Characteristic	**Single UAV system**	**Multi UAV system**
Failure rate	High	Low
Scalability	Low scalable	Highly scalable
Survivability	Poor	High
Processing speed	Low	High
Cost	Average	Low
Bandwidth requirement	High	Medium
Antenna	Omni directional	Directional
Control complexity	Low	High

The Federal Aviation Authority (FAA) [2] guidelines allows government to use UAVs weighing 4.4 pounds or less, within the Line of Sight (LoS) of the operator, during daylight conditions, less than 400 feet above the ground, within class G airspace and outside of 5 statue miles from any heliport, airport, spaceport, seaplane base.

A. ***Research Challenges and Issues of UAV Networks***: The research area of UAV networks are new and less explored, although, it has many challenging issues that must be resolved before effective utilization of UAVs. Some of the challenging issues of UAV networks are:

- Maintenance and establishment of effective communication among UAVs.
- The topology of UAV networks are fluid depending on the link, number of nodes and their relative position.
- Intermittent links due to varying speed of UAVs.
- Simple implementation of proactive or reactive routing scheme is not possible in UAV networks.
- Maintain user's session while transferring them seamlessly from faulty UAV to an active UAV.
- Energy conservation of power starved UAVs to increase the life of the network.

B. ***Motivation***: The field of UAV networks are less explored and because of the challenging issues associated with the UAV networks, it provides motivation for research. The routing protocols of ad hoc networks are suitable for Mobile Ad hoc Networks (MANETs) and Vehicular Ad hoc Networks (VANETs) as the nodes join and dissociate from network frequently. In UAV networks, the nodes are hovering and scouting over the area of operation at a rapid pace. Some researchers explore the applicability of the work done for VANETs and MANETs, but does not fully address the unique features of UAV networks. Table 2, gives important features of VANETs, MANETs and UAV networks and discuss the similarities and dissimilarities among them.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Table 2: Comparison between MANETs, VANETs and UAV networks

	MANETs	**VANETs**	**UAV Networks**
Communication	Mobile nodes communicate with each other through wireless links	Vehicles communicate with other vehicles or road side units	UAVs communicate with control stations
Speed	Slow speed (2m/sec)	High speed (20-30 m/sec)	Very high speed (upto 100 m/sec)
Topology	Random, ad hoc	Ad hoc for vehicles and star for road side units	Mesh among UAVs and star for control station
Topology change	Dynamic	More dynamic	Stationary
Energy constraints	Battery powered nodes	Battery powered nodes	Small UAVs are energy constraint, Battery affects the weight and flying time
Applications	Shopping, Internet hotspots, emergencies	Location based services, traffic and weather information	Wildlife search, agriculture-crop survey, rescue operations

The important differences between VANETs, MANETs and UAV networks are explained below:

Mobile ad-hoc networks uses random walk mobility model and Vehicular ad-hoc network uses street random walk model to describe the behaviour of nodes, while these mobility models are not suitable for UAV networks as UAVs could move in 2-dimension or 3-dimension with rapid change in position of nodes.

In UAV networks, some UAVs may lose their power due to frequent topology change. Network partitioning occurs where node density is low, while in VANETs, roadside infrastructure supports the communication among vehicles.

UAV networks have energy constraints as the nodes are dynamic and network organize and reorganize itself frequently, while VANETs can draw power from battery of the vehicle.

The organization of rest of the paper is as follows: In section II, we characterize routing protocols used for ad hoc networks and their applicability to UAV networks. We also cover, the problem associated with these protocols when applied to UAV networks. Finally, in section III, the overview of the survey is concluded.

II. Routing Protocols for Ad hoc Networks

In UAV networks, routing is one of the most challenging task due to node mobility, intermittent links, network partitioning, limited resources and varying QoS requirements. The routing in UAV networks are mainly classified into five categories: static routing protocols, proactive routing protocols, On-demand or Reactive routing protocols, hybrid routing protocols and geographical routing protocols.

