

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/330428120>

# Garbage Monitoring System Using Internet of Things: Methods and Protocols

Chapter · January 2019

DOI: 10.1007/978-981-13-3600-3\_28

---

CITATIONS

6

---

READS

2,274

2 authors, including:



[Nehal Patel](#)

Charotar University of Science and Technology

15 PUBLICATIONS 76 CITATIONS

SEE PROFILE

Jiacun Wang  
G. Ram Mohana Reddy  
V. Kamakshi Prasad  
V. Sivakumar Reddy *Editors*

# Soft Computing and Signal Processing

Proceedings of ICSCSP 2018, Volume 1

# **Advances in Intelligent Systems and Computing**

Volume 900

## **Series editor**

Janusz Kacprzyk, Systems Research Institute, Polish Academy of Sciences,  
Warsaw, Poland

e-mail: [kacprzyk@ibspan.waw.pl](mailto:kacprzyk@ibspan.waw.pl)

The series “Advances in Intelligent Systems and Computing” contains publications on theory, applications, and design methods of Intelligent Systems and Intelligent Computing. Virtually all disciplines such as engineering, natural sciences, computer and information science, ICT, economics, business, e-commerce, environment, healthcare, life science are covered. The list of topics spans all the areas of modern intelligent systems and computing such as: computational intelligence, soft computing including neural networks, fuzzy systems, evolutionary computing and the fusion of these paradigms, social intelligence, ambient intelligence, computational neuroscience, artificial life, virtual worlds and society, cognitive science and systems, Perception and Vision, DNA and immune based systems, self-organizing and adaptive systems, e-Learning and teaching, human-centered and human-centric computing, recommender systems, intelligent control, robotics and mechatronics including human-machine teaming, knowledge-based paradigms, learning paradigms, machine ethics, intelligent data analysis, knowledge management, intelligent agents, intelligent decision making and support, intelligent network security, trust management, interactive entertainment, Web intelligence and multimedia.

The publications within “Advances in Intelligent Systems and Computing” are primarily proceedings of important conferences, symposia and congresses. They cover significant recent developments in the field, both of a foundational and applicable character. An important characteristic feature of the series is the short publication time and world-wide distribution. This permits a rapid and broad dissemination of research results.

### *Advisory Board*

#### Chairman

Nikhil R. Pal, Indian Statistical Institute, Kolkata, India  
e-mail: [nikhil@isical.ac.in](mailto:nikhil@isical.ac.in)

#### Members

Rafael Bello Perez, Faculty of Mathematics, Physics and Computing, Universidad Central de Las Villas, Santa Clara, Cuba  
e-mail: [rbellop@uclv.edu.cu](mailto:rbellop@uclv.edu.cu)

Emilio S. Corchado, University of Salamanca, Salamanca, Spain  
e-mail: [escorchado@usal.es](mailto:escorchado@usal.es)

Hani Hagras, School of Computer Science & Electronic Engineering, University of Essex, Colchester, UK  
e-mail: [hani@essex.ac.uk](mailto:hani@essex.ac.uk)

László T. Kóczy, Department of Information Technology, Faculty of Engineering Sciences, Győr, Hungary  
e-mail: [koczy@sze.hu](mailto:koczy@sze.hu)

Vladik Kreinovich, Department of Computer Science, University of Texas at El Paso, El Paso, TX, USA  
e-mail: [vladik@utep.edu](mailto:vladik@utep.edu)

Chin-Teng Lin, Department of Electrical Engineering, National Chiao Tung University, Hsinchu, Taiwan  
e-mail: [ctlin@mail.nctu.edu.tw](mailto:ctlin@mail.nctu.edu.tw)

Jie Lu, Faculty of Engineering and Information, University of Technology Sydney, Sydney, NSW, Australia  
e-mail: [Jie.Lu@uts.edu.au](mailto:Jie.Lu@uts.edu.au)

Patricia Melin, Graduate Program of Computer Science, Tijuana Institute of Technology, Tijuana, Mexico  
e-mail: [epmelin@hafsamx.org](mailto:epmelin@hafsamx.org)

Nadia Nedjah, Department of Electronics Engineering, University of Rio de Janeiro, Rio de Janeiro, Brazil  
e-mail: [nadia@eng.uerj.br](mailto:nadia@eng.uerj.br)

Ngoc Thanh Nguyen, Wrocław University of Technology, Wrocław, Poland  
e-mail: [Ngoc-Thanh.Nguyen@pwr.edu.pl](mailto:Ngoc-Thanh.Nguyen@pwr.edu.pl)

Jun Wang, Department of Mechanical and Automation, The Chinese University of Hong Kong, Shatin, Hong Kong  
e-mail: [jwang@mae.cuhk.edu.hk](mailto:jwang@mae.cuhk.edu.hk)

More information about this series at <http://www.springer.com/series/11156>

Jiacun Wang · G. Ram Mohana Reddy  
V. Kamakshi Prasad · V. Sivakumar Reddy  
Editors

# Soft Computing and Signal Processing

Proceedings of ICSCSP 2018, Volume 1

 Springer

### *Editors*

Jiacun Wang  
Department of Computer Science  
and Software Engineering  
Monmouth University  
West Long Branch, NJ, USA

V. Kamakshi Prasad  
Department of Computer Science  
and Engineering  
JNTUH College of Engineering Hyderabad  
Hyderabad, Telangana, India

G. Ram Mohana Reddy  
Department of Information Technology  
National Institute of Technology Karnataka  
Surathkal, Mangaluru, Karnataka, India

V. Sivakumar Reddy  
Department of Electronics and  
Communication Engineering  
Malla Reddy College of Engineering  
and Technology  
Secunderabad, Telangana, India

ISSN 2194-5357

ISSN 2194-5365 (electronic)

Advances in Intelligent Systems and Computing

ISBN 978-981-13-3599-0

ISBN 978-981-13-3600-3 (eBook)

<https://doi.org/10.1007/978-981-13-3600-3>

Library of Congress Control Number: 2018962132

© Springer Nature Singapore Pte Ltd. 2019

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd. The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

# **Organizing Committee**

## **Chief Patron**

Sri. Ch. Malla Reddy  
Hon'ble MP, Government of India  
Founder Chairman, MRGI

## **Patrons**

Sri. Ch. Mahendar Reddy, Secretary, MRGI  
Sri. Ch. Bhadra Reddy, President, MRGI

