National College of Ireland

Secure Framework for Healthcare Systems Based on Big Data Analytics in Mobile Cloud Computing

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Secure Framework for Healthcare Systems Based on Big Data Analytics in Mobile Cloud Computing

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Abstract

In this research paper, we present a Healthcare Information Systems(HIS) architecture focused on big data technology in Mobile Cloud Environments. This framework (HIS) provides a high degree of collaboration, integration, accessibility and availability of data sharing among healthcare system providers, patient and practitioners. Electronic Health Records(EHR) are incorporated and maintained in the data storage area of patients distributed among various care delivery agencies, providing an electronic health records for every individual patient. Mobile Cloud computing allows for easy internet connectivity and EHR provision from anywhere and at any time across various platforms. Because of the vast scale of health care data, the rapid increase in the velocity at which this data is produced, and the sophistication of the form of health care data, the proposed system uses deep learning algorithms to find valuable insights to help practitioners make informed right decisions at right time. Therefore, our designed methodology proposes a set of protection and network security like Medical Cloud Multi-Agent System(MCMAS) and Dynamic Hadoop Slot Allocation(DHSA) that guarantee the credibility, privacy, and confidentiality of medical information. And using different algorithm to secure the data such as Genetic Algorithm(GA), Particle swarm optimizer(PSO) and Parallel Particle swarm optimization (PPSO) are used to build the proposed model. These algorithm protect the data compared to previous research. We think the current structure makes possible the way for a new wave of reduced cost (lower price), highly efficient and effective healthcare information systems.

Keywords: Mobile Cloud Computing, Big Data, Secure Framework for Healthcare Information System(HIS)

Contents

1 Introduction

The healthcare sector is data-intensive and could have used immersive integrated big data systems to improve patient safety and programs with emerging technology and resources. Every day, the healthcare sector maintains a vast volume of data from clinical and operational systems, such as Electronic Health Records(EHR), Laboratory Information and Library Systems etc[1]. The healthcare sector is as dynamic and competitive as any sector in today's world. When used to enhance access, communication and data sharing among healthcare professionals, patients, and researchers, the healthcare information system offers many benefits[7].

Cloud Computing(CC) has latest technology in today's world. Cloud plays a crucial role in all sectors, from manufacturing to a small retail store. To overcome the old-fashioned cloud-based network a new approach is followed called as Mobile Cloud Computing(MCC). Mobile cloud computing is a way of incorporating cloud technology into mobile device applications. Recent advances in digital computing and mobile technologies have influenced the diverse trends of digital services and applications in health care sector. Medical data can be processed and distributed in cloud network data from all over the place and response can be given to patients through the Web Application Network(WAN)[2]. We present a mobile cloud computing approach in this article via a web service in the healthcare industry. Mobile cloud computing integrates mobile computing and cloud computing to expand its strengths and benefits and address challenges such as low memory, Processing capacity(power) and battery life(power consumption). And Big-data technologies involve Velocity, Volume, Veracity, Variety of data[3].

Health care system aims at sustaining and enhancing people's health through diagnosis, treatment, and prevention of diseases. As guided by patient treatment, testing, Administration, and regulatory criteria produce large quantities of Big-data regular basis. Big data will support many healthcare and medical operations including support for clinical decision-making, disease monitoring and public health Organization. Big Data Analytics moves data processing and its strategies from data structure to unstructured or semi - structured data, and from a centralized terminal system to an cloud environment[13].

This help of each provider make their Electronic Medical Records(EMR) database decisions about patients using their own records. The main issue with today's EMR systems is that they were usually linear, and each Healthcare Professional(HP) has its own individual EMR system as well[9].

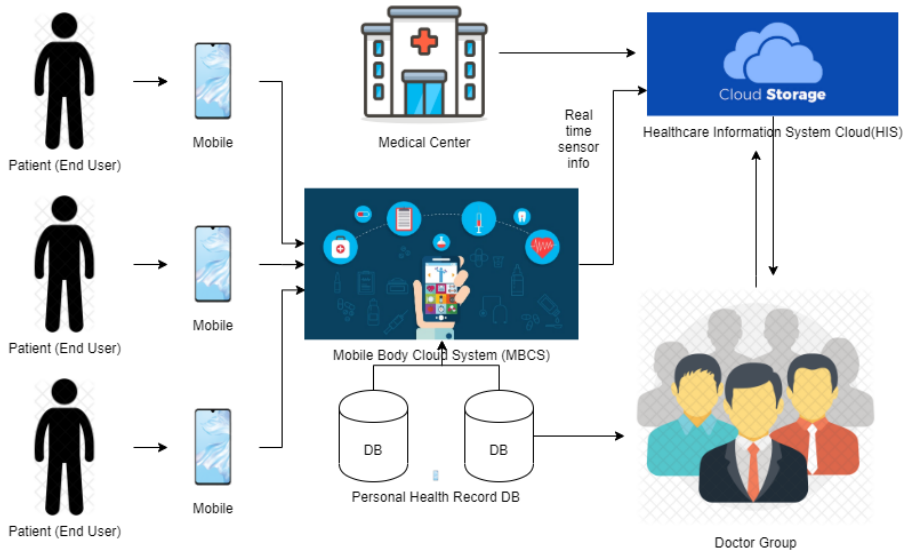

Figure 1: Healthcare Information system with Mobile cloud

It is emerging as a core resource sharing computing network that includes infrastructure, applications, software, and business operations. Virtualization is a key technology which allows the sharing of cloud resources. Cloud Computing may be applied to solve problems in many domains of Information Technology like Geographical Information Systems(GIS), Scientific Research, e-Governance Systems, Healthcare Industry, Decision Support Systems)DSS), Web Application Development, Mobile Technology etc[17]. Information Support Systems are computer-based Information Systems that supports business or organizational information processing and information dissemination activities[6]. Management Information Systems(MIS) support an organization's management planning levels and offer accessibility of information to a broad variety of users across a vast geographic region.