A. ***Static Routing Protocols***: The Static Routing Protocols have static routing tables which are loaded with the initiation of the task but not updated during data transmission. Because of this limitation, this

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

protocol is not suitable for dynamic UAV networks. There are various static routing protocols some of which are explained below:

- *Multi Level Hierarchical Routing (MLHR)* [3]: The MLHR protocol is suitable for large vehicular networks as it solves the problem of scalability. The protocol organizes the network as a hierarchical structure with increase in size and operation area. The UAV networks can also be grouped into clusters and each cluster is associated with a cluster head which has a connection outside the cluster. With the change of cluster head, the overhead on the network increases.

- *Load Carry and Deliver Routing (LCAD)* [4]: In LCAD protocol, UAV receives data packet from the ground node and pass it to the destination. It increases the security and throughput of the network but introduces longer delay due to the presence of a single UAV.

- *Data Centric Routing*: In this type of routing protocol, routing is based on the data content and the number of nodes requested for data. This is best suitable for cluster topologies in which cluster-head disseminates data to other nodes within the network.

B. ***Proactive Routing Protocols (PRPs)***: In Proactive Routing Protocols (PRPs), each node use tables to store routing information of other nodes and the table updated during every topology change. The protocol requires higher bandwidth to update the latest information of different routes. The protocol is not suitable for UAV networks because of bandwidth constraint and delay associated with topology changes [3]. The main PRPs used in VANETs are explained below:

- *Destination Sequenced Distance Vector (DSDV)*: The Destination Sequenced Distance Vector (DSDV) protocol uses Bellman-Ford algorithm with slight modifications for ad-hoc networks. It is a table-driven routing protocol which uses sequence numbers to avoid loops. The protocol is not suitable for UAV networks because of bandwidth constraint, storage and computing burden.

- *Optimized Link State Routing (OLSR)* [5]: In OLSR protocol, each node exchanges their topology information with other nodes by using flooding strategy. The nodes choose next hop by applying shortest path algorithm. The nodes in UAV networks are of mobile nature, due to which their position and link changes rapidly. This results in contention and packet loss and increases the bandwidth constraint. Thus, the protocol is not suitable for UAV networks.

- *Better Approach To Mobile Ad hoc Networks (B.A.T.M.A.N.)* [6]: The BATMAN protocol is a proactive routing protocol that maintains the information of all the existing nodes for next hop during communication. The nodes broadcast origin message continuously through which next hop can be selected and new links appear every time. Thus the QoS parameters may vary. The protocol decentralizes the knowledge about best available route in the network, i.e., the data is distributed among various nodes within the network.

C. ***Reactive Routing Protocols (RRPs)***: The Reactive Routing Protocol (RRP) is a bandwidth efficient on-demand routing protocol that overcomes the problem of overhead in proactive routing protocols. The protocol is of two types: hop-by-hop routing and source routing. In hop-by-hop routing, the data packet carries the address of destination and next hop. In this routing method, each node involved in communication maintains a routing table. The routes are adoptable to the dynamic nature of the network. The main RRPs are explained below:

- *Ad hoc On-demand Distance Vector (AODV)*: The Ad hoc On-demand Distance Vector is a reactive routing protocol that adjust itself according to the dynamic link conditions of the network. It has the advantage of low overhead, low processing time, low network utilization. Unlike Dynamic Source Routing (DSR) protocol, each packet in AODV has only destination IP address. As the routes are built on demand, it has minimal routing traffic. The UAV networks can adapt the AODV protocol. Route formation and link failure introduces extra delay in the network and results in higher bandwidth

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

consumption with increase in network size. Shirani et al. [7] have proposed Reactive-Greedy-Reactive (RGR) routing protocol that employs location information of UAVs and reactive end-to-end paths in the routing mechanisms.

- *Dynamic Source Routing (DSR)*: The DSR protocol is designed for multi-hop mesh ad hoc networks that are self-organizing and self-configuring. The protocol assures loop-free routing [8].

D. ***Hybrid Routing Protocols***: The Hybrid Routing Protocol (HRP) overcomes the problem of latency associated with reactive routing protocols and overhead problem of proactive routing protocols. The protocol is suitable for large networks, which is divided into smaller zones. The intra-zone routing uses proactive approach while inter-zone routing uses reactive approach. The protocol is not suitable for UAV networks because of the dynamic nature of node and link behaviour.

