Implementation Of Healthcare System By Using Internet Of Things (Iot)

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Abstract- *In the internet of things (IoT) , device gather and share information directly with each other , making it possible to collect, records and analyze new data stream faster and more accurately. Therefore the IoT play's an important role in healthcare system from managing chronic diseases at one end of the spectrum to preventing diseases at the other. The internet of things (IoT) is redesigning the modern healthcare system in which objects are sensed and controlled remotely. The IoT device can be used to enable remote health monitoring and emergency notification system. The patient's physiological information is managed and recorded for long time using wearable sensors, this system is expected to reduce cost, increase the quality of life and enriched the user's experience. According to the world health organization standard , 60 % population of India is affected by chronic and cardiovascular diseases. This system reduces the headache of patients to visit to doctor every time he/she needs to checks ECG and temperature and pulse oxygen in blood. Doctor and hospital could makes use of real - time data collected on the cloud platform to provide fast and efficient solution. In this paper we discussed the background of internet of things (IoT) and it's application in healthcare system. This also presents the idea of framework of IoT which works for healthcare.*

Keywords- Internet of things (IoT) , cloud , healthcare , wearable sensors.

I. INTRODUCTION

The internet of things (IoT) paradigm is based on the intelligent and self configuring nodes (things) interconnected in a dynamic and global network infrastructure . Simply we can say that the internet of things (IoT) is a new technology which connects physical objects with the help of internet. The IoT has different application in smart cities, healthcare logistics and industrial control. In addition to this the cloud computing has the almost unlimited capacity of storage and processing power which is more mature technology at least to a certain extend to solve the problems of most of the internet of things. IoT related healthcare system today are based on the essential definition of the IoT as a network of device that connect directly with each other to capture and share what data through a secure service layer (SSL) that connects to a control command and control server in the cloud. Let's begin with a closer look at what that entails and what it suggests for the way people collect record and analyze data not just in health care but in virtually every industry today.

The internet of things (IoT) comes in existence when Kevin Ashton explained a decade after first using the phrase at a business presentation in 1999. " Today computers and therefore the internet are almost wholly dependent on human beings for information, The problem is people have limited, time attention and accuracy - all of which means they are not very good at capturing data about user's things in real world". The solution he has always believed in empowering devices to gather information on their own without human intervention. The emergence of the IoT in which devices connects directly to data and to each other , is important for two reasons :

- Advance in sensors and connectivity technology are allowing devices to collect , record and analyze data that was not accessible before. In healthcare , this means being able to collect patients data over time that can be used to help enable preventive care , allow prompt diagnosis of acute complications and promote understanding of how a therapy (usually pharmacological) is helping to improve patients parameters.
- The ability of devices to gather data on their own removes the limitations of human entered data. Automatically obtaining the data doctors need at a time and in the way they need it. The automation reduced the risk of errors. Fever error can mean increased efficiency , lower cost and improvement in quality in just about in any industry. But it's of particular interest / need in healthcare. Where human errors can literally be the difference between life and death.

II. BACKGROUND

The idea is applied to healthcare to improve access and interconnection of devices used in the healthcare system.

Embedded technologies will take an important role to deliver healthcare to people in remote location and monitoring system that provide a continuous stream of accurate data for better healthcare decision . As the technology for collecting, analyzing and transmitting data , IoT continued to improve ; the IoT driven healthcare application and system emerge . In the internet of things (IoT) , device gather and share information directly with each other and cloud , making it possible to collect record and analyze new data stream faster and more accurately. That suggests all sort of interesting possibilities across a range of industries : that sense wear and tear and self schedule maintenance or train that dynamically calculate and report projected arrival times to waiting passenger. Communications are via sorts of long and short range wired and wireless devices in different kind of networking such as intranet, extranet and internet that are supported by technologies such as cloud computing, SaaS and SOA based on regulated data formats and transmission standards.

III. RELATED WORK

IoT based healthcare applications will have large impact on global economy by 2025 .There are different applications of IoT in healthcare such as glucose level sensing which measures blood sugar level using noninvasive techniques. Body temperature sensors are responsible for temperature recording and transmission. Oxygen level monitoring measures oxygen percentage in blood using noninvasive method. Home monitoring is a method that can help health system work more closely with physicians and patients. It is estimated that many elder persons are suffering from chronic illness and may benefit from telemedicine solutions have higher cost and complexity. A newer advanced solution reduces the cost compared to traditional delivery models. Every year around 17.3 million people die due to cardiovascular diseases and it will increase by 2030.