Implementing a Health Information System(HIS) based on big data technology and using the framework in Mobile Cloud Computing(MCC) environments ensures a strong level of consistency, protection and data sharing among healthcare providers, patients, and clinicians. Protected HIS system is already in use but some challenges are constantly being faced. So, I am using various analyzes and which research has given this approach the best result. This research is also useful for exchanging data and Safe on receiver and sender[28]. The divergence between conventional analytical solutions and our modern healthcare environment such as Hierarchical Analysis System, Adaptive Analysis System, cultural and social-technical Analysis Systems, Drawbacks of existing analytical methods, Cognitive work design, Workplace Domain Analysis, Management Tasks, and competencies Techniques[21].

The present crisis Healthcare Information System(HIS) has generated the capacity to store, manage electronically, safely exchanged data(Move data) around the global in a few seconds, and therefore has the potential to realize enormous productivity improvements and healthcare service quality. Electronic Medical Records(EMR) are highly vulnerable

to insufficient access, impacted data integrity or broad distribution-distributed unapproved[14]. New safety checks needed to keep records of HIS patients.

This Healthcare Information System(HIS) framework already used some healthcare organizations. But most of organizations facing the issues like Huge Investment, Legacy Systems, More IT Staffs for management, Lack of Computer equipment, Lack of computer skills, Lack of internet connection, Cost of internet connection, Lack of information, Lack of training and technical support, Lack of Electricity, Lack of Service providers etc. So, this framework already resolves most of the problems[25]. But our proposed HIS method give more analytical solution with best results.

2 Research Question

1)Which type of Analysis gives the best result for Mobile Cloud Computing in Healthcare system using Big Data?

2)How to manage patient information in private Cloud with help of HIS and how does it impact HIS?

The Research questions aims to find out the proper analysis with given the best solution and techniques for Mobile Cloud Computing and Manage the individual cloud for more security purpose and Impacts of this method HIS.

3 Literature Review

This literature review was initiated for the primary intention of providing the context for the authors conducting an evaluation project. During the literature review process, the authors became conscious that at present there was no systematic analysis of the critical pre-requisite and possibly inhibiting factors for the effective implementation of big data with healthcare information systems (HIS) that related this knowledge to their analysis. With this overview and reference this analysis builds on other studies in the literature.

*** Securing data using Big data analysis :-**
Highlights the importance of implementing Big data analysis for security problem.

*** Securing data in Healthcare Information System :-**
Highlights the No of method in Healthcare Information System.

*** Healthcare Information System connected with Mobile cloud Computing**
Highlights the significance of Hadoop method in Mobile Cloud Computing.

3.1 Securing data using Big data analysis

Big data analysis is the one of the method of securing data in whatever industries. It not only secure the data. it also used for user authentication from unauthorized access.

Research has been proposed by Ahmed at al[1], This author researched some technical aspects and got semi result of this research paper. So he proposed the scale complexity and velocity of processing healthcare data is now increasing very rapidly, and conventional database machine learning techniques are no longer effective in storing, analyzing and interpreting these information. New creative tools are required to manage these data

in a manageable time elapsed. The behavioral data of the patient is collected by multiple sensors; the various social experiences and communications of the patients. Now the modern medical practice transitions from largely and discretionary decision-make to evidence-based in healthcare[8].

Another researcher Adriana at al[2] has proposed Six V's Characteristics like Velocity, Veracity, Variability, Visualization, 0Value and Volume.Big data in healthcare contains patient-related information from electronic healthcare record, computerized provider order entry systems, decision support tools, clinical devices and sensors, etc., as well as less patient-related data like emergency services, news reports, and journal papers. This information is huge due to its dimension, variety of data types and speed which needs to be evaluated, which makes the conventional applications difficult and Handling hardware[2].

Descriptive analytics

Analyzes data to clarify healthcare decisions of the ancient and modern and keep new people updated. The simulations can classify, describe, merge and identify the data in order to extract valuable information. Graphs and presentations are also used for visualizing the results[3].

Predictive analytics

Reviews old or condensed data on health care in order to recognize trends of relationships that can be extrapolated to forecast the future. It makes Knowing why this happened, and what will possibly change in the future. This will help improve medical treatment, managing long-term illnesses and delivering healthcare. Data Mining techniques can be used to find hidden trends in vast quantities of health data, thereby identifying medical risks, predicting patient outcomes and improving health-related service[3].

Prescriptive analytics

Uses information or data to solve, but also medical and health awareness Problems involving too many alternatives which render concise or quantitative analysis impossible. It is also used in healthcare to help distinguish between various therapies or procedures, for example, to help to customized and evidence based healthcare medicine[3].

Discovery analytics

Uses information to recognise previously hidden facts from records, and make the future better. This may help identify new disorders or medical problems, medications and therapies[3].

The exponential advancement in the field of big data analytics has given rise to major opportunities,but also to a range of obstacles, most of which have significant implications for healthcare sector. And Big data challenges in Healthcare sector such as Interpretation and Correlations, Standards and Inter-separability, Privacy and Security, Data Expertise and Infrastructure, Timeliness, The IT leadership[9].

Big data and Big data analysis will help make healthcare sector more efficient and competitive. These could be used in a range of activities, ranging from disease prevention and control to medical science, which contribute to information that help healthcare professionals make more accurate which responsible decisions about the population they manage[16]. However, there are also obstacles to explore the potential of Big data in healthcare sector, the most prominent being the complexity of processing enormous amounts of data to achieve accurate information on a timely basis, and a need for optimization, integration, security , privacy and skills and funding for the advancement of the

Big data architecture and the integration of sets of data already accessible[22].

Table:1 Summarizes the different research papers on the topic securing data in using Big data analysis.

