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Advancements in Healthcare System Using IOT

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Abstract

Before internet of things the interactions of the doctors with the patients was very less. Previously, the patient had to visit the doctor once in while for the diagnosis and there was no way that a patient's health could be monitored continuously. With the help of IOT the interaction of the patient with the doctor has increased which resulted in better treatment by continuous monitoring with the help of sensors and other hardwares. this paper mainly focuses on the advancements in the previous healthcare system with the help of IOT for the better treatment of the patient. It proposes the architecture Of the new system in which technology like mhealth, IEEE 11073 ,6LoWPAN and COAP technologies are covered. In this paper we have applications of iot in healthcare system for continuous monitoring of the patients health and also tells about the sensors which are used in such system for making the system more smarter faster and continuous monitoring of health. It also gives the information about the benefits and challenges faced in new healthcare systems.

Keywords: IEEE, WPAN,COAP,IOT.

Introduction

In the traditional healthcare system there was no way that the health of the patient could be monitored continuously. Every time a patient once in a while had to visit the doctor for diagnosis and it was nearly impossible for them to be in contact with the doctor every time for getting diagnosed and consulted by the doctor regularly. But by the time new technologies have been evolved and by using them we can make a system which could be more smarter, accurate, and will give the information of the patient's health continuously to the doctor and will be easy to manage the required treatment for the same. In the past few years iot has given a lot of new devices and technology through which with the least interaction of the doctor with the patient proper solutions to the disease could be given and there are many applications in iot with the help of which the doctors, insurance company, hospitals and families could be benifited .

IOT Architecture For Healthcare System

The architecture of the healthcare system has been evolved in past few years. Some of the widely accepted healthcare systems are as follows:

1.mHealth

In Iot based healthcare system we need to develop and deploy an end-end frame work and such a framework is the m Health which is used in collecting data from sensors to analyzing data and taking actions accordingly. It comprises of three layers 1st is the Data Collection Layer which will collect the data from the sensors for examples:- heart rate monitoring device, heart rate monitoring device, blood glucose monitoring device etc.2nd Data Storage Layer stores the data coming from the sensors in huge amount in high speed racks. The 3rd layer is the Data Processing layer in which the data is been analyzed using various technologies involving AI or non AI based algorithms.

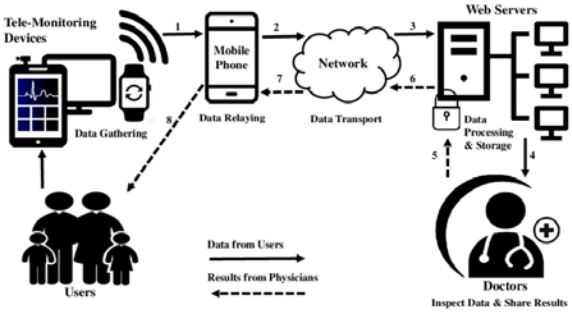

Fig.1: End-end architecture of mHealth.

6LoWPAN based healthcare system

The ip based network system is widely accepted and it is good to use in the healthcare system but the ipv6 protocol needs large amount of processing power and bandwidth and it is sometimes not possible to imply on such smaller scale of system that is why we started using 6LoWPAN protocol so, that the sensor nodes could send the data over the network.

HealthCare IOT Sensor	
UDP	ICMP
IPV6	
6LoWPAN	
IEEE 802.15.4 MAC	
IEEE 802.15.4 PHY	

Table 1: showing protocol stack for sensor augmented health care system using 6LoWPAN.

The end-to-end network with health sensors using 6LoWPAN. The data is been stored in the 6LoWPAN datagram and then send in the IEEE 802.15.4 frame to the edge router. The gateway changes the packets to the IPv6 packets and transmits to the network of IPv6 to server where the further processing is been done.

