

A Survey on Healthcare Management System

Jinal R.Prajapati¹, Rikin Thakkar², Satvik Khara³

¹Department of Computer Engineering Silver Oak College of Engineering Technology, Ahmedabad, Gujarat, India

²Assistant Professor, Department of Computer Engineering Silver Oak College of Engineering Technology, Ahmedabad, Gujarat, India

³Professor, Department of Computer Engineering Silver Oak College of Engineering Technology, Ahmedabad, Gujarat, India

Abstract- Internet-of-Things (IoT) is revolutionizing the healthcare by providing high-quality services, lowering the costs, and increasing the efficiency of management by allowing the physical objects to integrate with computer systems to collect the sensed data and process as per the need. Healthcare industries will also get benefited due to reduced investments and management, automated services, better disease diagnosis/analysis, and minimum operations and maintenance. Wireless Body Area Network (WBAN), an element of IoT, enables several sensor nodes attached to a body that generates enormous volumes of healthcare data over the period of a patient. In this paper, we propose a system for monitoring of pulse rate, body temperature (vital body parameters) of the person with dedicated sensor and IoT.

Index Terms- Healthcare System, Internet of Things, Sensors, cloud computing.

1. CLOUD COMPUTING

Cloud computing is a computing technology which provides computing resources on demand. It can also be considered as a system which provides self-service internet infrastructure to the users so that they can access the provided resources anywhere and anytime with the help of an internet connection. Cloud computing is the concept of internet based technology, which offers a variety of remote services over the internet such as infrastructure, data storage, software, and hardware[1].



Fig Cloud Computing

Cloud computing provides three major services, namely SAAS (Software as service), PAAS (Platform as Service), IAAS (Infrastructure as service). In order to deploy cloud computing, there is a need to deploy four major cloud models namely, private cloud, public cloud, hybrid cloud and community cloud[1].

This paper mainly discusses the various concepts and techniques available in cloud computing, its applications in the healthcare sector, IOT, benefits of cloud computing in healthcare management system, benefits of healthcare system ways to implement proper planning when the organization decides to move its model of service, different types of sensors the present opportunities and challenges that exist in cloud computing and healthcare sector.

Internet of Things

The “Internet of things” - IOT is a concept and model consisting of sensors, actuators, and development boards interacting with each other connected over the internet without any human intervention resulting into a more intelligent system. In simple words, IOT refers to a network of objects all connected to the internet at the same time. The main principle of Internet of things (IOT) is that the objects/things i.e. sensor nodes identify, sense, process and communicate with each other. IoT has a substantial influence in healthcare domain. Still, there are so many people who do not have access to quality healthcare services, thus remote patient monitoring becomes a need. IoT has already brought changes in various domains of health care like intelligent healthcare tools and devices, diagnostics and monitoring of patients, data storage, transfer, and collaborations[3].

An IoT-based platform provides solutions based on the integration of information technology[7]. This refers to hardware and software used to store, retrieve, and process data and communication technology which includes electronic systems used for communication between individuals or groups[7].

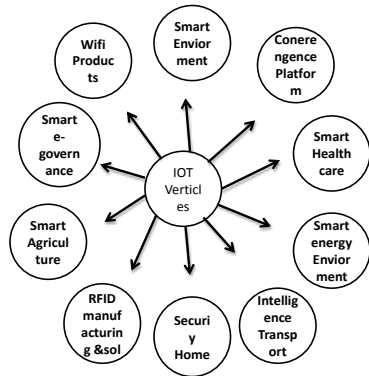


Fig IOT Uses

Healthcare System

A healthcare system also sometimes referred to as health system, is a community or organizations that include people, resources and service to meet the health needs of society delivering health care services.

WHO has identified 3 main goals for health systems: (1) Improving the health of populations (2) Improving the responsiveness of the health system to the population it serves (3) Fairness in financial contribution i.e. the extent to which the burden of paying for health system is fairly distributed across households[11].

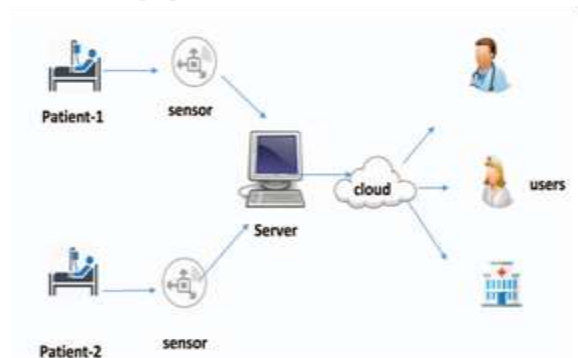


Fig Healthcare Management System[6]

The concept design of IoT based healthcare.