Refs	Objective	Algorithm	Type of computing	Result
[21]	Secure sharing of data with no attacks	Secure Effective Records (SER) with Transmission control	Cloud	Reduce energy level and increased efficient work
[17]	Securing the information in Healthcare Information System(HIS) Network	Heritage Provider Network(HPN	Mobile Cloud	Less power consumption and speed processing
[2]	To reach high computation and reduced energy with secure transmission	Unique Patient Identifier(UPI) approach algorithm	Mobile Cloud	Effective and efficiency Security of HIS data is improved
[27]	Overcome the problem with decrease latency	Attributes Encryption Security(AES) with Divisional control	Cloud	No information loss and efficiency resource planning provision
[14]	Provide secure framework transmission for various attacks	Big Data Security algorithm with large data sharing	Mobile Cloud	Increase the performance of the resource provision and reduce the cost
[8]	To solving the unauthorized access in muiti accounts	Mobile Division Sharing (MDS) with Private control	Cloud	Increased speed with secure sharing
[11]	Research provisioning control based on rent of the mobile cloud and processing velocity of Cloud storage	Mobile Identifier Security Method(MISM)	Mobile Cloud	low energy power and more efficiency of network

3.2 Securing data in Healthcare Information System

Research has been proposed by Jagadeeswari at el[13], Working to improve health care and decreasing medical expenses are the primary priorities of nations around the world. The healthcare data size revolution, however, remains an challenge that hinders achieving this target. Electronic healthcare data worldwide is measured at 500 terabytes of data in 2012 and are projected to exceed 25,000 terabytes of data by 2020[3]. Obviously, collecting, processing, finding, exchanging, and evaluating these big data in order to find valuable insights would enhance healthcare systems results by best choices and will also minimize healthcare costs, but conventional database management techniques are no longer appropriate for processing these data. This role requires modern, powerful algorithms. Safety will be the highest priority since day one at cloud-based HIS. Patient data should be secured with robust physical protection, data encryption, authentication mechanisms and protection of application, as well as the current safety practices and qualifications establishing requirements, and reliable point-to - point memory management for backup data[21].

Another researcher has been Ashwin at el[27], main healthcare cloud problem is security risks including misuse or disclosure of cloud data from sensitive patients, loss of patient data privacy, and inappropriate use of information. Hence, healthcare cloud computing services can meet a range of security specifications[8]. Discuss key protection and privacy specifications for healthcare clouds is Authentication, Authorization, Non-repudiation, Integrity and Confidentiality, Availability[4].

Authentication

In a healthcare information cloud, CSPs deliver both health information and User identities (HPs, clinicians and patient) should be checked with the username and password provided by CSPs at the entry of each connection[1].

Authorization

Is an important safety function used to test control preferences, Cloud User rights and account control. Each user in the cloud is given privileges based on their account[1]. Patients can require or reject sharing with the other healthcare professionals or CDOs of their information. The patient can grant users rights on the basis of a position or characteristics held by the registered user to administer patient consent in a healthcare system[8].

Non-repudiation

Indicates that every party to the transaction can't deny receiving a transaction Nor can the other party deny that the transaction has been sent. Technologies including such authentication, system logs, verification receipt, and encryption may be used in a healthcare system to establish patient, CDO and practitioner validity and non-repudiation[13].

Integrity and Confidentiality

Integrity requires the safeguarding of data integrity and continuity. This applies to the fact that EHRs were not fiddled with in the healthcare system Inappropriate use. The International Organization for Standardization (ISO) describes confidentiality in ISO-17799 as 'ensuring the information is only available to those who are allowed to access it[18][24].'

Availability

The details must be made available for any EHR program to fulfill its purpose When they need it. High availability methods enable at staying always usable, Prevents loss of operation due to power outages, equipment failures and network upgrades. Often main-

taining transparency means stopping denial of service (DoS) attacks[1].

Table:2 Summarizes the different research papers on the topic securing data in Healthcare Information System

Refs	Objective	Algorithm	Type of computing	Result
[8]	Recovery of generated information by Healthcare Information System and Cloud storage	HIS Secured Framework with merge of secured data	Mobile Cloud	Development of data (Information) processing with secure connection in Private cloud
[19]	Availability, Scalability, Sharing, Processing storage of Healthcare Information System	Mobile Cloud Transmis-sion(MCT)	Cloud	Multiple Patient record processing one way Cloud method
[23]	Increase the poor connection (communica-tion) process in Healthcare Information System	Hadoop technology algorithm	Cloud	Power consume is reduce and sharing data speed is increased
[17]	Resource planning allocation to increase the power efficiency and reduce the server	Data merging and Transmission Algorithm	Mobile Cloud	Improved number of servers and saving cost control management
[7]	Unauthorised Device Identifier in HIS	Mobile Cloud Identifica-tion(MCI)	Cloud	Secure data(Information) from Other persons and Device control authentication

Proposed framework research has been proposed by E. Youssef at al [1], Perhaps one of the most significant challenges in designing HISs is to provide frameworks for reliably, safely and rapidly accessing and collecting patient information from various EMR / EHR databases. In previous parts, we addressed the criteria for a new generation of stable HIS in a cloud-based Big Data Analytics environment.

The Cloud: The first aspect is the cloud infrastructure itself that houses patient data and allows the approved users with various types of service. The EHR: The second aspect is the EHR, where separate patient records in various units (pharmacist, enrollment, laboratory, ...) are combined into several CDOs diverted in a city , state or area and stored in the system cloud. The security model: The third element is that which safeguards protection and security guarantees in HIS. The big data analysis: This part will deploy can multi-terabyte analysis tools EHR cloud databases and offer real time insights into the results[25].

The researchers proposed structure for a new generation of HISs aims at achieving the following objectives such as Provide high-quality , low-cost healthcare services to patients using an Big data, cloud computing and mobile cloud computing innovations merged, Take advantage of the vast quantities of healthcare information and at the right moment have the right therapy for the right patient, Provide the patient with personalised healthcare, Safeguarding health care data and privacy, Link big data, mobile cloud computing , cyber technology and healthcare information cultures in order to promote interdisciplinary collaboration between them[1].