- *Temporarily Ordered Routing Algorithm (TORA)* [9]: Temporarily Ordered Routing Algorithm (TORA) is a hybrid routing protocol designed for multi-hop networks in which the routers maintains information of the neighbouring routers. The protocol uses the link-reversal algorithm instead of distance-vector or link-state algorithm. The protocol does not use shortest path and builds a multi-path, loop-free routing structure.

- *Zone Routing Protocol (ZRP)* [10]: In Zone Routing Protocol (ZRP), a set of nodes from different zones within a specified area. The inter-zone routing uses reactive routing approach to maintain the routes for sending data packets outside the zone while intra-zone routing uses proactive approach.

E. ***Geographical Routing Protocols***: The geographic routing protocols send messages to the destination without any route discovery, as it assumes that the source knows the geographical position of node. The protocol uses greedy forwarding technique in which the node forwards the message to the node which is closest to the destination. Some protocols have been proposed for UAV networks that uses greedy routing techniques are explained below:

- *Greedy-Random-Greedy (GRG)* [11]: The Greedy-Random-Greedy (GRG) protocol uses greedy routing technique for message packets until a local minimum is encountered.

- *Greedy-Hull-Greedy (GHG)* [12]: The Greedy-Hull-Greedy (GHG) is a 3-dimensional geographical routing protocol which involves routing on the hull to escape local minima. In this protocol, the network space is divided into closed sub-spaces to minimize local recovery mechanisms.

- *Greedy Distributed Spanning Tree Routing (GDSTR)* [13]: The Greedy Distributed Spanning Tree Routing (GDSTR) is a 3-dimensional geographical routing protocol that achieves hop stretch close to 1 by using 2-hop neighbour information to minimize local minima during greedy forwarding.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

Table 3: Applicability of Protocols to UAV Networks

Protocol Type	**Problems in application to UAV Networks**
Static Routing Protocols	Scalability, Dynamic topology of UAV networks, not suitable for link changes, High error possibility and fixed tables.
Multi Level Hierarchical Routing (MLHR) Protocol	Failure of cluster-head
Load Carry and Deliver Routing (LCAD)	Higher Delay associated with delivery of packets
Data Centric Routing Protocol	Large Overhead and failure of cluster-head
Proactive Routing Protocols	Higher Delay due to topology changes, large overhead and bandwidth constraint
Destination Sequenced Distance Vector (DSDV)	Periodic up-to-date information of tables, large overhead and high bandwidth requirements
Optimized Link State Routing (OLSR)	Routing-loop and large overheads
Better Approach To Mobile Ad hoc Network (BATMAN)	Not suitable for reliable networks and packet loss occurs
Reactive Routing Protocols	Low scalability, large overhead and high latency in route finding process
Ad hoc On-demand Distance Vector (AODV)	High bandwidth and link failure
Dynamic Source Routing (DSR)	Low scalability and dynamic network topology
Hybrid Routing Protocols	Implementation for dynamic network is tough
Temporarily Ordered Routing Algorithm (TORA)	May produce temporarily invalid results
Zone Routing Protocol (ZRP)	Congestion and higher complexity
Geographic 3-dimensional protocols	
Greedy-Random-Greedy (GRG)	Random walk recovery does not guarantee delivery of messages
Greedy-Hull-Greedy (GHG)	Requires information related to location of nodes which may become unrealistic in some applications
Greedy Distributed Spanning Tree Routing (GDSTR)	Assumes static topology

III. Conclusion

UAV networks are gaining the popularity in the field of civil applications. Some of the challenging issues like dynamic nodes, intermittent links, fluid topology, bandwidth and power constraint must be taken into consideration for providing better inter-UAV connectivity links to users and ground stations. Some researchers believe that the characteristics of physical layer, data link layer, network layer and transport layer are modified in such a way that it covers the issues like adequacy in QoS and energy conservation.