## **Conference Chair**

Dr. V. S. K. Reddy, Principal

## **Publication Chair**

Dr. Suresh Chandra Satapathy, Professor, KIIT, Bhubaneswar

## **Convener**

Prof. P. Sanjeeva Reddy, Director, ECE and EEE

## **Organizing Chair**

Dr. M. Murali Krishna, Dean, Academics

## **Organizing Secretaries**

Dr. S. Srinivasa Rao, HOD, ECE

Dr. D. Sujatha, HOD, CSE

Dr. G. Sharada, HOD, IT

## **Session Chairs**

Dr. C. Suchismita, Professor, NIT Rourkela

Dr. Ram Murthy Garimella, Professor, IIIT Hyderabad

Dr. Chandra Sekhar, Professor, Osmania University

Dr. Mohammed Arifuddin Sohel, Professor, Muffakham Jah CET

Dr. Samrat Lagnajeet Sabat, Professor, HCU

Dr. Malla Rama Krishna Murty, Professor, ANITS, Visakhapatnam

Dr. Mohana Sundaram, Professor, VIT, Vellore

Dr. Suresh Kumar Nagarajan, Professor, VIT, Vellore

## **Coordinators**

Dr. S. Shanthi, Professor, CSE

Dr. N. S. Gowri Ganesh, Professor, IT

Dr. V. Chandrasekar, Professor, CSE

Mr. G. S. Naveen Kumar, Associate Professor, ECE

Mr. K. Mallikarjuna Lingam, Associate Professor, ECE

Mr. M. Vazralu, Associate Professor, IT



## **Organizing Committee**

Prof. K. Kailasa Rao, Director, CSE and IT  
Prof. K. Subhas, Professor and Head, EEE  
Dr. B. Jyothi, Associate Professor, ECE  
Dr. Pujari Lakshmi Devi, Professor, ECE  
Dr. C. Ravishankar Reddy, Professor, ECE  
Dr. Ajeet Kumar Pandey, Professor, CSE  
Dr. A. Mummooorthy, Professor, IT  
Dr. V. M. Senthil Kumar, Professor, ECE  
Dr. Murugeshan Rajamanickam, Professor, ECE  
Sri. B. Rajeswar Reddy, Administrative Officer

## **Web Developer**

Mr. K. Sudhakar Reddy, Assistant Professor, IT

## **Proceedings Committee**

Dr. Sucharitha Manikandan, Associate Professor, ECE  
Ms. P. Anitha, Associate Professor, ECE  
Ms. M. Gayatri, Associate Professor, CSE  
Ms. D. Asha, Assistant Professor, ECE  
Mr. T. Vinay Simha Reddy, Assistant Professor, ECE  
Mr. N. Sivakumar, Assistant Professor, CSE

## **Technical Program Committee**

Dr. E. Venkateshwar Reddy, Professor, CSE  
Dr. R. Roopa Chandrika, Professor, IT  
Dr. A. Mummooorthy, Professor, IT  
Mr. M. Sandeep, Associate Professor, CSE  
Mr. M. Ramanjaneyulu, Associate Professor, ECE  
Mr. K. Murali Krishna, Associate Professor, ECE  
Mr. N. Ramesh, Associate Professor, EEE  
Mr. K. Srikanth, Associate Professor, CSE  
Mr. P. Bikshapathy, Associate Professor, CSE  
Mr. D. Chandrasekhar Reddy, Associate Professor, CSE

Mr. M. Sambasivudu, Associate Professor, CSE  
Mr. M. Jaypal, Associate Professor, CSE  
Ms. J. Suneetha, Associate Professor, IT

## **Publicity Committee**

Ms. D. Radha, Associate Professor, CSE  
Mr. Ch. Kiran Kumar, Assistant Professor, ECE  
Ms. P. Swetha, Associate Professor, ECE  
Mr. R. Chinna Rao, Assistant Professor, ECE  
Ms. Arthi Jeyakumari, Assistant Professor, CSE  
Mr. P. Raji Reddy, Assistant Professor, EEE  
Mr. K. D. K. Ajay, Assistant Professor, ECE  
Ms. Renju Panicker, Assistant Professor, ECE  
Mr. K. L. N. Prasad, Assistant Professor, ECE  
Mr. T. Srinivas, Assistant Professor, ECE  
Ms. R. Sujatha, Assistant Professor, CSE  
Mr. A. Yogananda, Assistant Professor, IT

## **Registration Committee**

Ms. M. Anusha, Assistant Professor, ECE  
Mr. K. Suresh, Assistant Professor, ECE  
Mr. V. Shiva Raja Kumar, Assistant Professor, ECE  
Ms. B. Srujana, Assistant Professor, ECE  
Ms. D. Kalpana, Assistant Professor, CSE  
Mr. S. Vishwanath Reddy, Assistant Professor, CSE  
Mr. Naresh, Assistant Professor, CSE

## **Hospitality Committee**

Mr. A. Syam Prasad, Associate Professor, CSE  
Mr. G. Ravi, Associate Professor, CSE  
Mr. P. Srinivas Rao, Associate Professor, IT  
Mr. M. Venu, Assistant Professor, CSE  
Ms. Novy Jacob, Assistant Professor, IT  
Mr. M. Anantha Gupta, Assistant Professor, ECE  
Mr. G. Sekhar Babu, Assistant Professor, EEE  
Mr. S. Rakesh, Assistant Professor, EEE

Mr. B. Mahendar, Assistant Professor, IT  
Mr. P. Harikrishna, Assistant Professor, IT  
Ms. W. Nirmala, Assistant Professor, CSE  
Ms. Shruthi Rani Yadav, Assistant Professor, CSE  
Ms. V. Alekya, Assistant Professor, CSE  
Ms. G. Shamini, Assistant Professor, CSE  
Mr. Naveen, Assistant Professor, CSE

### **Certificate Committee**

Mr. M. Sreedhar Reddy, Associate Professor, ECE  
Ms. S. Rajani, Assistant Professor, ECE  
Ms. M. Hima Bindu, Assistant Professor, ECE  
Mr. Manoj Kumar, Assistant Professor, CSE  
Mr. K. Srinivas, Assistant Professor, CSE  
Ms. Srilakshmi, Assistant Professor, IT

### **Decoration Committee**

Mr. M. Anantha Gupta, Assistant Professor, ECE  
Ms. N. Saritha, Assistant Professor, ECE  
Mr. O. Saidulu Reddy, Assistant Professor, EEE  
Mr. B. Srinivasa Rao, Assistant Professor, EEE  
Ms. M. Nagma, Assistant Professor, ECE  
Ms. D. Kavitha, Assistant Professor, ECE  
Mr. Maheswari, Assistant Professor, ECE  
Ms. Honey Diana, Assistant Professor, CSE  
Ms. K. Swetha, Assistant Professor, IT  
Ms. Sireesha, Assistant Professor, CSE  
Mr. Y. Dileep Babu, Assistant Professor, CSE