3.3 Healthcare Information System connected with Mobile cloud

Many healthcare applications have begun to make mobile devices abundant. The explanation for the increasing use of mobile computing has been its capacity to provide the user with a resource when and where it is required regardless of increased mobility[29], thus promoting independence from location.

Researcher has been proposed by Peter at el[8], Furthermore, it suffered some obvious flaws such as limited user and system scalability, limited software application availability, scarcity of resources in embedded devices, frequent disconnection and finite mobile device energy. In the healthcare sector, the impact of these limitations is magnified due to the enormous scale, unnecessary complexity and rapid data generation[18].

As a consequence, it is difficult to operate a broad variety of healthcare applications in mobile devices, such as diagnostic analysis and identification, social network data management for patients, genomic information, and sensor data applications. Additionally, advances in interoperation and data sharing between different EMR systems have been incredibly slow due to the increasing price and poor usability[17]. What is required is an infrastructure that is capable of efficiently collecting, processing, finding, exchanging and evaluating Big data in healthcare right time on the right patient[8][23].

Another researcher has been proposed ALI at el[21], by Cloud computing provides an appealing Information Technology (IT) option for many healthcare practices to reduce the expense of EHR systems, both in terms of ownership and IT infrastructure burdens[24]. Cloud environment can organize EHRs, enabling data sharing, integration, highly available, and rapid accessibility.

Cloud computing systems have the potential to solve mobile technology disparities with its flexible, easily accessible, and resource combining computing tools. The key concept behind Cloud computing is to offload data and computing to a centralized resource provider (technologies such as the internet) that offers broad access to the network. Use services providers (i.e., cloud infrastructure) rather than the embedded systems themselves that host the implementation of application programs and store user data, the idea of offloading data and computational methods in the cloud is used to solve the problems associated in mobile computing[19]. Use services providers (i.e., cloud infrastructure)

rather than the embedded systems themselves that host the implementation of application programs and store user data, the idea of offloading data and computational methods in the cloud is used to solve the problems associated in mobile computing[11].

The issues are addressed as follows : 1) by leveraging the cloud's computing and storage resources (resource pooling), mobile expensive applications running on low-resource mobile devices, and limited mobile energy; 2) Cloud wide network connectivity overcomes restricted capacity and regular disconnection issues, as cloud services are accessible everywhere and anytime; 3) Cloud computing infrastructure is very scalable, and cloud service providers can add more nodes and databases to the cloud with small cloud infrastructure modifications; more cloud services can be introduced, more smartphone users can be supported and more portable devices can connected to the cloud[22].

3.3.1 Researches on Securing data from HIS to Mobile cloud

Another researcher E. Youssef at al [1], proposed a securing data from Healthcare Information System to Mobile Cloud Computing Going to integrate health care data among various health-care sector and social media, Providing a shared computing resource pool capable of effectively processing and analyzing big data in healthcare to take better decisions in a timely manner, Provide dynamic availability of re-configurable computational power that can be scale up and down according to consumer demand[26]. It will help to reduce cloud-based health-care services cost, Improve scalability of users and devices, and availability of data and ease of access in healthcare systems.

Healthcare System (Cloud) provided by healthcare cloud are classified as follows: Software as a Service (SaaS): Healthcare application, such as EHRs, are distributed as a software and delivered over the Internet to physicians, healthcare professionals and patients without the need to configure and operate on their own machines, Hosted application can be accessed from different customer devices , such as laptops, PDA and mobile phones, via web browsers. Multiple users to share the applications and ignore the software development process, upgrading and additional licensing problems[14]. Platform as a Service (PaaS): PaaS is a technology framework allowing healthcare providers to deploy, design, model, build and test applications and services directly on the Cloud. This facilitates community collaboration on international healthcare initiatives, where members of the project team are geographically dispersed. That requires PaaS provide the infrastructure for implementation, such as tools and computer languages. Infrastructure as a Service (IaaS): Healthcare providers can direct using independent virtual servers which isolate the cloud 's underlying computer equipment[21]. We can provide or release platform virtualization services periodically, depending on their growing or declining demand for resources.

Table:3 Summarizes the different research papers on the topic in Healthcare Information System connected with Mobile Cloud

Refs	Objective	Algorithm	Type of computing	Result
[3]	Verified at the entry of every access using user names and passwords	Cloud Security Providers(CSPs) algorithm	Mobile Cloud	Identified User data original or not.
[9]	Control access priorities permissions ownership of the users on the cloud	Cloud Developed Optimisation Power(CDOP) With Secure Algorithm	Cloud	To implement patient consent in a healthcare system, patient may grant rights to users on the basis of a role or attributes held by the respective user
[13]	Non-repudiation transaction on Mobile Cloud	Digital Signature Encryption(DSE) Algorithm	Mobile Cloud	Establish authenticity and non-repudiation for patients get Confirmation receipt, Timestamp etc
[26]	Integrity and Confidentiality in Healthcare Sector	International Organization for Standardization (IOS)	Cloud	Confidentiality and integrity can be achieved by access control and encryption techniques in Electronic Healthcare Records systems
[5]	Availability for Electronic Healthcare System with secure data in Multi-Cloud	Denial-of-Service (Dos) attacks Algorithm	Cloud	To improve preventing service disruptions due to power outages, hardware failures, and system upgrades

4 Research Methods and Specifications

Below section specifies the Implementation and working of Healthcare Information System framework and methodology (Big Data) proposed in this research paper which is

combination of Medical Cloud Multi-Agent System (MCMAS) and Dynamic Slot Allocation (DSA).