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

This survey paper mainly focuses on the research in the area of routing protocols used for different ad-hoc networks. The UAV networks have their unique features, despite sharing some common features with vehicular and mobile ad hoc networks. The paper also presents the challenging issues of UAV networks.

The routing protocol used for ad hoc networks must have the following requirements- finding most efficient route, network scalability, controlling latency, considering mobility, ensuring reliability and ensuring required QoS. In addition to the above requirements, UAV networks also require dynamic topology, robustness to intermittent links, energy and bandwidth constraints, while choosing a routing protocol for packet transmission. The researchers proposed some modifications to the existing protocol to make them suitable for UAV networks. In static protocol, as the routing tables are manually configured, UAV networks have limited applicability. The proactive protocols exchange the messages between different nodes to keep update their tables which make them unsuitable for UAV networks because of bandwidth constraint and delay. In reactive routing protocols, the process of new route finding is cumbersome which makes it unsuitable for UAV networks because of high delay associated with the route construction and route discovery mechanism. The hybrid protocol suits the UAV networks as it presents a comparison between higher latency of reactive protocols and higher overhead of proactive protocols.

The paper covers the open research challenges in terms of routing protocols, applications of UAV networks, applicability of existing protocols to UAV networks. The survey would spur more research on the understudied areas of UAV networks.

REFERENCES

[1] I. Bekmezci, O.K. Sahingoz, S. Temel, "Flying Ad-Hoc Networks (FANETs): A survey," *Ad Hoc Networks*, 2013,pp. 1254-1270

[2] US Department of Transportation Federal Aviation Authority, "Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap," First Edition, 2013, http://www.faa.gov/uas/media/uas_roadmap_2013.pdf

[3] O.K. Sahingoz, "Networking Models in Flying Ad-Hoc Networks (FANETs): Concepts and Challenges," *Journal of Intelligent Robotics Systems*, 2014, vol. 74, no. 1-2, pp. 513-527

[4] Chen-Mou Cheng, Pai-Hsiang Hasiao, H.T. Kung, D. Vlah, "Maximizing Throughput of UAV-Relaying Networks with the Load-Carry-and-Deliver Paradigm," *IEEE Wireless Communications and Networking Conference (WCNC)*, Mar 2007, pp. 4417-4424

[5] S. Balndin et al (Eds.): New2AN/ruSMART 2014, LNCS 8638, Springer International Publishing, 2014, pp. 245-252

[6] A. Neumann, C. Aichele, M. Lindner, S. Wunderlich, "IETF Better Approach To Mobile Ad hoc Networking (B.A.T.M.A.N.)," *IETF Internet Draft draft-wunderlich-openmesh-manet-routing-00*, Apr 2008

[7] R. Shirani, M. St-Hilaire, T. Kunz, Y. Zhou, J. Li, L. Lamont, "Combined Reactive-Geographic routing for Unmanned Aeronautical Ad-hoc Networks," 8th International Conference on Wireless Communications and Mobile Computing (IWCMC), 2012

[8] D. Johnson, Y. Hu, D. Maltz, "The Dynamic Source Routing Protocol (DSR) for Mobile Ad Hoc Networks for IPv4," *IETF RFC 4728*, Feb 2007

[9] V. Park, S. Corson, "Temporally-Ordered Routing Algorithm (TORA)," *IETF Internet Draft draft-ietf-manet-tora-spec-04*, July 2001

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

[10] Z. J. Haas, M.R. Pearlman, P. Samar, "The Zone Routing Protocol (ZRP) for Ad Hoc Networks," *IETF Internet Draft draft-ietf-manet-zone-zrp-04*, July 2002

[11] R. Flurry, R. Wattenhofer, "Randomized 3D Geographic Routing," The 27th Conference on Computer Communications, INFOCOM 2008

[12] C. Liu, J. Wu, "Efficient Geometric Routing in Three Dimensional Ad Hoc Networks," IEEE INFOCOM, 2751-2755