At the patient’s side, we have sensor nodes to monitor the patient’s symptom. This sensor captures the data and sends it to a server. Then the server will further process the collected monitor data and

provide it to different users like cloud, doctors, nurses, and hospital to diagnose and monitor health problems[6].

Healthcare management is one of the most promising applications of information technology. Portable devices such as heart rate monitors, pulse ox meters, and blood pressure monitors are essential instruments in intensive care. Traditionally, the sensors for these instruments are attached to the patients by wires; and the patient sequentially becomes bed bound.

In addition whenever the patient needs to be moved, all monitoring device has to be removed and reconnected later.

Nowadays, all of these Time-consuming jobs could be terminated and patients could be liberated from instrumentation and bed by wireless technology. Wireless technology could be the best solution for mass emergency situations like natural or human included disasters.

Cloud in field of Healthcare

Cloud computing supports the field of e-healthcare, e-telemedicine, biometrics etc. Remote patient monitoring is made possible through medical providers to electronically observe a patient remotely using medical monitoring devices and telecommunication networks. Usage of cloud in the field of healthcare provides security and authentication for data handling. Health care technologies with the potential to have a significant impact on patients which include Internet-enabled applications for chronic diseases which could help increase citizen empowerment in health maintenance and decision making supporting self-care[9].

The benefits of cloud computing in healthcare as follows:

1. On-demand access to powerful computing and large storage facilities in a way that is not feasible, or if feasible, very costly when using traditional IT environments[7].
2. Relieves hospitals and other medical entities from the burden of storing big data sets of Electronic Health Records (EHRs), radiology images, and any other medical data. This in turn allows rapid access to information (sharing of EHRs) by all identified stakeholders in an efficient manner thus leading to better management of the different medical cases[7].

3. Cloud computing enhances the business intelligence capabilities of the different health organizations and their data visualization abilities since digitizing patients' information allows for the generation of valuable knowledge, and provides a better insight that would assist these organizations in making informed decisions[7].

Hence, cloud computing can reduce the overall cost of healthcare, permits increased access to critical data from different geographical locations and by different stakeholder, and provide a much needed scalability and elasticity to the demand for health services[7].

Benefits of Healthcare System

[1] Simultaneous reporting and monitoring

Real-time monitoring via connected devices can save lives in event of a medical emergency like heart failure, diabetes, asthma attacks, etc. With real-time monitoring of the condition in place by means of a smart medical device connected to a smart phone app, connected devices can collect medical and other required health data and use the data connection of the smart phone to transfer collected information to a physician[10].

[2] End-to-end connectivity and affordability

IoT can automate patient care workflow with the help healthcare mobility solution and other new technologies, and next-gen healthcare facilities. IoT enables interoperability, machine-to-machine communication, information exchange, and data movement that makes healthcare service delivery effective.

Connectivity protocols: Bluetooth LE, Wi-Fi, Z-wave, Zig Bee, and other modern protocols, healthcare personnel can change the way they spot illness and ailments in patients and can also innovate revolutionary ways of treatment.

Consequently, technology-driven setup brings down the cost, by cutting down unnecessary visits, utilizing better quality resources, and improving the allocation and planning[10].

[3] Data assortment and analysis

Vast amount of data that a healthcare device sends in a very short time owing to their real-time application is hard to store and manage if the access to cloud is unavailable. Even for healthcare providers to acquire data originating from multiple devices and sources and analyze it manually is a tough bet.

IoT devices can collect, report and analyses the data in real-time and cut the need to store the raw data. This all can happen over cloud with the providers only getting access to final reports with graphs[10].

[4]Tracking and alerts

On-time alert is critical in event of life-threatening circumstances. IoT allows devices to gather vital data and transfer that data to doctors for real-time tracking, while dropping notifications to people about critical parts via mobile apps and other linked devices.

Reports and alerts give a firm opinion about a patient's condition, irrespective of place and time. It also helps make well-versed decisions and provide on-time treatment.

