IOT Based Modern Healthcare Applications: A Review

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Abstract- *The Internet of Things will hold 30 billion connected devices by 2020. IoT applications are changing industries and consumer habits drastically. In this paper different applications of modern health are discussed. Modern health care applications are ingestibles, moodables, health care charting, food safety etc. And role of IoT in healthcare.*

Keywords- Health care application ,protocol, connectivity, IoT.

I. INTRODUCTION

Internet of Things had connected 7 billion to 10 billion objects by 2013.It is expected to have 30 billion devices to connect by 2020.There is 15 to 20% of growth annually. IoT plays important role in health care. There are many benefits of IoT, but it has challenges. Healthcare, hospital executives and IT are concerned about data security and IoT device management .IoT has the potential to improve patient outcomes. Lack of EHR integration and concerns about data security may prevent healthcare from fully adopting the technology. IoT medical devices are increasing in hospitals, but keeping the devices patched and updated is challenging .Device management and activity monitoring are to be aware by hospital CIO when using IoT.

II. RELATED WORK

For food intake recognition in daily life, a wearable acoustic sensor system is used which is called autodietary. An embedded hardware prototype is developed to collect food intake sensor data. Markov model is used to identify chewing or swallowing events, which are processed to extract their time/frequency domain and non linear features. A light weight decision tree based algorithm is adopted to recognize the type of food.[5] The advancement of sensing technology, embedded system, wireless communication technology, nano technology, and miniaturization makes it possible to develop smart system to monitor activities of human beings continuously. Wearable sensor detect abnormal and/or unforeseen situations by monitoring physiological parameters along with other symptoms.[2] Security is the important factor in IoT based Healthcare system using Body Sensor Network (BSN).Security requirements in IoT based healthcare system using BSN are data integrity, data freshness, authentication, anonymity, and secure localization.[7]

III. MODERN HEALTHCARE APPLICATIONS

Ingestible

Healthcare industry is popularizing by ingestible cameras and internet connected sensors. IoT is focusing on pill sized ingestible sensor which measures patients medications according to prescription or not.

Moodables

The area of mood enhancing wearable or moodables is still coming into existence and beginning to display signs of future potential. Head mounted wearable transmits low intensity currents to the brain in order to elevate mood.

Healthcare charting

Documenting the patient history, laboratory results, medications and results of physical examinations remains a manual process. Smart glass technology which is powered by voice commands and allow doctor to record patients visits and quickly enter into patients chart using HIPAA encrypted network. It saves average 15Hr per week for doctor.

Food safety

Organic chemistry lab is required to test the food contamination. IoT startups are attacking food safety with consumer level connected devices. For example allergen monitor made by 6sensor labs can detect gluten content in food in a 2min test with 99.5% accuracy, sending results to smart phone.

IV. FUNCTIONALITY BASED IoT PROTOCOL ORGANIZATION

Connectivity:

6LowPAN(Low Power Personal Area Network over IPv6) is used for low power devices to the internet. Allow for the smallest devices with limited processing ability to transmit information wirelessly using an internet protocol. RPL (Routing Protocol for Lossy and Low Power Networks) maintains routing topology using low rate beaconing. It supports for message confidentiality and integrity.

IPv6 for IoT:

IPv6 enables the extension of the internet to the web of things, provides strong features and solutions to supports mobility of end nodes as well as mobility of the routing nodes of the network. IPv6 will be the key enabler for future IoT. It offers highly scalable address scheme. It solves the NAT (Network Address Translation) barrier. It enables several users and devices to share the same public IP address. IPv6 provides end to end connectivity.

Communication:

Connection establishment between devices takes place by inquiry, paging and connection. There are four types of modes - active, sniff, hold and park. ***Active mode****:* Actively transmitting and receiving data. ***Sniff mode:*** Sleeps and only listens for transmissions at a set interval. ***Hold mode*****:** Power saving mode where a device sleeps for a defined period and then returns back to active mode .***Park mode*****:** Slave will become in active until the master tells it to wake back up.