4.1 Working procedure of Healthcare Information System

Healthcare Information System(HIS) is approaching a secure framework of healthcare sector industries between Data and secure transmission in Mobile Cloud[17]. Another challenge in today's Healthcare Information Systems is the increase data (Information) size with data scale. Not only is this revolution about the vast scale of healthcare data, but we are also seeing an unprecedented increase in the frequency which this information is analysed and a myriad data form varieties. For example, Structured data, Semi-Structured data, Unstructured. Developing emerging technology such as recording cameras, sensors, and mobile phones is a significant source of data on healthcare. New sources are added daily; patient social network contact in digital forms is growing, genomics information collection has become cheaper, and more Accumulating scientific findings information[23]. These wide health care data can hardly be processed or analyzed using common data management methods. Clearly, collecting, processing, searching, and analyzing big data in healthcare to find valuable insights can improve healthcare systems results through smarter decisions and also reduce healthcare costs, but it needs effective optimization algorithms and a computationally intensive position[29].

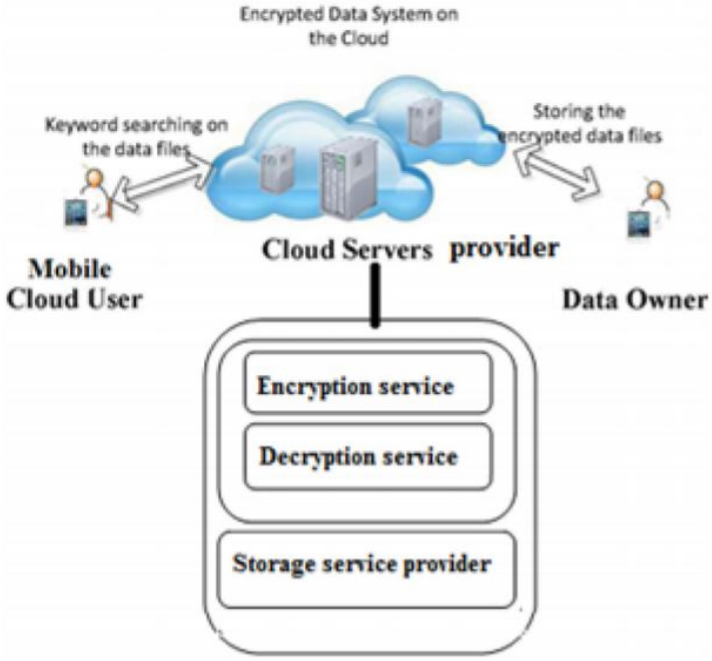

Figure 2: Healthcare Information System Workflow

The Healthcare Information System workflow is as follow,

Step 1: Using a key of information, User get information from Data owner. Mobile Cloud Computing User can access the all data with Encryption service, Decryption service and Storage service provider.

Step 2: Implementing distributed healthcare information system among growing healthcare organizations with secure data transmission and Encrypted data system on the Cloud.

Step 3: Providing a common computing resource pool capable of effectively collecting and retrieving big data in healthcare to take better decisions in a timely manner.

Step 4: Providing flexible availability of re configurable computational power that can be scaling up and down according to application requirements. It will help decrease cloud based health-care services prices.

Step 5: Improve scalability of users and application, and quality of data and transparency in health-care systems.

4.1.1 Working procedure of Medical Cloud Multi-Agent System (MCMAS)

This method is consistent with previous research in the health domain when authors developed Media Computing Multi-Agent System (MCMAS) for healthcare and represented the communication in a healthcare agent-based structure. This method consists of a group of intelligent entities that are tailored for the interaction[2].

Intelligent authorities or professional agents (Doctor Physician, nurses, workers, etc)

Swarm layer motivated by the fields of Swarm Intelligence (applies group collective action in solving a problem), such as workplace, healthcare materials...

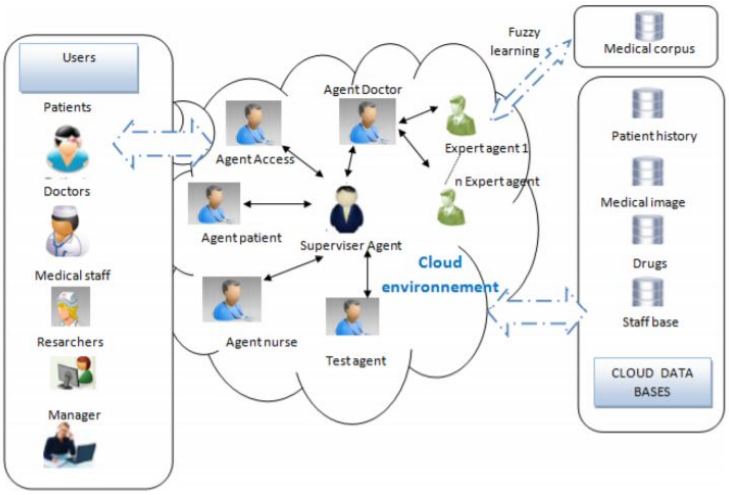

Figure 3: Workflow Architecture of Medical Cloud Multi-Agent System (MCMAS)

The developing and evolving architecture includes two previous layers of smart agents, reflecting a medical association with various functions and contact patterns, and promoting inter-operability, as well as information accessibility. Research aims to establish a scientific system which can address a wide range of medical problems[2]. We developed cloud architecture composed of thousands dispersed agents that were put in the cloud areas.The prototype's key purpose is to provide a mobile interface for users to access healthcare information; the framework of the applications is a tool for many uses.

Hospital staff:- This includes all the people concerned with the delivery of healthcare services to patients. This group should be able to learn and validate the abstract representation of the hospital's theoretical model, and to exploit and use the system 's effects.

Team study:- Such as engineers, researchers..

Patients who are not hospitalized constitute the primary consumers of the healthcare system and the center of the treatment system.

Our aim is to have the function of the agent in the background to provide the final users with an ambient environment. In other words, the agents are interacting with each other, acquiring their actions and receiving information through cloud data.

4.1.2 Working procedure of Dynamic Slot Allocation(DSA) method

MapReduce is a high-performance computing framework for cluster and data center data processing on a wide scale, and has become very common in recent years. An open source MapReduce implementation is known as Hadoop.