### **Transportation Committee**

Mr. V. Kamal, Associate Professor, CSE  
Mr. P. Dileep, Associate Professor, CSE  
Mr. G. Ravi, Associate Professor, CSE  
Mr. M. Arun Kumar, Assistant Professor, ECE  
Mr. E. Mahender Reddy, Assistant Professor, ECE  
Mr. Saleem, Assistant Professor, CSE

## **International and National Advisory Committee**

Dr. Heggere Ranganath, Chair of CS, The University of Alabama in Huntsville, USA

Dr. Someswar Kesh, Professor, Department of CISA, University of Central Missouri, USA

Mr. Alex Wong, Senior Technical Analyst, Diligent Inc., USA

Dr. Bhaskar Kura, Professor, University of New Orleans, USA

Dr. Ch. Narayana Rao, Scientist, Denver, Colorado, USA

Dr. Arun Kulkarni, Professor, University of Texas at Tyler, USA

Dr. Sam Ramanujan, Professor, Department of CIS and IT, University of Central Missouri, USA

Dr. Richard H. Nader, Associate Vice President, Mississippi State University, USA

Prof. Peter Walsh, Head of the Department, Vancouver Film School, Canada

Dr. Ram Balalachandar, Professor, University of Windsor, Canada

Dr. Asoke K. Nandi, Professor, Department of EEE, University of Liverpool, UK

Dr. Vinod Chandran, Professor, Queensland University of Technology, Australia

Dr. Amiya Bhaumik, Vice Chancellor, Lincoln University College, Malaysia

Prof. Soubarethisamy, UNIMAS International, Malaysia

Dr. Sinin Hamdan, Professor, UNIMAS

Dr. Hushairi bin Zen, Professor, ECE, UNIMAS

Dr. Bhanu Bhaskara, Professor, Majmaah University, Saudi Arabia

Dr. Narayanan, Director, ISITI, CSE, UNIMAS

Dr. Koteswararao Kondepu, Research Fellow, Scuola Superiore Sant'Anna, Pisa, Italy

Shri. B. H. V. S. Narayana Murthy, Director, RCI, Hyderabad

Prof. P. K. Biswas, Head, Department of E & ECE, IIT Kharagpur

Dr. M. Ramasubba Reddy, Professor, IIT Madras

Prof. N. C. Shiva Prakash, Professor, IISc, Bangalore

Dr. B. Lakshmi, Professor, Department of ECE, NIT Warangal

Dr. Y. Madhavee Latha, Professor, Department of ECE, MRECW, Hyderabad

# Preface

The International Conference on Soft Computing and Signal Processing (ICSCSP 2018) was successfully organized by Malla Reddy College of Engineering and Technology, an UGC autonomous institution, during June 22–23, 2018, at Hyderabad. The objective of this conference was to provide opportunities for the researchers, academicians, and industry persons to interact and exchange the ideas, experience, and gain expertise in the cutting-edge technologies pertaining to soft computing and signal processing. Research papers in the above-mentioned technology areas were received and subjected to a rigorous peer review process with the help of program committee members and external reviewers. ICSCSP 2018 received a total of 574 papers, each paper was reviewed by more than two reviewers, and finally, 156 papers were accepted for publication in two separate volumes in Springer AISC series.

We would like to express our sincere thanks to Chief Guest Dr. S. B. Gadgil, Outstanding Scientist, Associate Director, RCI, DRDO, and keynote speakers Mr. Aninda Bose, Senior Editor, Springer Nature; Dr. C. Suchismita, Professor, NIT Rourkela; and Dr. Rishu Gupta, Senior Application Engineer, MathWorks, India.

We would like to express our gratitude to all the session chairs, viz., Dr. Ram Murthy Garimella, IIIT Hyderabad; Dr. Chandra Sekhar, Osmania University; Dr. Mohammed Arifuddin Sohel, Muffakham Jah College of Engineering and Technology; Dr. Samrat Lagnajeet Sabat, HCU; Dr. Malla Rama Krishna Murty, ANITS, Visakhapatnam; Dr. Mohana Sundaram, VIT, Vellore; and Dr. Suresh Kumar Nagarajan, VIT, Vellore, for extending their support and cooperation.

We are indebted to the program committee members and external reviewers who have produced critical reviews in a short time. We would like to express our special gratitude to Publication Chair Dr. Suresh Chandra Satapathy, KIIT, Bhubaneswar, for his valuable support and encouragement till the successful conclusion of the conference.

We express our heartfelt thanks to our Chief Patron Sri. Ch. Malla Reddy, Founder Chairman, MRGI; Patrons Sri. Ch. Mahendar Reddy, Secretary, MRGI;

Sri. Ch. Bhadra Reddy, President, MRGI; Convener Prof. P. Sanjeeva Reddy, Director, ECE and EEE; and Organizing Chair Dr. M. Murali Krishna, Dean.

We would also like to thank the organizing secretaries, viz., Dr. S. Srinivasa Rao, HOD, ECE; Dr. D. Sujatha, HOD, CSE; and Dr. G. Sharada, HOD, IT, for their valuable contributions. Our thanks also to all the coordinators and the organizing committee as well as all the other committee members for their contributions in the successful conduct of the conference.

Last but not least, our special thanks to all the authors without whom the conference would not have taken place. Their technical contributions have made our proceedings rich and praiseworthy.

West Long Branch, NJ, USA  
Surathkal, India  
Hyderabad, India  
Hyderabad, India

Jiacun Wang  
G. Ram Mohana Reddy  
V. Kamakshi Prasad  
V. Sivakumar Reddy

# Contents

<b>A New Method for the Spectral Analysis of Unevenly Sampled Time Series</b> . . . . .	1
Steven M. Boswell and Alexandra L. Boghosian	
<b>Analysis of Early Detection of Emerging Patterns from Social Media Networks: A Data Mining Techniques Perspective</b> . . . . .	15
Yadala Sucharitha, Y. Vijayalata and V. Kamakshi Prasad	
<b>Initial Centroids for K-Means Using Nearest Neighbors and Feature Means</b> . . . . .	27
Muddana A. Lakshmi, Gera Victor Daniel and D. Srinivasa Rao	
<b>Secured Cluster-Based Distributed Fault Diagnosis Routing for MANET</b> . . . . .	35
Vani Garikipati and N. Naga Malleswara Rao	
<b>A Comparative Analysis of Unequal Clustering-Based Routing Protocol in WSNs</b> . . . . .	53
Tanmay Biswas, Sushil Kumar, Tapaswini Singh, Kapil Gupta and Deepika Saxena	
<b>YouTube Video Ranking by Aspect-Based Sentiment Analysis on User Feedback</b> . . . . .	63
Ganpat Singh Chauhan and Yogesh Kumar Meena	
<b>Diet Recommendation to Respiratory Disease Patient Using Decision-Making Approach</b> . . . . .	73
Prashant Gaurav and Sanjay Kumar Dubey	
<b>Detection of False Positive Situation in Review Mining</b> . . . . .	83
Devottam Gaurav, Jay Kant Pratap Singh Yadav, Rohit Kumar Kaliyar and Ayush Goyal	