Thus, IoT enables real-time alerting, tracking, and monitoring, which permits hands-on treatments, better accuracy, apt intervention by doctors and improve complete patient care delivery results[10].

[5]Remote medical assistance

In event of an emergency, patients can contact a doctor who is many kilometers away with a smart mobile apps. With mobility solutions in healthcare, the medics can instantly check the patients and identify the ailments on-the-go.

Also, numerous healthcare delivery chains that are forecasting to build machines that can distribute drugs on the basis of patient's prescription and ailment-related data available via linked devices. IoT will Improve the patient's care In hospital[10].

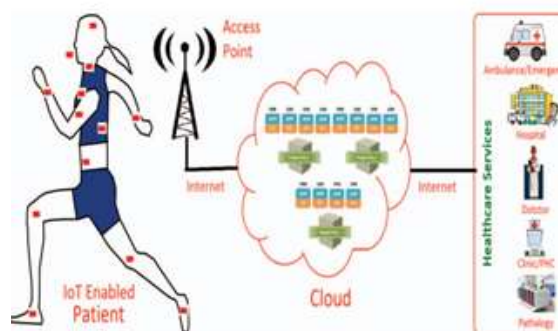


Fig Cloud-IOT Scenario[2]

In above scenario IOT enable patient's symptoms data store in the cloud using internet those data access any time anywhere. Those data access through healthcare services hospital, doctors, clinic/PHC, pathology, users etc[2].

2. LITERATURE REVIEW

Manikandan Shanmugam, Prof. Monisha Singh[1] in this paper discussed cloud computing, Opportunities and Challenges of Cloud Computing to improve Healthcare services, A survey of Cloud based healthcare system. Various integration methods: Integration of healthcare system with public cloud, Integration of healthcare system with private cloud, Integration of healthcare the system with social media, a scoping review of Cloud Computing in healthcare.

Kavitha Kadarla, S.C. Sharma, Tushar Bhardwaj and Ajay Chaudhar [2] in this paper discussed cloud computing, cloud work load in healthcare system, cloud-IOT scenario, a very little work towards effective utilization of cloud services for IoT enabled healthcare devices, in particular, resource management in the cloud to meet the changing healthcare data needs. In this paper the virtual resource allocation system in Cloud the corresponding Cloud-IoT scenario. These applications are developed and deployed in the cloud to analyze the health condition of a particular patient and to generate suitable alerts to the healthcare services like ambulance, doctor, public healthcare centers (PHCs), hospitals, and pathology during critical conditions of the patient. This approach helps to attend the patient as soon as possible and provide the supportive diagnosis online. In this paper also mention equations of healthcare_score like temp_score, heartbeat_score, blood pressure_score and also discussed the how the workload manage in cloud also provide the fast data transfer.

Kavita Jaiswal, Srichandan Sobhanayak, Bhabendu Kumar Mohanta, Debasish Jena[3] discussed a model that allows the sensor to monitor the patient's symptom. The collected monitored data transmitted to the gateway via Bluetooth and then to the cloud server through docker container using the internet. Thus enabling the physician to diagnose and monitor health problems wherever the patient

is. Also, we address the several challenges related to health monitoring and management using IoT.

Raafat Aburukba, Assim Sagahyroon, Mohammed[4] discussed This work proposes a healthcare brokering services that enables the integration with existing cloud platforms to capture the data from the patient's devices. The work also presents a way to model the patient's health condition to be remotely monitored and takes right decision at the right time. This work

proposed a healthcare brokering cloud services that integrate multiple health device cloud platforms. The work also proposes a model for RPM that incorporates the concept of rules and monitoring the assigned rules for the patient. Once an action requires a specific physical or human resources (such as a hospital or doctors respectively) the decision making takes in consideration defined rules related to those resources. The main objective with the decision is to allocate the proper available resources (healthcare facilities and human resources), to the patient based on his/her health condition, at the right time.

Abdelrahman Rashed, Ahmed Ibrahim, Ahmed Adel, Bishoy Mourad, Ayman Hatem, Mostafa Magdy, Nada Elgaml, Ahmed Khattab[5] In this paper discussed develop an integrated medical platform for remote health monitoring. The proposed multi-layer architecture senses and collects information about the patient vitals alongside his/her surrounding environment. Then, it relays such information to a cloud for storage and data analysis where further actions are applied for a better end user experience. Such data is accessible to the patient's healthcare providers and remote family members through a mobile application. We built and tested a prototype of the proposed IoMT architecture to illustrate how it achieves the AAL goals.

