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IOT Based Health Care Services

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ABSTRACT

Health care is a kind of livelihood maintenance and improving one's health through prevention, diagnosis and treating illness, disease and injury and physical and medical discomforts in patients. The proposed system uses the Body Sensor Network (BSN) which is a network that connects the medical sensors all over the body, even the implants placed inside or outside the human body and can operate autonomously. The BSN technology is a core technology of IoT performing in the field of health care, where patients are of monitoring using a cluster of tiny powered and lightweight wearable wireless sensor nodes for sensing and for analysis of various vital frameworks of the human body. The BSN gathers, stores the information and also shares with each other, making it achievable to gather record and analyze data. Therefore it overcomes the trouble crossing under the name of manual checkups. Patients will have high quality services. The emerging new technology in the field of health care also concerned with the security of the patient's privacy information invulnerably. Thus the proposed system mainly concerned with both the vital health care of the patients and the security issues of the patients via a sensor named Body Sensor Network (BSN).

Keywords: Body Sensor Network, IoThNet Architecture, IoT Application and Services, Embedded Gateway Configuration, Gateway Communication, Cloud Computing, Grid Computing, Clouds for health.

1. INTRODUCTION

Health care stands by the performance of taking care or reimpose of the physical, mental, or emotional comforts of the person especially by the trained and the licensed professional doctors and the health care providers. Unfortunately, the stable growth in the population and the increased rate of people being affected by the disease creates the shortage of sources from the doctors and nurses to even for the hospital beds is running extremely high. The technology in the field of medicine and health care is increasing day by day as the scientists have culturing new trends with their innovative ways and methods. The researchers in recent times concentrates on Internet of Things (IoT) because of its popularity of providing a perfect solution which in turn removes the pressure set up on health care systems. The patients are supervised with peculiar conditions. Patients who are diabetic or with Parkinson's disease are remarkably considered for the health care supervising research purposes. Patient's progress is known through constant supervising and this information collected helps to further research on discrete purposes which include aiding rehabilitation. A field that has yet to be explored in health care is emergency healthcare which is in relation to health care. Remote health monitoring, fitness competence programs, chronic diseases, and care for senior citizen are certain notable exploits of IoT. Providers of health care can issue treatment and medication at home; this is a reliable application in the field of IoT. The

core part of the IoT is endowed with various sensors, medical devices and imaging devices and diagnostic which can be contemplated as smart objects or devices. The person who uses IoT is expected to have quality treatment with low budget and better value of life. Health records are built using vital methods like gateways, medicine aided servers, and databases which includes health contents. To legalize stakeholders delivering of on-demand health services are required.

A. IoT Healthcare Networks

IoT in health care implements vital element named IoT healthcare network otherwise known as "IoThNet". It underpins access to the IoT provisions, facilitates ease of transmission and acceptance of medical knowledge, and allows access for the utilization of health care communications. The IoThNet discusses entirely about the IoThNet architecture, topology which the health care networks based on and the platform where the system runs.

1. IoThNet Architecture

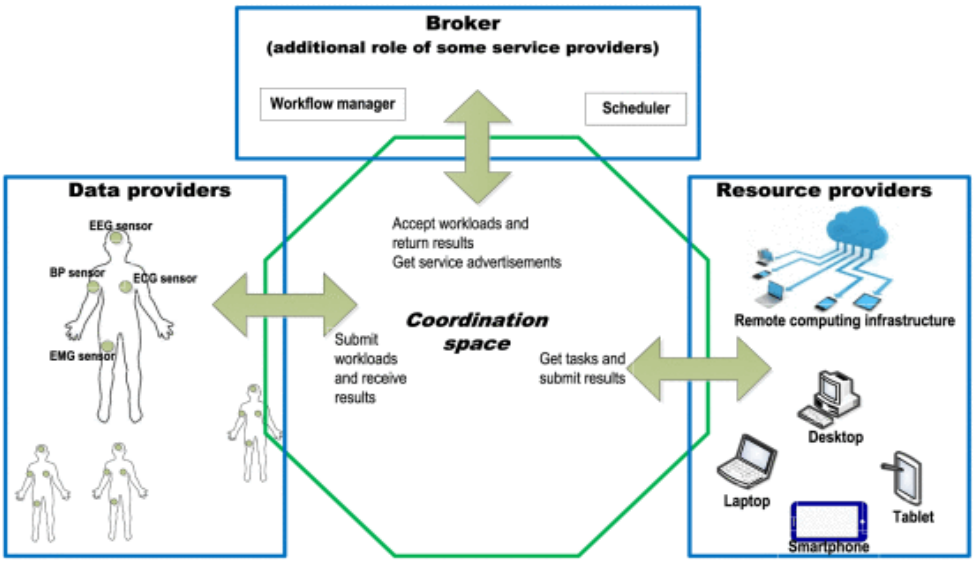

Fig 1: Topology

This topology explains how grid computing gathers expansive quantity of sensor data such as blood pressure (BP), body temperature, Electrocardiogram (ECG) and vital sign of the human body and the saturated oxygen and forms an IoThNet topology. Sensors are affixed to the patient's body. The movable medical devices are also affixed to the patient's body which in turn helps to monitor the patient's health profile and vitals. The data is collected from different sensors of the body. The cached data contains the information provided by the sensors such as vitals and other characteristics of the body. The doctor can monitor and give medical advice to patients by accessing the sensors from any locale as it is ease to access the chip from anywhere. As per the topology, the streamlet of medicine based videos is supported by the vital network structure. This topology helps letting the stream of ultrasound videos via an interconnected network with the help of worldwide interoperability for microwave access (WiMAX), an internet protocol (IP) network, global system for a mobile (GSM) network and the routine gateways and access service networks as well.