<b>Optimization of Cloud Datacenter Using Heuristic Strategic Approach</b> .....	91
Biswajit Nayak, Sanjay Kumar Padhi and Prasant Kumar Pattnaik	
<b>Blockchain Technology for Decentralized Data Storage on P2P Network</b> .....	101
Akshay Raul, Shwetha Kalyanaraman, Kshitij Yerande and Kailas Devadkar	
<b>Comparative Analysis of Clustering Algorithms with Heart Disease Datasets Using Data Mining Weka Tool</b> .....	111
Sarangam Kodati, R. Vivekanandam and G. Ravi	
<b>A Machine Learning Approach for Web Intrusion Detection: MAMLS Perspective</b> .....	119
Rajagopal Smitha, K. S. Hareesha and Poornima Panduranga Kundapur	
<b>White Blood Cell Classification Using Convolutional Neural Network</b> .....	135
Mayank Sharma, Aishwarya Bhawe and Rekh Ram Janghel	
<b>Analysis of Mobile Environment for Ensuring Cyber-Security in IoT-Based Digital Forensics</b> .....	145
G. Maria Jones, S. Godfrey Winster and S. V. N. Santhosh Kumar	
<b>Payment Security Mechanism of Intelligent Mobile Terminal</b> .....	153
Seshathiri Dhanasekaran and Baskar Kasi	
<b>Hybrid Neuro-fuzzy Method for Data Analysis of Brain Activity Using EEG Signals</b> .....	165
Rajalakshmi Krishnamurthi and Mukta Goyal	
<b>Gait Recognition Using J48-Based Identification with Knee Joint Movements</b> .....	175
Jyoti Rana, Nidhi Arora and Dilendra Hiran	
<b>Cyber Intelligence Alternatives to Offset Online Sedition by in-Website Image Analysis Through WebCrawler Cyberforensics</b> .....	187
N. Santhoshi, K. Chandra Sekharaiah, K. Madan Mohan, S. Ravi Kumar and B. Malathi	
<b>Deep Convolutional Neural Network-Based Diabetic Retinopathy Detection in Digital Fundus Images</b> .....	201
S. Saranya Rubini, R. Saai Nithil, A. Kunthavai and Ashish Sharma	
<b>A Framework for Semantic Annotation and Mapping of Sensor Data Streams Based on Multiple Linear Regression</b> .....	211
K. Vijayaprabakaran and K. Sathiyamurthy	



<b>Cyclostationarity Analysis of GPS Signals for Spoofing Detection . . . . .</b>	<b>223</b>
R. Lakshmi, S. M. Vaitheeswaran and K. Pargunarajan	
<b>Implementation of Fingerprint-Based Authentication System Using Blockchain . . . . .</b>	<b>233</b>
Dipti Pawade, Avani Sakhapara, Melvita Andrade, Aishwarya Badgujar and Divya Adepu	
<b>NSGLTLBOLE: A Modified Non-dominated Sorting TLBO Technique Using Group Learning and Learning Experience of Others for Multi-objective Test Problems . . . . .</b>	<b>243</b>
Jatinder Kaur, Surjeet Singh Chauhan and Pavitdeep Singh	
<b>Homomorphic Encryption Scheme for Data Security in Cloud Using Compression Technique . . . . .</b>	<b>253</b>
D. K. Chandrashekar, K. C. Srikantaiah and K. R. Venugopal	
<b>Efficient Query Clustering Technique and Context Well-Informed Document Clustering . . . . .</b>	<b>261</b>
Manukonda Sumathi Rani and Geddati China Babu	
<b>Motif Shape Primitives on Fibonacci Weighted Neighborhood Pattern for Age Classification . . . . .</b>	<b>273</b>
P. Chandra Sekhar Reddy, P. Vara Prasad Rao, P. Kiran Kumar Reddy and M. Sridhar	
<b>A Novel Virtual Tunneling Protocol for Underwater Wireless Sensor Networks . . . . .</b>	<b>281</b>
A. M. Viswa Bharathy and V. Chandrasekar	
<b>Garbage Monitoring System Using Internet of Things . . . . .</b>	<b>291</b>
Arpan Patel and Nehal Patel	
<b>Mobile Learning Recommender System Based on Learning Styles . . . . .</b>	<b>299</b>
Shivam Saryar, Sucheta V. Kolekar, Radhika M. Pai and M. M. Manohara Pai	
<b>Privacy Sustaining Constant Length Ciphertext-Policy Attribute-Based Broadcast Encryption . . . . .</b>	<b>313</b>
G. Sravan Kumar and A. Sri Krishna	
<b>A Comprehensive Study of Challenges and Issues in Cloud Computing . . . . .</b>	<b>325</b>
Shadab Siddiqui, Manuj Darbari and Diwakar Yagyasen	
<b>Comparative Analysis of Major Jacobian and Gradient Backpropagation Optimizers of ANN on SVPWM . . . . .</b>	<b>345</b>
Neeraj Seth, Ashish Ubrani, Sneha Mane and Faruk A. S. Kazi	