In comparison to YARN, Dynamic Hadoop Slot Allocation (DHSA) maintains the slot-based resource model. Both mapping and may tasks will run on YARN's proposed new resource model of 'container.' The proposal for Dynamic Hadoop Slot Allocation (DHSA) is to lift the slot-allocation limit to allow that: The slots and slots may be common for either map or reduction functions, even though the number of maps and reduction slots are preconfigured[6]. In other words, if there is a greater number of map tasks than map slots, then map tasks will borrow the unused, reduce spaces, and the reverse. While unused map tasks can be used to minimize slots, map tasks tend to use map slots. Likewise, while reducing tasks that use unallocated map slots in the event that insufficient slots are reduced, reducing tasks tend to use reduced slots[6].

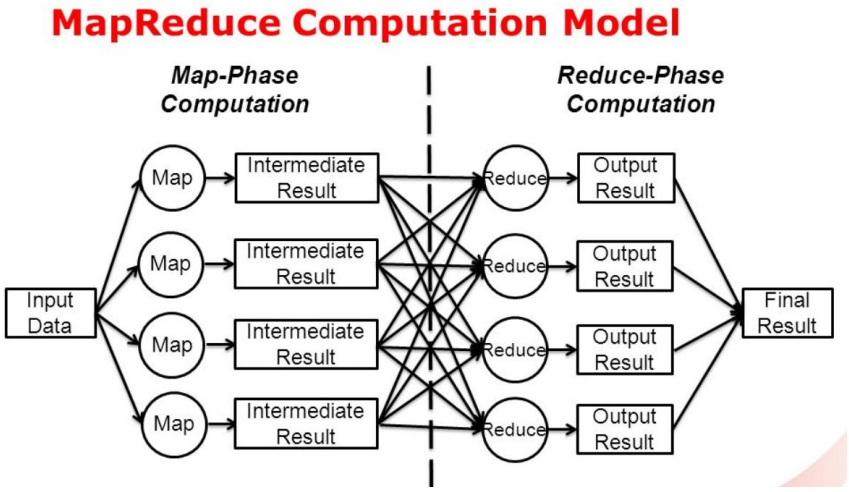

Figure 4: Working of Dynamic Slot Allocation (DSA) Method

The Dynamic Slot Allocation (DSA) workflow chat is as follow,

Step 1: Given input via MapReduce Computation Model and validation the data with Map-phase Computation.

Step 2: And split the data to separate result but name should be common such as Intermediate Result.

Step 3: Finally data should be moved multi-transmission control method to reduce the consumption using the Reduce-Phase Computation and get final result from various output.

Abbreviations and Acronyms DHSA: Dynamic Hadoop Slot Allocation PI-DHSA: Pool Independent DHSA PD-DHSA: Pool Dependent DHSA

4.2 Proposed Methodology

In this section, the proposed architecture is executed three algorithm such as Genetic Algorithm (GA), Particle Swarm Optimizer (PSO), Parallel Particle Swarm Optimization (PPSO) algorithm to be used to build the proposed model[16].

The proposed approach consists of three important attributes, namely CPU utilization, turn around time and wait timing. The calculations of those attributes depend on the three parameters that follow.

CPU Utilization(U) = 100
Turnaround Time(TT) = CT AT ——————————————————————————-(2)
Waiting Time(WT) = TT BT ——————————————————————————(3)

- Arrival Time(AT): the time at which the task arrives in the ready queue.
- Burst Time(BT): the time required by a task for CPU execution.
- Completion Time(CT): the time at which the task completes its execution

4.2.1 Proposed Architecture

As shown below in algorithm 1 and algorithm 2, the three different algorithms used to incorporate our proposed cloud-IoT in an integrated industry 4.0 for HCS in a big data application are listed here[16]. The proposed algorithms aim to find the optimal set of VMs to the time taken to execute requests (tasks) from stakeholders and optimize the efficiency of resources.

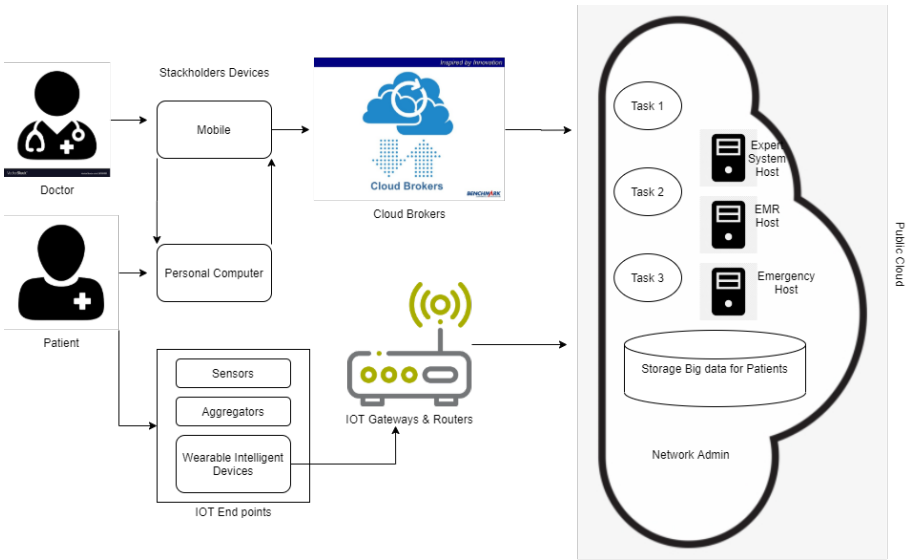

Figure 5: Intelligent model of cloud-IOT for Healthcare Services.

4.2.2 The proposed cloud-IoT model using Genetic Algorithm (GA)

In this article, we address extensively the proposed GA algorithm which is used by integrated industry 4.0 definition to incorporate our proposed Cloud-IoT model. The importance of the probabilities of population size, crossover, and mutation generates new offspring which helps to find innovative solutions[16].