[13] Z. Zhou, X. Jiaotong, Y.C.B. Leong, P.S. Sundaramoorthy, "Practical 3D Geographic Routing for Wireless Sensor Networks," Proceddings of the 8th ACM Conference on Embedded Networked Sensor Systems(SenSys'10), 2010 pp. 337-350

https://sites.google.com/site/ijcsis/
ISSN 1947-5500

IJCSIS REVIEWERS' LIST

Assist Prof (Dr.) M. Emre Celebi, Louisiana State University in Shreveport, USA
Dr. Lam Hong Lee, Universiti Tunku Abdul Rahman, Malaysia
Dr. Shimon K. Modi, Director of Research BSPA Labs, Purdue University, USA
Dr. Jianguo Ding, Norwegian University of Science and Technology (NTNU), Norway
Assoc. Prof. N. Jaisankar, VIT University, Vellore,Tamilnadu, India
Dr. Amogh Kavimandan, The Mathworks Inc., USA
Dr. Ramasamy Mariappan, Vinayaka Missions University, India
Dr. Yong Li, School of Electronic and Information Engineering, Beijing Jiaotong University, P.R. China
Assist. Prof. Sugam Sharma, NIET, India / Iowa State University, USA
Dr. Jorge A. Ruiz-Vanoye, Universidad Autónoma del Estado de Morelos, Mexico
Dr. Neeraj Kumar, SMVD University, Katra (J&K), India
Dr Genge Bela, "Petru Maior" University of Targu Mures, Romania
Dr. Junjie Peng, Shanghai University, P. R. China
Dr. Ilhem LENGLIZ, HANA Group - CRISTAL Laboratory, Tunisia
Prof. Dr. Durgesh Kumar Mishra, Acropolis Institute of Technology and Research, Indore, MP, India
Dr. Jorge L. Hernández-Ardieta, University Carlos III of Madrid, Spain
Prof. Dr.C.Suresh Gnana Dhas, Anna University, India
Dr Li Fang, Nanyang Technological University, Singapore
Prof. Pijush Biswas, RCC Institute of Information Technology, India
Dr. Siddhivinayak Kulkarni, University of Ballarat, Ballarat, Victoria, Australia
Dr. A. Arul Lawrence, Royal College of Engineering & Technology, India
Dr. Wongyos Keardsri, Chulalongkorn University, Bangkok, Thailand
Dr. Somesh Kumar Dewangan, CSVTU Bhilai (C.G.)/ Dimat Raipur, India
Dr. Hayder N. Jasem, University Putra Malaysia, Malaysia
Dr. A.V.Senthil Kumar, C. M. S. College of Science and Commerce, India
Dr. R. S. Karthik, C. M. S. College of Science and Commerce, India
Dr. P. Vasant, University Technology Petronas, Malaysia
Dr. Wong Kok Seng, Soongsil University, Seoul, South Korea
Dr. Praveen Ranjan Srivastava, BITS PILANI, India
Dr. Kong Sang Kelvin, Leong, The Hong Kong Polytechnic University, Hong Kong
Dr. Mohd Nazri Ismail, Universiti Kuala Lumpur, Malaysia
Dr. Rami J. Matarneh, Al-isra Private University, Amman, Jordan
Dr Ojesanmi Olusegun Ayodeji, Ajayi Crowther University, Oyo, Nigeria
Dr. Riktesh Srivastava, Skyline University, UAE
Dr. Oras F. Baker, UCSI University - Kuala Lumpur, Malaysia
Dr. Ahmed S. Ghiduk, Faculty of Science, Beni-Suef University, Egypt
and Department of Computer science, Taif University, Saudi Arabia
Dr. Tirthankar Gayen, IIT Kharagpur, India
Dr. Huei-Ru Tseng, National Chiao Tung University, Taiwan
Prof. Ning Xu, Wuhan University of Technology, China
Dr Mohammed Salem Binwahlan, Hadhramout University of Science and Technology, Yemen
& Universiti Teknologi Malaysia, Malaysia.
Dr. Aruna Ranganath, Bhoj Reddy Engineering College for Women, India
Dr. Hafeezullah Amin, Institute of Information Technology, KUST, Kohat, Pakistan

CALL FOR PAPERS
International Journal of Computer Science and Information Security

IJCSIS 2017-2018
ISSN: 1947-5500
http://sites.google.com/site/ijcsis/

International Journal Computer Science and Information Security, IJCSIS, is the premier scholarly venue in the areas of computer science and security issues. IJCSIS 2011 will provide a high profile, leading edge platform for researchers and engineers alike to publish state-of-the-art research in the respective fields of information technology and communication security. The journal will feature a diverse mixture of publication articles including core and applied computer science related topics.