IoThNet Architecture

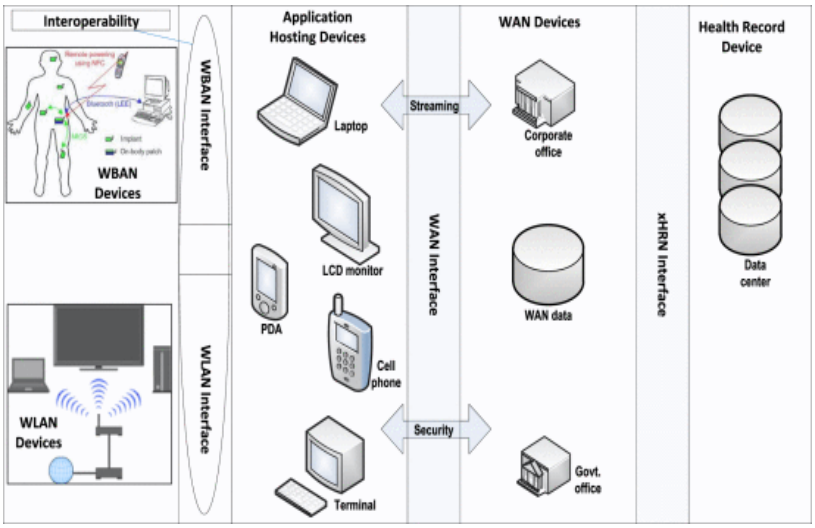

Fig 2: Architecture

The state of defining the IoThNet's physical elements, working principles, techniques and their functional organizations are the silhouette referred by the IoThNet architecture. The Continua Health Alliance approached the telehealth and the ambient assisted living systems where the basic reference architecture is presented. The keys for the architecture is interoperability of the IoT gateway and the wireless local area network (WLAN)/wireless personal area network (WPAN), multimedia streaming, and safe and secure private communication system between IoT gateways and doctors. Thus it cannot be able to hack or to trap the patient's personal medicine aided details even by the hackers all over the world. It is safe, ease and private way of gathering, analyzing and caching the data of an individual patient and monitoring the vitals and illness via a sensor and transferring the communicative information from the IoT gateways to the care advisors as it cannot be trapped or hacked by the hackers.

2. IoThNet Platform

The IoThNet platform includes both the network platform and the computing platform model. A resident's health data gets in all its concerns from the service platform framework. This platform based framework follows up a hierarchy model of how the doctors or are advisors access various database from layer called application layer with the assistance of supportive layer called support layer. Three classes of interface standardization to determine a cooperative system are given, together with hardware, package interfaces and health knowledge formats (electronic health record; EHR), and security schemes. this may eventually guarantee associated ability. The design framework comprises of the human-machine interface, multidisciplinary optimization, and application managements as well. The observed flaw which the sensor collects data from device all over the body through a wireless medium for the healthcare service is updated periodically. The vital diseases are said to be monitored periodically and to diagnose it as soon as possible as it has a chance of getting patients die all of a sudden.

B. IoT Healthcare Services and Applications

Healthcare system based on IoT can also appeal to difference division of fields, in addition the care for pediatric and the older patients, the monitoring of chronic disease and organize the health of individual and their body fitness among others. This is diverse into two topics they are

services and application. And these two topics plays a major role in the IoT based health care system. It is main to the nowadays technology. Application are divided into two types are single condition and clustered-condition.

1. Iot Healthcare Services

It is created to enable a variety of types and services and each of types provide set of Medicare solutions. In the setting of healthcare, there is no quality explanation of IoT services. And there may be

Some exception in which the healthcare services are not differentiated objectively from the particular solution or the application. And this project explores the potential and generic of building blocks and for set of solution and application. The important IoT frameworks which required for general services and the protocols are changed slightly for their better functioning in Medicare scenarios. The easy, secure, low power, fast, discovering of new devices and services can be added to the list. The entire health service contains the some subtopics that are of about the future and upcoming health services.