<b>Minimization of Energy Consumption in Wireless Sensor Networks by Using a Special Mobile Agent</b> .....	359
S. Shanthi, Padmalaya Nayak and Sujatha Dandu	
<b>Improved Wisdom of Crowds Heuristic for Solving Sudoku Puzzles</b> .....	369
Neeraj Pathak and Rajeev Kumar	
<b>An End-to-End Secure and Energy-Aware Routing Mechanism for IoT-Based Modern Health Care System</b> .....	379
R. Nidhya, S. Karthik and G. Smilarubavathy	
<b>Internet of Things: Present State of the Art, Applications, Protocols and Enabling Technologies</b> .....	389
A. Anjaiah, A. Govardhan and M. Vazralu	
<b>Implementation of Multithreaded BFS Using Bag Data Structure</b> .....	399
Hemalatha Eedi and Mohd Abdul Rasheed	
<b>Context-Aware Agents for IoT Services</b> .....	409
K. Deeba and RA. K. Saravanaguru	
<b>Multicriteria-Based Ranking Framework for Measuring Performance of Cloud Service Providers</b> .....	419
K. S. Sendhil Kumar and N. Jaisankar	
<b>An Optimized Computer Vision and Image Processing Algorithm for Unmarked Road Edge Detection</b> .....	429
Jayalakshmi Annamalai and C. Lakshmikanthan	
<b>Performance Analysis of EMTCMOS Technique-Based D Flip-Flop Design at Varied Supply Voltages and Distinct Submicron Technology</b> .....	439
Patikineti Sreenivasulu	
<b>Error Detection Using Counting Technique in Low-Power VLSI</b> .....	449
Kumud Kumar Bhardwaj and T. Swapna Rani	
<b>Adaptive Sampling Rate Converter for Wireless Sensor Networks</b> .....	457
P. Swetha, S. Srinivasa Rao and P. Chandrasekhar Reddy	
<b>Improvement of Signal-to-Noise Ratio for MST Radar Using Weighted Semi-parametric Algorithm</b> .....	467
C. Raju and T. Sreenivasulu Reddy	
<b>A Robust DCT-SVD Based Video Watermarking Using Zigzag Scanning</b> .....	477
K. Meenakshi, K. Swaraja and Padmavathi Kora	

<b>Digitization and Parameter Extraction of Preserved Paper Electrocardiogram Records</b> .....	487
Rupali Patil and Ramesh Karandikar	
<b>Segmentation and Classification of CT Renal Images Using Deep Networks</b> .....	497
Anil Kumar Reddy, Sai Vikas, R. Raghunatha Sarma, Gurudat Shenoy and Ravi Kumar	
<b>A Novel Traffic Sign Recognition System Combining Viola–Jones Framework and Deep Learning</b> .....	507
Ajay Jose, Harish Thodupunoori and Binoy B. Nair	
<b>Detection of Cardiac Arrhythmia Using Convolutional Neural Network</b> .....	519
Padmavathi Kora, K. Meenakshi and K. Swaraja	
<b>Dual-Function Radar-Communication Using Neural Network</b> .....	527
K. S. Anjali and G. Prabha	
<b>Patient Nonspecific Epilepsy Detection Using EEG</b> .....	541
Sandeep Banerjee, Varun Alur and Divya Shah	
<b>Power Efficient PUF-Based Random Reseeding True Random Number Generator</b> .....	549
Anirudh Siripragada, R. Shiva Prasad and N. Mohankumar	
<b>Edge Cut Dual-Band Slot Antenna for Bluetooth/WLAN and WiMAX Applications</b> .....	561
J. Rajeshwar Goud, N. V. Koteswara Rao and A. Mallikarjuna Prasad	
<b>A Complete End-to-End System for Iris Recognition to Mitigate Replay and Template Attack</b> .....	571
Richa Gupta and Priti Sehgal	
<b>Tampering Detection in Digital Audio Recording Based on Statistical Reverberation Features</b> .....	583
Tejas Bhangale and Rashmika Patole	
<b>Acoustic Scene Identification for Audio Authentication</b> .....	593
Meenal Narkhede and Rashmika Patole	
<b>Retinal Blood Vessel Extraction Using Morphological Operators and Kirsch's Template</b> .....	603
Jyotiprava Dash and Nilamani Bhoi	
<b>Wire Load Variation-Based Hardware Trojan Detection Using Machine Learning Techniques</b> .....	613
N. Suresh Babu and N. Mohankumar	

<b>A Neural Network Approach for Content-Based Image Retrieval Using Moments of Image Transforms</b> .....	625
D. Kishore, S. Srinivas Kumar and Ch. Srinivasa Rao	
<b>Probe-Fed Wideband Implantable Microstrip Patch Antenna for Biomedical and Telemetry Applications</b> .....	635
Komal Jaiswal, Ankit Kumar Patel, Shekhar Yadav, Sweta Singh, Ram Suchit Yadav and Rajeev Singh	
<b>Mapping Urban Ecosystem Services Using Synthetic-Aperture Radar (SAR) Images from Satellite Data for Rural Microgrids in India</b> .....	643
Prem Raheja, Surmeet Kaur Jhaji, Purva Jhaveri and Jignesh Sisodia	
<b>Analysis of Denoising Filters for Source Identification Using PRNU Features</b> .....	655
Nadia Siddiqui, Syeda Shira Moin and Saiful Islam	
<b>Advanced Protection for Automobiles Using MSP430</b> .....	665
C. Ravi Shankar Reddy, V. Siva Kumar Reddy, T. Vinay Simha Reddy and P. Sanjeeva Reddy	
<b>Performance Analysis of KNN Classifier with Various Distance Metrics Method for MRI Images</b> .....	673
Karthick Ganesan and Harikumar Rajaguru	
<b>Comparison of Low Current Mismatch CMOS Charge Pumps for Analog PLLs Using 180 nm Technology</b> .....	683
Alan Saldanha, Vijil Gupta and Vinod Kumar Joshi	
<b>Optimized Node Swapping for Efficient Energy Usage in Heterogeneous Network</b> .....	693
Satyanarayan K. Padaganur and Jayashree D. Mallapur	
<b>Content-Based Video Shot Boundary Detection Using Multiple Haar Transform Features</b> .....	703
D. Asha and Y. Madhavee Latha	
<b>An Analysis of IPv6 Protocol Implementation for Secure Data Transfer in Cloud Computing</b> .....	715
Anitha Patibandla, G. S. Naveen Kumar and Anusha Meneni	
<b>Anomaly Detection in Crowd Using Optical Flow and Textural Feature</b> .....	723
Pranali Ingole and Vibha Vyas	
<b>Automatic Tonic (Shruti) Identification System for Indian Classical Music</b> .....	733
Mahesh Y. Pawar and Shrinivas Mahajan	