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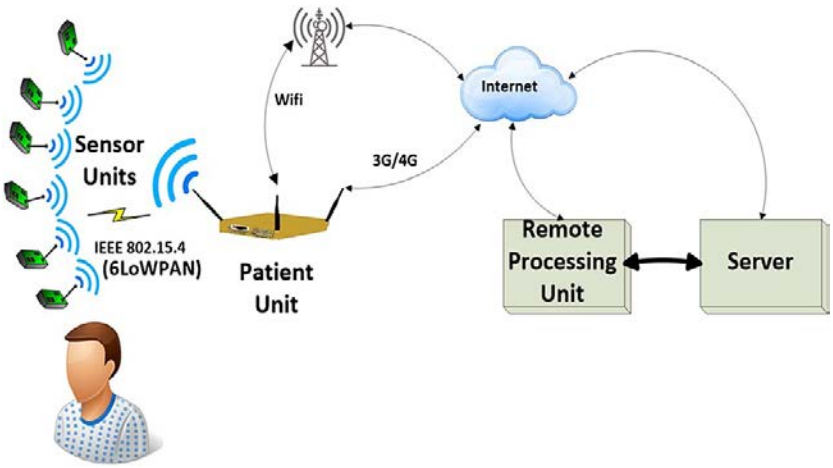

Fig.2: End to end architecture for 6loWPANbased healthcare system.

Constrained Application protocol based architecture

It is an application layer protocol which is built for the less capable devices like sensors. It is based on the representational state transfer (REST) model. It is similar to the https protocol CoAP supports reliable communication using CON and ACK message and also supports best effort communication using NON message.it has four methods to communicate the sensor data which are GET, PUT, POST, and DELETE.

Traditional Stack	CoAP Stack
Application Layer	CoAP
Transport Layer	UDP
Network Layer	IPV6/RPL
Network Adaptation Layer	6LoWPAN
Data Link Layer	802.15.4
Physical Layer	802.15.4

Fig. 2: CoAP protocol stack for healthcare system.

IEEE 11073 Health Standard based architecture

Health device communication standards enables the communication between the medical/health related devices and external computers. They provide the detailed information or data of the clients and some vital health related data as well as device operational data. The standards are applied on the devices at both the places place where the care has been taken of the patients for ex: ventilators, infusion pumps, ECG, etc. and personal care devices such as glucose monitors, pulse oximeters, weighing devices and activity monitors.

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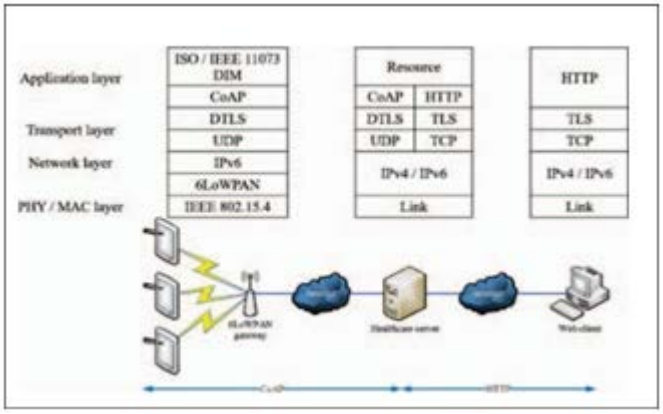

Fig. 3: Three major models in IEEE 11073.

Applications In IOT Based Healthcare System

According to P&S market research there was 37.6% growth in the market of IOT in healthcare system in between 2015 to 2020. IOT has immensely changed the healthcare sector and will continue doing so. So, here are the applications of IOT in healthcare system.

Implantable blood sugar monitoring system

Patients who has the diabetes will be implanted with a device under the skin which will have a sensor of sensing the blood glucose level and this device would be connected to the mobile of the patient and the patient would get notify of their blood glucose level if it is getting too high or too low and this will store the historical data so that the patient would be likely to understand when his or her blood sugar is getting affected.

Body activity tracker for cancer patients

Sometimes the weight and the age of the cancer is not that important but their lifestyles and other factors also plays a vital role in their treatment for that there is tracker which tracks the patients fatigue level and appetite of the patient prior to the treatment and after the treatment and sends the information to the doctors and they change their treatment accordingly.