Many monitoring devices that display the patients physiological data are present in the operating rooms . But there are instances where the doctor is not available in case of an emergency; also the data can not be shared remotely with other specialized doctors and the family members. The existing solutions are of large size , very expensive and need lot of wires . several communication protocols that are used between gateway and cloud include HTTP, CoAP, MQTT and XMPP . HTTP is not perfect for IoT because it is not offering predictable latency and it depends on polling to detect state changes. Comparison among these protocol is shown in the following table .

MQTT	CoAP	XMPP
Based on OASIS Standards	Based on CoRE IETF Group	Based on internet official protocol standards
One to one , many to one , one to many communications	One to one communication	One to one or multiuser communication
Lightweight publish subscribe model	Client server model	Client server model
M2M , memory constrained devices	M2M applications, smart energy and automations	VOIP, Gaming, IoT applications

IV. PROPOSED SYSTEM

Healthcare is undergoing a major revolution with a larger ecosystem involving tech giants, smart device manufactures, analysts, and data scientists. Healthcare is going to depend on the connected devices that connects all the elements and in turn creates a stronger healthcare pool. This concept is also called ‘System of Systems’ backing IoT.

Figure shows proposed IoT driven healthcare which collects the information related to patients body temperature, pulse and ECG.

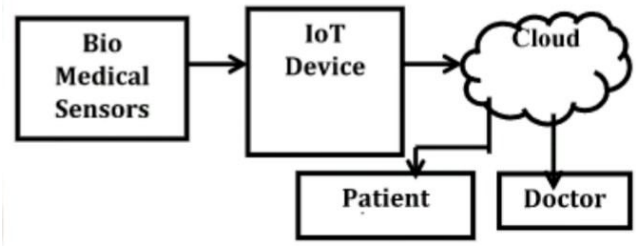


Fig. 1 : IoT Healthcare block diagram

A. **Bio-medical Sensors**: The proposed solution uses following bio-medical sensors. The vital parameters include temperature, pulse and ECG. These wearable sensors are easy to wear on patients body without disturbing his/her daily routine. The data from sensors is wirelessly transmitted to IoT devices.

- Temperature sensor: This sensor measures the body temperature. Body temperature recognizes characteristic change in body that are caused due to many diseases.

- Pulse sensors: A pulse sensor is used when a patients oxygenation is unstable. A situation includes emergency and intensive care , operation recovery. Sensors determines the need for oxygen supplement.
- ECG sensors: The ECG sensors measures the muscular and electrical functions of heart. By analyzing the exact waveform pattern, we can identify electrolyte imbalances, rhythm, disturbances and conduction abnormalities.

These devices would be capable of applying complex algorithms and analyzing them so the patient receives proper attention and medical care. The collected patient information would be stored in cloud. Through remote monitoring, patients can significantly reduce the length of hospital stay and perhaps, even hospital readmission. This kind of intervention is a boon to people living alone, especially seniors. If there is any interruption in the daily activity of a person, alerts would be sent to family members and concerned health providers. These monitoring devices are available in the form of "wearables" too.

B. **IoT devices**: IoT device includes development boards such as microcontroller from different vendors. It is used as a processing subsystem. The task is performed by the controlling the subsystem of other components in the sensors node. Sensor to IoT device communication is done using short range RF protocols like ZigBee, Z-wave, Bluetooth, BLE, and Wi-Fi and gateway to cloud communicates using protocols like HTTP, MQTT, CoAP AND XMPP.

C. cloud : cloud is a network or internet which is present at remote location. It provides service over network on public networks or on private networks. There are different applications running on the cloud such as e-mail, customer relationship management. Cloud computing manipulates, configures and access the application online. The cloud has unlimited storage capacity.

Internet of Things (IoT) is a computing process, where each physical object is equipped with sensors, microcontrollers and transceivers for empowering communication and is built with suitable protocol stacks which help them interacting with each other and communicating with the users. In IoT based healthcare, diverse distributed devices aggregate, analyze and communicate real time medical information to the cloud. The use of wireless sensors for such situations leads to great improvements in operational efficiency. The use of IoT-based devices also allows for faster updates for electronic records. For example, an order can be placed for an ECG, and once completed, it can be automatically saved to the archives. From here, the ECG report can be remotely viewed by medical staff and even compared against previous ECG reports.