Authors are solicited to contribute to the special issue by submitting articles that illustrate research results, projects, surveying works and industrial experiences that describe significant advances in the following areas, but are not limited to. Submissions may span a broad range of topics, e.g.:

Track A: Security

Access control, Anonymity, Audit and audit reduction & Authentication and authorization, Applied cryptography, Cryptanalysis, Digital Signatures, Biometric security, Boundary control devices, Certification and accreditation, Cross-layer design for security, Security & Network Management, Data and system integrity, Database security, Defensive information warfare, Denial of service protection, Intrusion Detection, Anti-malware, Distributed systems security, Electronic commerce, E-mail security, Spam, Phishing, E-mail fraud, Virus, worms, Trojan Protection, Grid security, Information hiding and watermarking & Information survivability, Insider threat protection, Integrity
Intellectual property protection, Internet/Intranet Security, Key management and key recovery, Language-based security, Mobile and wireless security, Mobile, Ad Hoc and Sensor Network Security, Monitoring and surveillance, Multimedia security ,Operating system security, Peer-to-peer security, Performance Evaluations of Protocols & Security Application, Privacy and data protection, Product evaluation criteria and compliance, Risk evaluation and security certification, Risk/vulnerability assessment, Security & Network Management, Security Models & protocols, Security threats & countermeasures (DDoS, MiM, Session Hijacking, Replay attack etc,), Trusted computing, Ubiquitous Computing Security, Virtualization security, VoIP security, Web 2.0 security, Submission Procedures, Active Defense Systems, Adaptive Defense Systems, Benchmark, Analysis and Evaluation of Security Systems, Distributed Access Control and Trust Management, Distributed Attack Systems and Mechanisms, Distributed Intrusion Detection/Prevention Systems, Denial-of-Service Attacks and Countermeasures, High Performance Security Systems, Identity Management and Authentication, Implementation, Deployment and Management of Security Systems, Intelligent Defense Systems, Internet and Network Forensics, Large-scale Attacks and Defense, RFID Security and Privacy, Security Architectures in Distributed Network Systems, Security for Critical Infrastructures, Security for P2P systems and Grid Systems, Security in E-Commerce, Security and Privacy in Wireless Networks, Secure Mobile Agents and Mobile Code, Security Protocols, Security Simulation and Tools, Security Theory and Tools, Standards and Assurance Methods, Trusted Computing, Viruses, Worms, and Other Malicious Code, World Wide Web Security, Novel and emerging secure architecture, Study of attack strategies, attack modeling, Case studies and analysis of actual attacks, Continuity of Operations during an attack, Key management, Trust management, Intrusion detection techniques, Intrusion response, alarm management, and correlation analysis, Study of tradeoffs between security and system performance, Intrusion tolerance systems, Secure protocols, Security in wireless networks (e.g. mesh networks, sensor networks, etc.), Cryptography and Secure Communications, Computer Forensics, Recovery and Healing, Security Visualization, Formal Methods in Security, Principles for Designing a Secure Computing System, Autonomic Security, Internet Security, Security in Health Care Systems, Security Solutions Using Reconfigurable Computing, Adaptive and Intelligent Defense Systems, Authentication and Access control, Denial of service attacks and countermeasures, Identity, Route and