<b>Single-Plane Scene Classification Using Deep Convolution Features . . .</b>	<b>743</b>
Nikhil Damodaran, V. Sowmya, D. Govind and K. P. Soman	
<b>A Novel Methodology for Multiplication of Three n-Bit Binary Numbers . . . . .</b>	<b>753</b>
Anirban Mukherjee, Niladri Hore and Vinay Kumar	
<b>Speed-Breaker Early Warning System Using 77 GHz Long-Range Automotive Radar . . . . .</b>	<b>761</b>
Umarani Deevela, Swapna Raghunath and Srinivasa Rao Katuri	
<b>Face Recognition using Invariant Feature Vectors and Ensemble of Classifiers . . . . .</b>	<b>769</b>
A. Vinay, Abhijay Gupta, Harsh Garg, Aprameya Bharadwaj, Arvind Srinivas, K. N. Balasubramanya Murthy and S. Natarajan	
<b>Pattern and Frequency Reconfigurable MSA for Wireless Applications . . . . .</b>	<b>781</b>
Deeplaxmi V. Niture, Chandrakant S. Patond and S. P. Mahajan	
<b>Feature Fusion and Classification of EEG/EOG Signals . . . . .</b>	<b>793</b>
Ayushi Mishra, Vikrant Bhateja, Aparna Gupta, Apoorva Mishra and Suresh Chandra Satapathy	
<b>High-Efficiency Video Coding De-blocking Filter: Through Content-Split Block Search Algorithm . . . . .</b>	<b>801</b>
Perla Anitha, P. Sudhakara Reddy and M. N. Giri Prasad	
<b>Key Frame Extraction Using Content Relative Thresholding Technique for Video Retrieval . . . . .</b>	<b>811</b>
K. Mallikharjuna Lingam and V. S. K. Reddy	
<b>Author Index . . . . .</b>	<b>821</b>

## About the Editors

**Jiacun Wang** received his Ph.D. in computer science engineering from Nanjing University of Science and Technology (NJUST), China, in 1991. He is currently Professor in the Department of Computer Science and Software Engineering at Monmouth University, West Long Branch, New Jersey. From 2001 to 2004, he was a member of scientific staff at Nortel Networks in Richardson, Texas. Prior to joining Nortel, he was Research Associate at the School of Computer Science, Florida International University (FIU), Miami, and Associate Professor at NJUST. He has published numerous books and research papers and is an associate editor of several international journals. He has also served as program chair, program co-chair, special session chair, and program committee member for several international conferences. He is Secretary of the Organizing and Planning Committee of the IEEE SMC Society and has been a senior member of IEEE since 2000.

**G. Ram Mohana Reddy** completed his BE in electronics and communication engineering at Sri Venkateswara University, Andhra Pradesh, in 1987; his M.Tech. in telecommunication systems engineering at IIT Kharagpur, in 1993; and his Ph.D. in cognitive hearing science from the University of Edinburgh in 2005. He is currently Professor and Head of the IT Department at NITK Surathkal, Mangalore. He has contributed to several projects of national and international importance in areas such as affective human-centered computing, big data and cognitive analytics, cognitive hearing and speech science, cloud computing, social multimedia, and social network analysis. He has published numerous books, research papers, and conference proceedings in these areas and is an active member of a number of international associations, including IEEE and ACM.

**V. Kamakshi Prasad** completed his Ph.D. in speech recognition at IIT Madras and his M.Tech. in computer science and technology at Andhra University in 1992. He has more than 20 years of teaching and research experience. His areas of research and teaching interest include speech recognition and processing, image processing, pattern recognition, ad hoc networks, and computer graphics. He has published several books, chapters, research papers in peer-reviewed journals and

conference proceedings. He is also an editorial board member of the International Journal of Wireless Networks and Communications and a member of several academic committees.

**V. Sivakumar Reddy** is Professor in the Department of Electronics and Communication Engineering, Malla Reddy College of Engineering and Technology. He completed his BE in electronics and communication engineering from SV University, his M.Tech. in digital systems at JNT University, and his Ph.D. in electronics and communication engineering at IIT Kharagpur. His areas of research interest include computer networks and communication, video processing, multimedia system design, operating systems, TCP/IP networks and protocols. He has published more than 100 papers in peer-reviewed journals and conference proceedings in these areas. He is a member of several academic bodies, such as IETE, IEEE, ISTE, and CSI. He is also Reviewer for several IEEE journals.

# Garbage Monitoring System Using Internet of Things



Arpan Patel and Nehal Patel

## Contents

1	Introduction .....	292
2	Literature Survey .....	292
3	Proposed Work .....	292
4	Implementation .....	295
5	Results and Discussion .....	295
6	Conclusion .....	297
	References .....	298

**Abstract** Garbage management is becoming the chief issue owing to escalate in population. In most of the metropolises, the overflowed garbage bins are producing an unsanitary atmosphere. Moreover, it leads to emerging of diverse varieties of anonymous illnesses. However, it damages the living standard. So, we need to take some responsible actions for garbage management. We have to improve garbage management level by decreasing the time for tacking garbage and finding the more efficient way. In this paper, we had done the literature survey and also proposed IoT-based garbage monitoring system which checks the level of garbage in bins and sends that information to authorized worker through SMS. Information contains level of garbage and Google map link of bin. Using the garbage bin link, worker reaches the garbage bin when it is full and saves the time which is unnecessarily used to go through for garbage bin even it is not full.

**Keywords** NodeMCU (Esp8266 12-E) • Ultrasonic sensor • Geolocation API IFTTT service • IoT

---

A. Patel • N. Patel (✉)

Department of Information Technology, CSPIT, CHARUSAT, Changa,  
Gujarat, India

e-mail: [nehalpatel.it@charusat.ac.in](mailto:nehalpatel.it@charusat.ac.in)

A. Patel

e-mail: [patelarpan3355@gmail.com](mailto:patelarpan3355@gmail.com)

© Springer Nature Singapore Pte Ltd. 2019

J. Wang et al. (eds.), *Soft Computing and Signal Processing*, Advances in Intelligent Systems and Computing 900, [https://doi.org/10.1007/978-981-13-3600-3\\_28](https://doi.org/10.1007/978-981-13-3600-3_28)

291



## 1 Introduction

In current decade, people are migrating from rural to urban areas; therefore, garbage is increasing in urban areas rapidly, but technology is same in rural as well as urban areas to control the garbage. Hence, the technology used for controlling garbage is real-time monitoring using Internet of things (IoT) because communication through the Internet has evolved from user to user, and new technologies took a birth like IoT, cloud computing. IoT can link services with modern techniques and try to metamorphose urban centers into the smart cities by optimizing system.

In garbage monitoring system, sensor senses the information and sends to authorized worker in the form of message with the location of bin. After garbage is taken, they will send that garbage for disposal to organic, plastic, and metal [1, 2]. So it is getting easy to regenerate another thing using this garbage which is helping to make easy day-to-day life. We implement this system using embedded system with IoT. For that we need to take the information from ultrasonic sensor and check that information is above garbage limit or not; if it is above the limit, then send that information to authorized worker in the form of message with Google map location. Thus, worker can track that bin and easily collect the bin [3]. Ultimately it helps to retain cleanness in the society.

## 2 Literature Survey

See Table 1.