Heart monitoring

Patients can wear the heart rate and blood pressure monitoring devices. Doctors could have access to the data related to patients hearts and would be informed at the time any emergency like arrhythmiyas, palpitation, strokes or in case heart attack. With the help of this device ambulances could be called at the time of emergency, and life could be saved.

Emergency Alert System

Individuals can wear a device which would look like jewelry but it will track any case of emergency then in that case it will notify the family members or the care takers. for an instance,[7] If a person is wearing a bracelet fells down some where their their family members would get notify on their mobile phones that there is need for help.

Ingestible sensors

Patients can swallow the devices which is shaped in the form of pill. so, that the patients could be monitored about the medication that has taken at the right time and right dosages and all the information would be notified in the patient's mobile with the help of which he would never miss the medication and dosages as well as time of taking the medication.

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Different Sensors

Wireless sensors are being used to keep the proper temperatures of the blood samples in the labs and refrigerates [7]the medicines and other biomedical materials. Basically, it tracks the temperature which is required.

Benefits of IOT in healthcare system

The use of iot in healthcare system has automated many of the processes which took time previously and had scope errors in those processes but now due to the iot many thing are automated for example:-control of temperature and airflow in the operation theatres are controlled with the help of devices.

There are lots of advantages of Iot in the healthcare system but few of major advantages are as follows:-

Lesser Errors: Iot makes the processes automated and collects the data from the sensors accurately and minimizes the waste. But above all this it reduces the risk of error in healthcare.

Decreased Costs: With the help of iot, patient monitoring is been done on run time. so, the need of doctor running out and visiting patients has been reduced. Connected home care facilities would also reduce staying in hospitals as well as re admissions.

Improved Experience of patient: All the connectivity throughout in the healthcare system with the help of iot makes the system more to follow proper procedures, good treatment options and better accuracies in diagnosing which gives better experience to the patient.

Improved Disease management: With the run time monitoring of the patients health care workers can detect any risk of major disease and can start the treatment accordingly.

Care Taken at Home: Many patients are not comfortable at the hospitals for those people sensors attached with the medical apparatus such as heart rate monitor which gathers the information and sends to the hospital where the doctors could analyse the situation and can act accordingly**.**

Challenges In Iot Based Healthcare System

Data Security and Privacy: One of the major problems face in this system is the data security and privacy. Iot enabled mobiles and other devices capture the data in the real time hence sometimes they lack in following the proper protocols and standards. There is also not clear about the data ownership and regulations about the data. Hence, the data becomes vulnerable to the cyber criminals who can hack into someone's device and fetch some personal data. some of the examples of cyber crimes in this field are making fake ID's and buying and selling drugs and fraudulent health claims by misusing the data.

Adding multiple devices and the Protocols: The implementation of the iot in healthcare becomes difficult because of the multiple devices which the manufacturer's of these devices haven't came to a consensus on the protocols and the standards and due to which the manufacturer makes their own ecosystem of the IOT which doesn't work with other manufacturer's device and app. This makes the asynchronization in following the protocols for data accumulation. This problem hinders the scalability of IOT system.

Data Overload And Accuracy: Due to the non-uniformity of data and communication protocols, [9] it is difficult to

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aggregate the data for vital insights and analysis. Iot collects data in bulk and for proper data analysis, the data need to be segregated in chunks without overloading with precise accuracy with better results. Overloading of data might result in affecting the decision making process in the hospitality sector in the longer run.

Cost : Cost are one of the major challenge in iot based healthcare because the iot based application needs to invest lots of money in it. But, for [9] the greater cause it is worth investing in it for solving major problems. The amount which is invested in it iot app will give equally huge profits by saving resources and manpower.

Conclusion

The paper provides the a comprehensive survey of the architecture and applications of iot based healthcare systems. It describes about the advantages of the iot based healthcare system an also the challenges which are faced in these systems and keeping them in mind overcoming them. This paper mainly focuses on the advancement in the healthcare systems using the IOT technology

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