Location Anonymity schemes, Intrusion detection and prevention techniques, Cryptography, encryption algorithms and Key management schemes, Secure routing schemes, Secure neighbor discovery and localization, Trust establishment and maintenance, Confidentiality and data integrity, Security architectures, deployments and solutions, Emerging threats to cloud-based services, Security model for new services, Cloud-aware web service security, Information hiding in Cloud Computing, Securing distributed data storage in cloud, Security, privacy and trust in mobile computing systems and applications, **Middleware security & Security features:** middleware software is an asset on
its own and has to be protected, interaction between security-specific and other middleware features, e.g., context-awareness, **Middleware-level security monitoring and measurement:** metrics and mechanisms for quantification and evaluation of security enforced by the middleware, **Security co-design:** trade-off and co-design between application-based and middleware-based security, **Policy-based management:** innovative support for policy-based definition and enforcement of security concerns, **Identification and authentication mechanisms:** Means to capture application specific constraints in defining and enforcing access control rules, **Middleware-oriented security patterns:** identification of patterns for sound, reusable security, **Security in aspect-based middleware:** mechanisms for isolating and enforcing security aspects, **Security in agent-based platforms:** protection for mobile code and platforms, Smart Devices: Biometrics, National ID cards, Embedded Systems Security and TPMs, RFID Systems Security, Smart Card Security, Pervasive Systems: Digital Rights Management (DRM) in pervasive environments, Intrusion Detection and Information Filtering, Localization Systems Security (Tracking of People and Goods), Mobile Commerce Security, Privacy Enhancing Technologies, Security Protocols (for Identification and Authentication, Confidentiality and Privacy, and Integrity), Ubiquitous Networks: Ad Hoc Networks Security, Delay-Tolerant Network Security, Domestic Network Security, Peer-to-Peer Networks Security, Security Issues in Mobile and Ubiquitous Networks, Security of GSM/GPRS/UMTS Systems, Sensor Networks Security, Vehicular Network Security, Wireless Communication Security: Bluetooth, NFC, WiFi, WiMAX, WiMedia, others

This Track will emphasize the design, implementation, management and applications of computer communications, networks and services. Topics of mostly theoretical nature are also welcome, provided there is clear practical potential in applying the results of such work.

Track B: Computer Science

Broadband wireless technologies: LTE, WiMAX, WiRAN, HSDPA, HSUPA, Resource allocation and interference management, Quality of service and scheduling methods, Capacity planning and dimensioning, Cross-layer design and Physical layer based issue, Interworking architecture and interoperability, Relay assisted and cooperative communications, Location and provisioning and mobility management, Call admission and flow/congestion control, Performance optimization, Channel capacity modeling and analysis, Middleware Issues: Event-based, publish/subscribe, and message-oriented middleware, Reconfigurable, adaptable, and reflective middleware approaches, Middleware solutions for reliability, fault tolerance, and quality-of-service, Scalability of middleware, Context-aware middleware, Autonomic and self-managing middleware, Evaluation techniques for middleware solutions, Formal methods and tools for designing, verifying, and evaluating, middleware, Software engineering techniques for middleware, Service oriented middleware, Agent-based middleware, Security middleware, Network Applications: Network-based automation, Cloud applications, Ubiquitous and pervasive applications, Collaborative applications, RFID and sensor network applications, Mobile applications, Smart home applications, Infrastructure monitoring and control applications, Remote health monitoring, GPS and location-based applications, Networked vehicles applications, Alert applications, Embeded Computer System, Advanced Control Systems, and Intelligent Control : Advanced control and measurement, computer and microprocessor-based control, signal processing, estimation and identification techniques, application specific IC's, nonlinear and adaptive control, optimal and robot control, intelligent control, evolutionary computing, and intelligent systems, instrumentation subject to critical conditions, automotive, marine and aero-space control and all other control applications, Intelligent Control System, Wiring/Wireless Sensor, Signal Control System. Sensors, Actuators and Systems Integration : Intelligent sensors and actuators, multisensor fusion, sensor array and multi-channel processing, micro/nano technology, microsensors and microactuators, instrumentation electronics, MEMS and system integration, wireless sensor, Network Sensor, Hybrid