## 3 Proposed Work

As depicted in Fig. 1, first we start the NodeMCU. After starting NodeMCU, it will connect to router then it will request to ultrasonic sensor for information. Ultrasonic sensor collects the information and lends that information to NodeMCU [4]. Afterward, NodeMCU checks that information and figures out whether the information reaches the garbage limit or not. Nevertheless, if garbage level is less than 70% then NodeMCU will stop for some time and check again for newly arrived data from ultrasonic sensor. If garbage level is greater than 70% but less than 90%, then NodeMCU will get the longitude and latitude of that bin using geolocation API and send the message, "bin is 70% full," with "Google map link" of that particular bin to authorized worker. If garbage level is greater than 90%, then it sends the message, "bin is full," with "Google map link" of that particular bin to authorized worker.

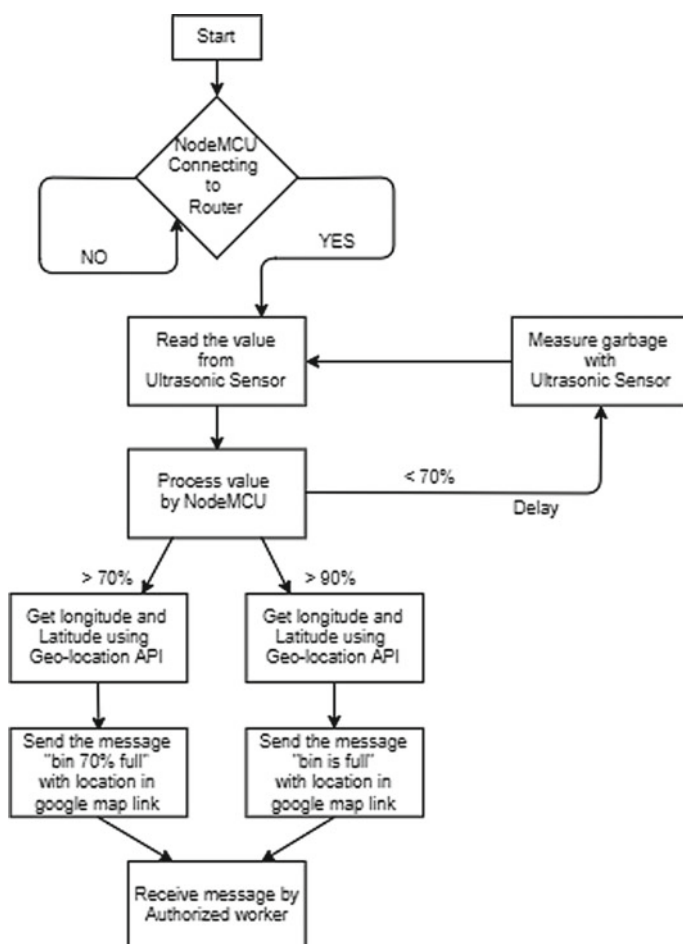
**Table 1** Comparison of diverse existing garbage monitoring system

S. No.	Title of papers	Year	Sensors used	Information transfer methods and technology used
1	Smart Garbage Monitoring System Using Internet of Things [6]	2017	Ultrasonic sensor	Microcontroller, Wi-Fi modem, IoT, GSM
2	Smart garbage monitoring and clearance system using Internet of things [3]	2017	Ultrasonic sensor, force sensor	Embedded, IoT, GSM, Microcontroller, Web server
3	Smart waste management using Internet of Thing [7]	2017	Ultrasonic ranging module HC-SR04	Wi-Fi, Embedded, IoT, MySQL, AI
4	Smart Garbage Monitoring System for Waste Management [8]	2017	HC-SR04 ultrasonic sensor	SIM900A GSM Module, Arduino Uno board
5	Smart city technology based architecture for refuse disposal management [9]	2016	Proximity, light, odor, force sensitive sensor	Embedded, Arduino UNO microcontroller board, breadboard, GSM/GPRS, Wi-Fi
6	A Cloud-based Dynamic Waste Management System for Smart Cities [10]	2016	Load sensor SEN-10245, ultrasonic sensor	Cloud server, Microcontroller, and GPRS
7	Automatic Waste Segregator and Monitoring System [11]	2016	Ultrasonic sensor, proximity sensor	Arduino Uno board, Microcontroller, GSM
8	Cloud-based Smart Waste Management for Smart Cities [2]	2016	RFID, load cell sensor	Cloud, Big Data Analytics
9	Smart Dustbin-An Efficient Garbage Monitoring System [12]	2016	Ultrasonic sensor HC-SR04	GSM, Arduino Uno

(continued)

**Table 1** (continued)

S. No.	Title of papers	Year	Sensors used	Information transfer methods and technology used
10	Real-time solid waste bin monitoring system framework using wireless sensor network [13]	2014	Accelerometer, hall effect, ultrasound, temperature, humidity, load cell sensor	Zigbee PRO, GPRS, central server database

**Fig. 1** System architecture

**Fig. 2** NodeMCU (Esp8266 12-E)



## 4 Implementation

### A. Ultrasonic Sensor

This module is connected to NodeMCU and waits for NodeMCU reply. When it gets a reply from NodeMCU, it sends the signal and waits for receiving that signal and calculates that amount of time and gives it to NodeMCU.

### B. NodeMCU

This module gives the instruction to ultrasonic sensor to sense the time. After retrieving that time, it performs some operations and calculates distance. If distance is more than 70%, then this module is connected to geolocation API and gets the longitude and latitude of that location and sends the Google map link through IFTTT service.

### C. Geolocation API

NodeMCU connects to geolocation API server and gives the information about nearby Wi-Fi network or cell tower. Geolocation API performs the calculation and gives the longitude and latitude with accuracy.

### D. IFTTT Service

After getting longitude and latitude, NodeMCU connects to IFTTT service and triggers the message using Webhook service to assign number with value. Value contains percentage of garbage level and location of garbage bin.

## 5 Results and Discussion

The hardware mechanisms must be associated correctly. Moreover, ensure that the android phone and the server must be connected to the Internet.

In Fig. 2, this module is called NodeMCU which is used to load program and connect to the server. In Fig. 3, ultrasonic sensor is used to measure distance of garbage. It detects the range from 3 cm up to 3 m. Figure 4 shows the diagram of implemented system and Fig. 5 shows bin with garbage.