Offspring1 = A Parent 1 + (1 A) Parent 2 ———————————— (4)

Offspring2 = (1 A) Parent 1 + A Parent 2 ———————————— (5)

Where:

1. A is represented a random number (selected before each crossover operation), and
2. parent is Virtual Machine

The GA aims to determine the objective functions (optimized selection of VMs) by using U, TT and WT for each chromosomes (VM) to pick the optimum combination of VMs for each chromosomes (VM) on a cloud environment through the smallest execution time.

4.2.3 The proposed cloud-IoT model using Particle swarm optimizer (PSO)

Assume M particles (VMs) are = 100, C1 = 2, C2 = 2 and iteration number = 10. Nusselt number is a crucial consideration in PSO which significantly impacts the PSO process's consolidation and discovery exploitation trade-off[16].

The velocity value is computed by Equavation:

VI(t + 1) = VI(t) + U1C1 (Pp-best Xi(t)) + U2C2 (Pg-best Xi(t)) ——(6)

Where:

• VI (t + 1) represents the new velocity of a particle and VI (t) represents its current velocity.
• U1 and U2 are two random variables in the range [0, 1].
• The constants C1 and C2 represent the learning factors.
• The x-vector records the current position of the particle in the search space.
• Pp-best is the best particle agent I.
• Pg-best is the best particle in search space

The position value is computed by Equavation:

Xi(t + 1) = Xi(t) + VI(t + 1) ————————————————————————-(7)

Where:

• Xi (t + 1) represents the new position of a particle
• Xi(t) represents its current position.

4.2.4 The proposed cloud-IoT model using PPSO

The third algorithm proposed for the potential-IoT model is based on PPSO. In PPSO, parallel processing aims at generating the same classical PSO results using multiple processors simultaneously with the goal of reducing runtime. Some changes will be implemented with the same steps mentioned in PSO as stated below[6][16].

Update particle velocity according to Equavation:

VI,j(t) = WVI,j(t 1)
+ C1R1(Pi,j(t 1) Xi,j(t 1))
+ C2R2(Ps,j(t 1) Xi,j(t 1))
+ C3R3(Pg,j(t 1) Xi,j(t 1))————————————————————————————(8)

Where:

- Xi,j = the position of (i)th particle in (j)th swarm,
- VI,j = the velocity of (i)th particle in (j)th swarm,
- Pi,j = the pbest of (i)th particle in (j)th swarm,
- Ps,j = the swarm best of (j)th swarm,
- Pg, j = the global best among all the sub swarms,
- W = inertia weight,
- C1, C2, C3 = acceleration parameters.
- R1, R2, R3 = the random variables.

Update particle position according to Equavation:

Xi,j(t) = Xi,j(t 1) + VI,j(t) ————————————————————————————(9)

Where:

- Xi,j (t) = the current position of (i)th particle in (j)th swarm,
- Xi,j(t 1) = the new position of (i)th particle in (j)th swarm,
- VI,j (t) = the current velocity of (i)th particle in (j)th swarm.

This proposed methodology algorithm is combination of Medical Cloud Multi-Agent System and Dynamic Slot Allocation (Hadoop) method as well.

4.3 Proposed Implementation

For the implementation, we'll using the Amazon Web Services (AWS) Platform for cloud demonstration. We shall be using the Elastic-Cloud-Compute (EC2) instance service of the Amazon Web Service Cloud Platform along with Elastic Block Storage (EBS) service. The following criteria will apply to our instance specification:

- Country: Ireland
- CentOS 7 64-bit operating system:
- Type of instance: t2.micro (libre tier)
- CPU: One VCPU
- Language: JAVA
- RAM: One(1) GB
- Storage: Thirty(30) GB

List the most important points, the drawbacks of previous works and the beneficial aspects of our Medical Cloud Multi-Agent System(MCMAS) program. There are

in reality no complete programs providing full healthcare solutions. Describes a cloud computing simulator comparison based on its features such as interface, language tools, or equipment. Many of these simulators are based on software, and built using Java.

To cloud simulation, we select CloudSim as a platform for the modeling, simulation and testing of evolving cloud technology infrastructures and software services. CloudSim has been successfully deployed and implemented predisposing factors to mapping virtual machine hosts in data centers; demonstrates the development of one host data center and runs one cloudlet corresponding to our experiment on it[30]. Although the CloudSim is not intended to replace the actual cloud world, it is a useful aid in making a preceding and partial cloud simulations.

The main aim of this research paper is to describe a model of the mobile network application for the health service in the cloud world, through which patients can access immediate medical interface information. Have a patient and have an appointment with the relevant physicians[11].