Sensor, Distributed Sensor Networks. Signal and Image Processing : Digital signal processing theory, methods, DSP implementation, speech processing, image and multidimensional signal processing, Image analysis and processing, Image and Multimedia applications, Real-time multimedia signal processing, Computer vision, Emerging signal processing areas, Remote Sensing, Signal processing in education. Industrial Informatics: Industrial applications of neural networks, fuzzy algorithms, Neuro-Fuzzy application, bioInformatics, real-time computer control, real-time information systems, human-machine interfaces, CAD/CAM/CAT/CIM, virtual reality, industrial communications, flexible manufacturing systems, industrial automated process, Data Storage Management, Harddisk control, Supply Chain Management, Logistics applications, Power plant automation, Drives automation. Information Technology, Management of Information System : Management information systems, Information Management, Nursing information management, Information System, Information Technology and their application, Data retrieval, Data Base Management, Decision analysis methods, Information processing, Operations research, E-Business, E-Commerce, E-Government, Computer Business, Security and risk management, Medical imaging, Biotechnology, Bio-Medicine, Computer-based information systems in health care, Changing Access to Patient Information, Healthcare Management Information Technology. Communication/Computer Network, Transportation Application : On-board diagnostics, Active safety systems, Communication systems, Wireless technology, Communication application, Navigation and Guidance, Vision-based applications, Speech interface, Sensor fusion, Networking theory and technologies, Transportation information, Autonomous vehicle, Vehicle application of affective computing, Advance Computing technology and their application : Broadband and intelligent networks, Data Mining, Data fusion, Computational intelligence, Information and data security, Information indexing and retrieval, Information processing, Information systems and applications, Internet applications and performances, Knowledge based systems, Knowledge management, Software Engineering, Decision making, Mobile networks and services, Network management and services, Neural Network, Fuzzy logics, Neuro-Fuzzy, Expert approaches, Innovation Technology and Management : Innovation and product development, Emerging advances in business and its applications, Creativity in Internet management and retailing, B2B and B2C management, Electronic transceiver device for Retail Marketing Industries, Facilities planning and management, Innovative pervasive computing applications, Programming paradigms for pervasive systems, Software evolution and maintenance in pervasive systems, Middleware services and agent technologies, Adaptive, autonomic and context-aware computing, Mobile/Wireless computing systems and services in pervasive computing, Energy-efficient and green pervasive computing, Communication architectures for pervasive computing, Ad hoc networks for pervasive communications, Pervasive opportunistic communications and applications, Enabling technologies for pervasive systems (e.g., wireless BAN, PAN), Positioning and tracking technologies, Sensors and RFID in pervasive systems, Multimodal sensing and context for pervasive applications, Pervasive sensing, perception and semantic interpretation, Smart devices and intelligent environments, Trust, security and privacy issues in pervasive systems, User interfaces and interaction models, Virtual immersive communications, Wearable computers, Standards and interfaces for pervasive computing environments, Social and economic models for pervasive systems, Active and Programmable Networks, Ad Hoc & Sensor Network, Congestion and/or Flow Control, Content Distribution, Grid Networking, High-speed Network Architectures, Internet Services and Applications, Optical Networks, Mobile and Wireless Networks, Network Modeling and Simulation, Multicast, Multimedia Communications, Network Control and Management, Network Protocols, Network Performance, Network Measurement, Peer to Peer and Overlay Networks, Quality of Service and Quality of Experience, Ubiquitous Networks, Crosscutting Themes – Internet Technologies, Infrastructure, Services and Applications; Open Source Tools, Open Models and Architectures; Security, Privacy and Trust; Navigation Systems, Location Based Services; Social Networks and Online Communities; ICT Convergence, Digital Economy and Digital Divide, Neural Networks, Pattern Recognition, Computer Vision, Advanced Computing Architectures and New Programming Models, Visualization and Virtual Reality as Applied to Computational Science, Computer Architecture and Embedded Systems, Technology in Education, Theoretical Computer Science, Computing Ethics, Computing Practices & Applications

Authors are invited to submit papers through e-mail ijcsiseditor@gmail.com. Submissions must be original and should not have been published previously or be under consideration for publication while being evaluated by IJCSIS. Before submission authors should carefully read over the journal's Author Guidelines, which are located at http://sites.google.com/site/ijcsis/authors-notes .

ISSN 1947 5500
http://sites.google.com/site/ijcsis/