R. Shiny Sharon, Dr. R Joseph Manoj[6] E-Healthcare system plays a major role in the society. It monitors the health condition and helps in giving appropriate medical treatments. This system aims at gathering and storing patient's details and sharing health related information. It also has high legitimate concerns about patient's privacy and information security. This system minimizes the infrastructural barriers for the developing nations. In this paper proposed Privacy preserving techniques for securing the PHI such as Layered model of access structure which solves the problem of multiple hierarchical files sharing also discussed applications of Cloud Computing a part of Cloud in field of Healthcare.

S Pradeep Kumar, Vemuri Richard Ranjan Samson, U Bharath Sai, P L S D Malleswara Rao, K Kedar Eswar UG Students[7]discussed one of the approaches is to monitor the health state of the patient and screen it to doctors or paramedical staff through the IoT, as it is hard to screen the patient for 24 hours. So here the patient health condition or status i.e. Pulse rate, Respiratory rate, Body

Temperature, Position of the body, Blood glucose, ECG and so on can be measured by utilizing the Non-invasive sensors. These sensors are associated with the Arduino Uno board, it gathers the information i.e. biomedical data from the sensors and the detected biomedical information can be transmitted to the server. The "Thingspeak" named new cloud is utilized here to place the detected information into the server.

Chengathir Selvi. M ,T.D.Rajeeve,A.John Paul Antony, Prathiba. T[8] discussed designed wireless sensor based healthcare monitoring system using cloud is able to transmit the data which is sensed from patient to the doctor's PC by using wireless transmission technology. The proposed system is able to monitor the body temperature, heart pulse rate, body movement with enough accuracy. By using the system the healthcare professionals can monitor their patients all the time. The physiological data are stored and published online. Hence, the healthcare professional can monitor their patients from a remote location at any time.

Sensors Use in Healthcare System

A sensor is a device that detects and responds to some type of input from the physical environment. The specific input could be light, heat, motion, moisture, pressure, or any one of a great number of other environmental phenomena. The output is generally a signal that is converted to human-readable display at the sensor location or transmitted electronically over a network for reading or further processing [12].

Healthcare monitoring system uses the sensors to measure various parameters of the patient's like temperature, pulse, body movement, blood pressure. The patient's status will be updated in the database in cloud storage. The healthcare professionals can access the physiological parameters of a patient. It enables the personalization of treatment and management.

Temperature Sensor	Heartbeat Sensor	Blood pressure Sensor
Humidity Sensor	Smoke Sensor	Gas Sensor
Oxygen Sensor	Alcohol Sensor	Touch Sensor

Fig Different types of Sensors[12]

Wearable and non-wearable devices that can capture a patient's health condition and behavior trends can be considered as objects (things)[8].

We use two categories of sensors:

1. wearable sensors
2. Unwearable sensors.

Each category is grouped into a separate node

A. Wearable Node: Our wearable node consists of three skin-contact sensors to detect the main vital signs which are of high importance to the medical professionals and consistently checked by healthcare providers[8].

- Heart Pulse Rate: It is responsible for measuring the number of times the heart beats per minute. Based on the fundamentals of optoelectronics light is emitted using light-emitting diode from one side of the finger and then, the received light intensity is measured on the other side using a light dependent resistor[8].

- Motion Detection: Fall detection is one of the most critical issues for frail elderly. Based on accelerometers, this sensor consists of micro-machined structures on a silicon wafer which are designed to measure acceleration and magnetic fields in the Cartesian coordinate system[8].

- Body Temperature: This contact-sensor can be applied to the skin to detect any temperature-related abnormal activities such as fever or hypothermia. Such temperature sensors are great replacement of the traditional glass thermometers which lead to toxic environmental hazards[8].

B. Unwearable Node: The unwearable node is designed to keep track of the environmental conditions that surround the patient in order to provide advanced healthcare services. Our unwearable node contains the following three sensors[8].

- Indoor Temperature and Humidity: Both humidity and temperature are considered to be an extremely important factor in providing a comfortable environment[8].

- Light: Detecting the light intensity with a high resolution, providing low light level operation and a high sensitivity to detect even small change in light[8].