Discovery :

mDNS provides object based interface to announce and brows services on the local network.

Data Protocol:

MQTT(Message Queue Telemetry Transport): Designed for remote connections, Limited band width and small code foot print. It has different methods such as connect, disconnect, subscribe, unsubscribe and publish.

*CoAP (Constrained Application Protocol):*Which is based on request response model between end points. It has four messaging modes such as confirmation, non confirmation, piggyback and separate.

*AMQP(Advanced Messaging Queuing Protocol):*It guarantees message delivery as at most once, at least once and exactly once.

Device Management:

TR-069(Technical Report-069): Defines an application layer protocol for remote management of end user devices.

V. ARCHITECTURE

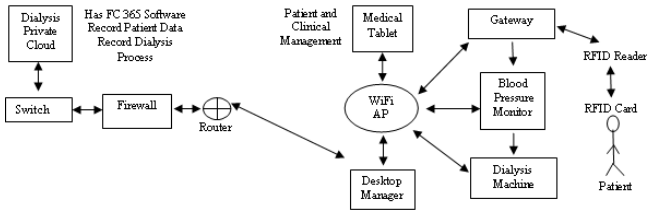

Fig. 1. Architecture of connecting medical devices to healthcare network

Capturing electronic medical records with IoT is began. NEXCOM use IoT gateway to deliver medical information through connected medical devices to a private cloud. That is medical device data converted to electronic medical records (EMR).This EMR is send to hospitals private cloud ,where data analytics can be performed to better evaluate patient condition.

Dialysis data could not be viewed on a display terminal located at the patients beside, so it was not possible to monitor multiple patients at the same time. With the help of IoT, doctors and nurses can remotely monitor all the patients on a computer display or a wireless medical tablet.

VI. CONNECTIVITY TECHNOLOGIES

There are different communication protocols used for connectivity in consumer IoT and Industrial IoT. Those protocols are IEEE802.15.4, ZigBee, 6LoWPAN, Wireless HART, Bluetooth, NFC and RFID.

IEEE802.15.4: Which uses DSSS modulation, tolerant of noise and interference.Transmission range is up to 1000m.These networks can be classified in to two types. Beacon enabled and non beacon enabled. These networks uses different types of devices such as FFD (Full Function Device) and RFD (Reduced Function Device).FFD can talk to all types of devices and RFD can only talk to an FFD.

ZigBee*:* ZigBee is heavily used for IoT application. There are two ZigBee components - ZDO (ZigBee Device Object) and APS (Application Support Sublayer). ZDO used for device management security and policies. APS is used for interfacing and control services, acts as bridge between network and other layer.

6LoWPAN: It runs over IPv6, used for IoT addressing. Used in IoT, smart grid, M2M applications. LOADng and RPL protocols are used for routing.

Wireless HART: Wireless HART network manager supervises each node, when and where to send packets. Allows for collision free, timely delivery services. Updates neighbors information.

NFC: Uses active and passive devices. There are three modes of operation, peer to peer, Read/Write and Card emulation.

Bluetooth: Used for short range communication, which is based on Ad-hoc piconets. It is a cable replacement protocol. Operating ranges are 1m for class 3,10m for class 2 and 100m for class 1.

RFID: It uses active and passive tags. Derived from AIDC (Automatic Identification and Data Capture).It has applications such as asset tracking,personal tracking, controlling access to restricted area, supply chain management etc.

VII. CONCLUSION

IoT play an important role in healthcare. With the help of IoT technology patient conditions can be monitored remotely and hence lot of time is saved by doctor.

VIII. FUTURE

We will see more and more experiments where Internet of Things devices enter the body for diagnosis and treatment. Advancement in IoT healthcare and miniaturization along with leap in IoT different challenges of healthcare can be solved. And hence healthcare applications can be handled smoothly.

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