Figure below shows the architecture of a healthcare system . The system architecture is commonly divided into following parts :

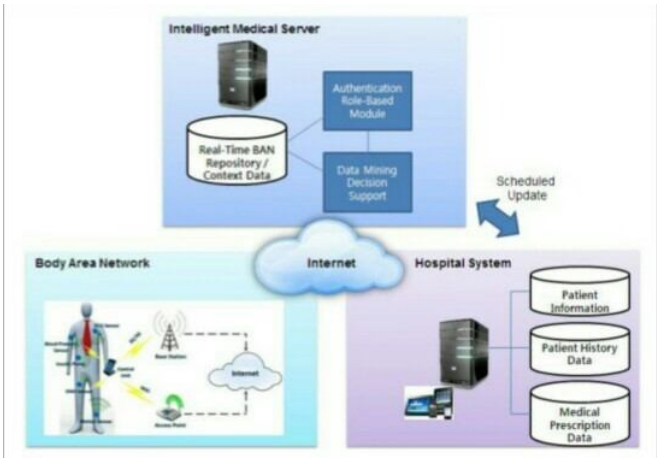
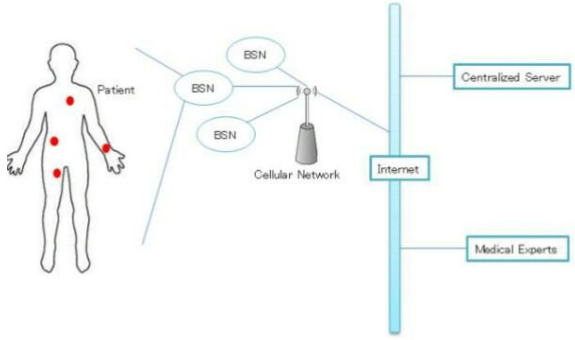


Fig. 2 : Healthcare system Architecture



1) Body area network
   I. Wearable body sensors
   II. personal monitoring devices
2) Intelligent medical server
3) Hospital system

A. Body area network (BAN)

In BAN system sensors are attach to body area in order to capture bio signals, including blood pressure, body temperature, pulse and breathing. It is mainly divided into two parts as WBSN and PMD..

wireless body area network (WBAN) - The wearable body sensor network is formed of wearable and implantable bio sensor in patients body. The sensor collect necessary

readings from patients body and send to the central node in the form of low frequency electromagnetic waves.

Personal monitoring devices (PMD) - The patients personal monitoring devices can be a personal computer or a cell phone or a PDA device . It gets information from WBSN by means of Bluetooth or ZigBee. PMD contains logics to determine whether to send this information to this or not. Personal computer based PMD communicates with IMS using internet .Mobile device based PMD communicates with IMS by using GPRS /Edge /SMS technology. The IMS will act as service provider and patients PMD will act as the service requester.

B. Intelligent medical server

The second part is the intelligent Medical server (IMS) which receive information from the BAN. It serves as the hub between the patient and hospital. It is the backbone of the entire system and is capable of learning patients specific threshold. An agent determine whether a patient is in a critical condition based on the medical data transferred from the BAN system. It is determined that there is an emergency. The data is transferred to hospital system for enacting emergency measures immediately after being stored in the IMS systems. If it is not an emergency the data is merely stored in the IMS. For data stored in IMS , necessary data is regularly saved to the central database of the hospital. These real time data will be deleted after some specific period of time unless there is no emergency. Data stored in the IMS is available to doctor and support staff in the hospital.

C. Hospital system

The third area is the hospital sub system. If necessary data is register, retrieved, changed, updated or deleted by doctor, patients and hospital support staff. Depending on the output or report hospital staff will take the preventive or corrective action for the corresponding patients.

V. CONCLUSION

There is no doubt that the Internet of Things is transforming the healthcare industry completely by redefining how apps, devices and people interact and connect with each other in delivering healthcare solutions. That is, IoT is constantly offering new tools as well as efficiencies that make up an integrated healthcare system with the view of ensuring patients are cared for better, health care costs are reduced significantly and treatment outcomes are improved. IoT and health care can also make an impact with regards to the number of infusion pumps that are dispensing medication to patients. Doctors and nurses can, in an IoT-enabled setup, easily change and dispense medication automatically via a wireless network, rather than physically touching each pump to perform a load or make changes. This means that new formulations can be pushed out in a matter of minutes rather than half- hour or 45-minute time periods. This system is useful for doctors who are overwhelmed with the patients load and also beneficial for rural patients who have less access to healthcare facilities.

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