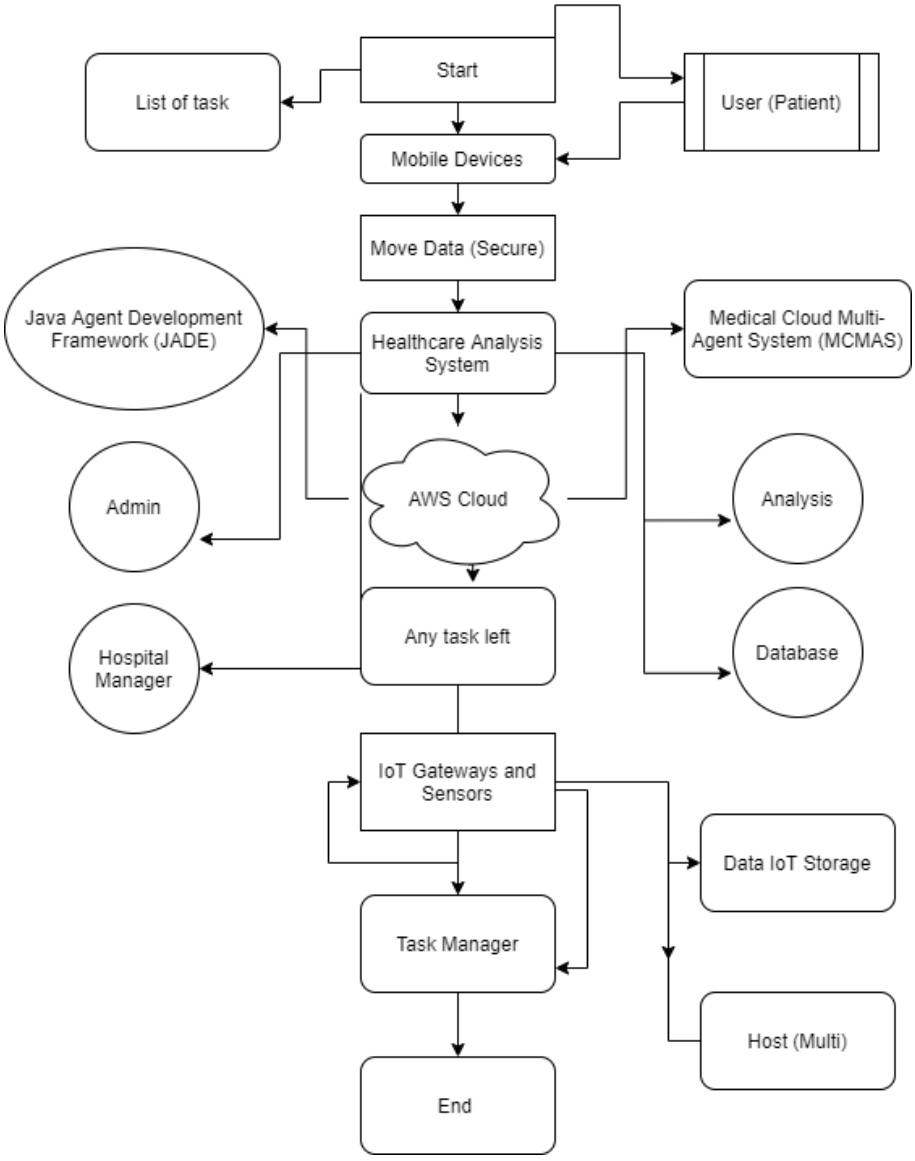

Figure 6: Flowchart of the proposed algorithm for allocation method of HIS and HCS

4.4 Proposed Evaluation

We have proposed (Evaluate) to 15 participants to test our approach and sample based on questionnaires Including 7 doctors and 8 patients will get the performance of this questionnaire survey after a training session. For healthcare Information System (HIS) and Healthcare Sector (HCS) testing benchmark the effective and efficiency of the algorithm, we will be using the Medical Cloud Multi-Agent System (MCMAS) and Dynamic Hadoop Slot Allocation (DHSA) which is used for monitor in number of servers.We also used for the (Genetic Algorithm(GA), Particle swarm optimizer(PSO) and Parallel Particle swarm optimization(PPSO) algorithm and tools to get workflow GET requests[16]. The same result will be done on the Healthcare Information System framework and performance will be data in evaluated. Finally, Using Programming language of JAVA and Java Agent Development Framework (JADF) command line utility such as Big data analysis etc. And Result of every data stored in private (separate) Cloud with help of HIS method. will be need to calculate (Evaluate) the CPU usage like memory usage and power consumption and input/output data processing each data of container.

5 Research Timeline and Gantt chart

The numerous tasks involved in implementing the proposed model have been identified along with the time period for each of those tasks to be completed. The related timeline for each of those tasks is described graphically using a Gantt chart.

Task ID	Task name	Start Date	End Date	Duration (Days)
T1	In-depth understanding of Healthcare Information System (HIS) models and different resource allocation algorithm	16-09-20	22-09-20	7
T2	Learning Java programming Language	17-09-20	15-10-20	29
T3	Learning and understanding the EC2 instances to work like mobile cloud	25-09-20	01-10-20	7
T4	Setting up the environment based on project requirement	02-10-20	06-10-20	5
T5	Developing the code for proposed algorithm	17-10-20	30-10-20	14
T6	Implementation of proposed Big data analysis and resource allocation algorithm	02-11-20	09-11-20	8
T7	Fine tuning of the code and environment	10-11-20	12-11-20	3
T8	Evaluating and comparing the results of proposed algorithm with existing one	12-11-20	15-11-20	4
T9	Showcasing project progress to guide and taking corrective action	16-11-20	22-11-20	7
T10	Documentation, Report Writing and Fian feedback session.	18-11-20	30-11-20	13

Figure 7: Timeline for the proposed Research project

6 Conclusion

This research paper proposes a structure for secure Health Information Systems (HISs) in mobile cloud computing environment based on big data analytics. The system provides a high degree of integration, integration and sharing of Electronic Healthcare Record (EHRs)among providers , patients and practitioners of healthcare. The proposed research is an attempt to incorporate MCC into the process of delivering health care. Advances in IT, such as mobile technology and CC, are generating new opportunities for enhancing the health care environment. Mobile and CC thus provide the critical features which make them suitable for use in the distributed healthcare sector. The results of prototyping and evaluation showed that for the majority of users the proposed MCMAS would achieve efficient and proficient prediction. Big data analytics ensures security and privacy. Big data analytics technologies are now at a nascent period of development and their introduction in the healthcare industry will definitely benefit their organizations.DHSA the technology we mentioned above is about full usage of slots by adding (or reducing) slots to map, and dynamically reducing tasks. The experimental model has been implemented using three separate algorithms with optimizers from GA , PSO, and PPSO. The proposed model is aimed at identifying the best set of VMs to assist stakeholders in minimizing execution time, processing time and waiting time for medical requests (tasks), optimizing task scheduling, enhancing resource efficiency and securely accessing data from patient storage.

Future research should concentrate on the method of scheduling the activities. Additional experiments have been performed to examine the effectiveness of the proposed scheme in different environments , particularly applications with a limited number of processors that require overuse of the processor.

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