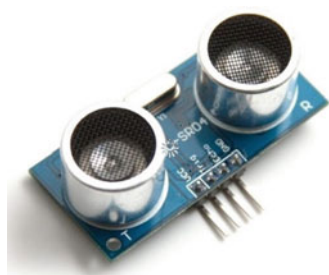
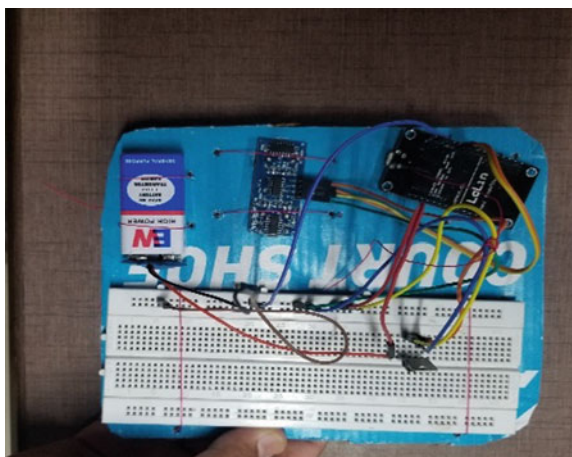
**Fig. 3** Ultrasonic sensor**Fig. 4** Diagram of implemented system**Fig. 5** Bin with garbage

Fig. 6 Received message

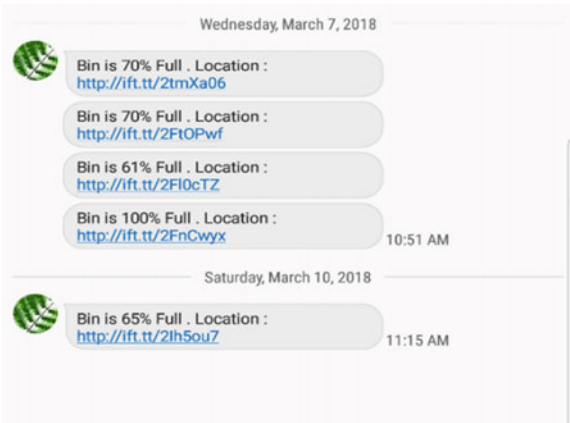
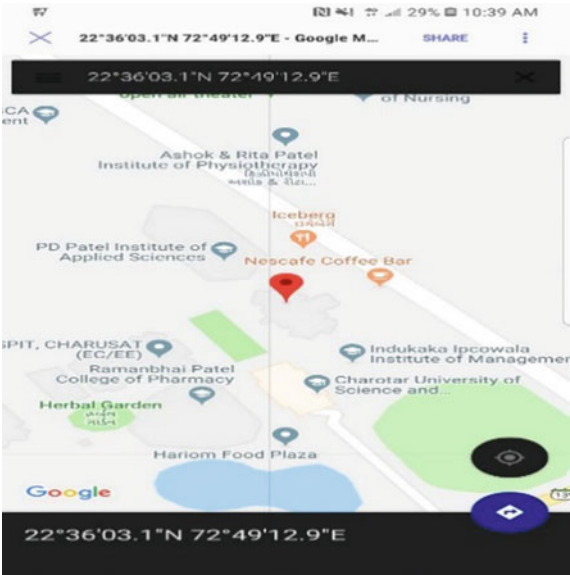


Fig. 7 Garbage bin location



In Fig. 6, when garbage reaches the threshold value, message will be received to phone via SMS with garbage bin location link [5]. In Fig. 7, we can see the garbage bin location using Google map link.

## 6 Conclusion

In this paper, we presented a smart garbage monitoring system for single bin using IoT. It is accountable for computing the waste level in the bins and later sends the information to authorized worker through SMS. This information helps to calculate

to optimized routes for the workers. Furthermore, we get the location without using GPS module and send the message deprived of using GSM component. In the future, we would like to elongate this system for different kinds of wastes such as metallic, organic, and dry waste segregator and monitoring system.

## References

1. G. Soni, S. Kandasamy, Smart garbage bin systems—a comprehensive survey, in *International Conference on Intelligent Information Technologies* (Springer, Singapore, 2017), pp. 194–206
2. M. Aazam, M. St-Hilaire, C.-H. Lung, I. Lambadaris, Cloud-based smart waste management for smart cities, in *2016 IEEE 21st International Workshop on Computer Aided Modelling and Design of Communication Links and Networks (CAMAD)* (IEEE, USA, 2016), pp. 188–193
3. S.V. Kumar, T. Senthil Kumaran, A. Krishna Kumar, M. Mathapati, Smart garbage monitoring and clearance system using internet of things, in *2017 IEEE International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM)* (IEEE, USA, 2017), pp. 184–189
4. R.M. Saji, D. Gopakumar, H. Kumar, A survey on smart garbage management in cities using IoT. *Int. J. Eng. Comput. Sci.* **5**(11) (2016)
5. M.S. Kumbhar, P.S. Yalagi, Survey on technology tools for water and garbage management for smart city planning, in *International Journal of Computer Applications (0975–8887) National Seminar on Recent Trends in Data Mining (RTDM 2016)* (2016)
6. S.M. Chaware, S. Dighe, A. Joshi, N. Bajare, R. Korke, Smart garbage monitoring system using internet of things (IoT). *Int. J. Innov. Res. Electr. Electron. Instrum. Control Eng.* **5**(1) (2017)
7. G.K. Shyam, S.S. Manvi, P. Bharti, Smart waste management using Internet-of-Things (IoT), in *2017 2nd International Conference on Computing and Communications Technologies (ICCT)* (IEEE, USA, 2017), pp. 199–203
8. N.M. Yusof, A.Z. Jidin, M.I. Rahim, Smart garbage monitoring system for waste management, in *MATEC Web of Conferences*, vol. 97 (EDP Sciences, France, 2017)
9. J.O. Adeyemo, O.O. Oludayo E. Adetiba, Smart city technology based architecture for refuse disposal management, in *IST-Africa Week Conference* (IEEE, USA, 2016)
10. S. Sharmin, S.T. Al-Amin, A cloud-based dynamic waste management system for smart cities, in *Proceedings of the 7th Annual Symposium on Computing for Development* (ACM, USA, 2016)
11. A. VJ, K. Balakrishnan, T.B. Rosmi, K.J. Swathy Krishna, S. Sreejith, T.D. Subha, *Automatic Waste Segregator and Monitoring System*
12. K.A. Monika, N. Rao, S.B. Prapulla, G. Shobha, Smart dustbin—an efficient garbage monitoring system. *Int. J. Eng. Sci. Comput.* **6**(6), 7113–7116 (2016)
13. M.A. Al Mamun, M.A. Hannan, A. Hussain, Real time solid waste bin monitoring system framework using wireless sensor network, in *2014 International Conference on Electronics, Information and Communications (ICEIC)* (IEEE, USA, 2014)