- Passive Infrared (PIR): Such pyroelectric sensors can detect the level of infrared radiation of objects and humans. We deploy many of such sensors in the patient's residency to keep track of his/her location[8].

3. CONCLUSION

Healthcare system with IOT and latest sensors is already available but we can improve the existing algorithm by response time and overall cost of the system so we have proposed the algorithm improve cost and response time of healthcare management system.

REFERENCES

- [1] Manikandan Shanmugam, Prof. Monisha Singh, "A Comparative Study on Traditional Healthcare System and Present Healthcare System Using Cloud Computing and Big data," International Conference on Signal Processing and Communication (ICSPC'17) – 28th & 29th July 2017/IEEE ECE Programme, Karunya University.
- [2] Kavitha Kadarla, S.C. Sharma, Tushar Bhardwaj and Ajay Chaudhary, "A Simulation Study of Response Times in Cloud Environment for IoT-based Healthcare Workloads" 2017 IEEE 14th International Conference on Mobile Ad Hoc and Sensor Systems
- [3] Amandeep Kaur, Ashish Jasuja," Health Monitoring Based on IoT using RASPBERRY PI" 978-1-5090-6471-7/17/\$31.00 ©2017 IEEE International Conference on Computing, Communication and Automation (ICCCA2017).
- [4] Chengathir Selvi. M ,T.D.Rajeeve,A.John Paul Antony, Prathiba. T "Wireless Sensor Based Healthcare Monitoring System Using Cloud," 978-1-5090-4715-4/17/\$31.00 ©2017 IEEE International Conference on Inventive Systems and Control
- [5] S Pradeep Kumar, Vemuri Richard Ranjan Samson, U Bharath Sai, P L S D Malleswara Rao, K Kedar Eswar UG Students "Smart Health Monitoring System of Patient Through IoT," 978-1-5090-3243-3/17/\$31.00 ©2017 IEEE International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)
- [6] Kavita Jaiswal, Srichandan Sobhanayak, Bhabendu Kumar Mohanta, Debasish Jena, "IoT-Cloud based framework for patient's data collection in smart healthcare system using Raspberry-pi," 978-1-5386-0872-2/17/\$31.00 ©2017 IEEE.
- [7] Raafat Aburukba, Assim Sagahyoon, Mohammed Elnawawy, "Remote Patient Health Monitoring Cloud Brokering Services", 978-1-5090-6704-6/17/\$31.00 ©2017 IEEE
- [8] Abdelrahman Rashed, Ahmed Ibrahim, Ahmed Adel, Bishoy Mourad, Ayman Hatem, Mostafa Magdy,Nada Elgaml, Ahmed Khattab," Integrated IoT Medical Platform for Remote Healthcare and Assisted Living", 978-1-5386-1359-7/\$31.00 c 2017 IEEE
- [9] R. Shiny Sharon, Dr. R Joseph Manoj," E-HEALTH CARE DATA SHARING INTO THE CLOUD BASED ON DEPLICATION AND FILE HIERARCHICAL ENCRYPTION" 978-1-5090-6135-8/17/\$31.00 ©2017 IEEE
- [10] Benefits of IOT Healthcare application available at: <https://www.peerbits.com/blog/internet-of-things-healthcare-applications-benefits-and-challenges.html>
- [11] Goals of healthcare system avilable at<https://www.google.com/search?q=goals+of+h ealthcare+system&oq=goals+of+&aqs=chrome..69i57j0l5.5803j0j7&sourceid=chrome&ie=UTF-8>
- [12] Different types of sensors avaiable at : https://www.google.com/search?q=what+is+sens or&source=lnms&tbm=isch&sa=X&ved=0ahUKEwidp9vmxLDfAhVRVH0KHfSRBLkQ_AUI DigB&biw=1366&bih=657#imgrc=tisH
- [13] Amar Ibrahim E.Sharaf Eldein, Hany H.Ammar, Dale G. Dzielski," Enterprise Architecture of Mobile Healthcare for large Crowd Events" 6th International Conference on Information and Communication Technology and Accessibility.
- [14] Jaeki Hong, Peter Morris, Jonghwa Seo DS Software R&D Center" Interconnected Personal Health Record Ecosystem Using IoT Cloud Platform and HL7 FHIR".
- [15] Mohammed Irfan, Naim Ahmad," Internet of Medical Things: Architectural Model, Motivational Factors and Impediments".