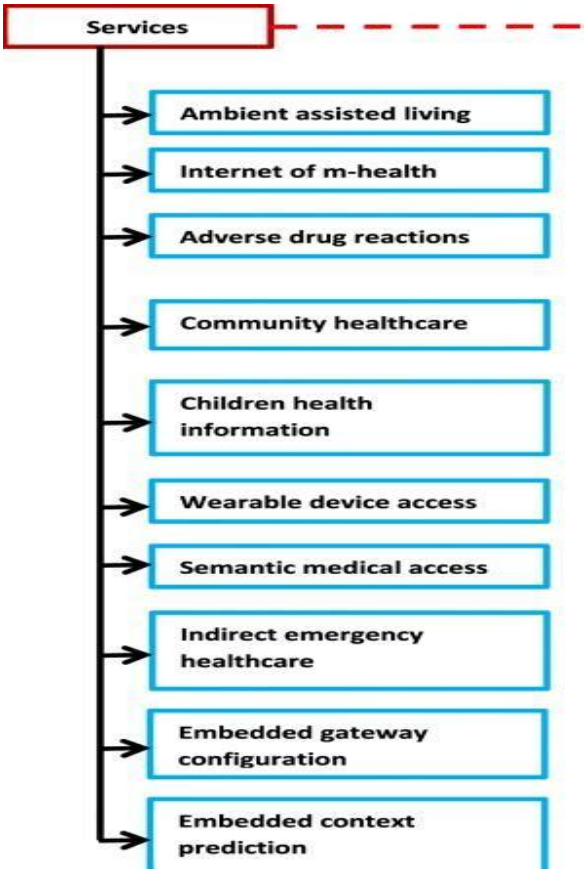

Fig 3: IoT healthcare services

2. IoT Healthcare Application

In this application it is directly used by the user and the patients, so application plays a major attention among the users. In this it is cleared that the services are only to develop the user's application. In a simple word services are developer-centric and the applications are user's-centric. The products that are listed below are the some gadget, wearable, and other healthcare devices that are sailing high in the market rate. Thus the subsection below includes the both type that is single and clustered condition. The IoT based healthcare application consists of healthcare

apps for the patients that to monitoring their health by creating apps like oxygen saturation monitoring, rehabilitation system, blood pressure monitoring, body temperature monitoring and so on.

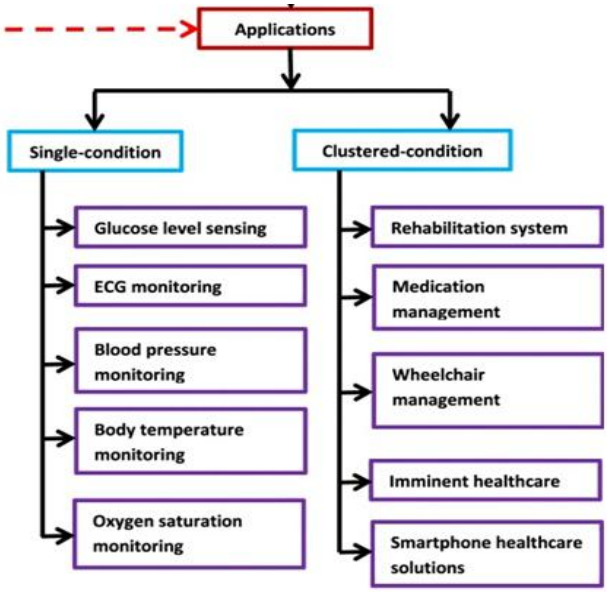

Fig 4: IoT healthcare applications

3. TECHNOLOGIES ON HEALTHCARE SERVICES

There are many technologies associated with IoT healthcare services as it works or plays explicitly with one vital being in the world. There are so many technologies associated with the IoT healthcare services. But the proposed system ensures explain few of the technologies which devoted its heart core for the services offered in the field of medicine.

1. Cloud Computing

The facilities such as ever-present access to shared resources, services offered when request over the networks and accomplishing operations to meet the required needs are happening only after the merging of cloud computing on to its IoT based healthcare services.

2. Grid Computing

Grid computing, otherwise known as cluster computing is known as the backbone of cloud computing. Grid computing ensures the universal healthcare networks that it addresses the inadequate computational capability of the sensor nodes placed over the patient's body.

3. Big Data

Big data ensures trapping large amount of vital health data generated from various sort of sensor nodes over the body and bestow tools for improving the coherence of health diagnosis and monitoring stages and methods.

4. Networks

There are various networks ranging from short-range communications such as, 6LoWPANs, WPANs, WBANs, WLANs and WSNs to long-range communications like any sort

of cellular network are all the part of physical infrastructure of IoT-based healthcare networks. The UWB (ultra-wideband), BLE, RFID, and NFC technologies help designing communications protocols and the medical sensor devices with low power as well.

5. Ambient Intelligence

Ambient Intelligence ensures continuous monitoring of human activities and executes any action required for the recognized event. But it is crucial as it continuously monitors the human Activities.

6. Augmented Reality

Augmented Reality ensures devoting its whole on to the surgery, remote monitoring and other sort of regular checkups of the patients comparing among others.

7. Wearable

The sensors such as pulse sensor, Body temperature sensor, pulse oximetry sensor, respiratory rate sensor are used as the wearable as it is designed with soft, smooth and easily wearable features as well. And also it is easy to operate and to place it on to any individual's body. The benefits of wearable are healthcare communities, gamification and connected information as well.

4. CLOUD FOR HEALTHCARE

- **Software as a Service (SaaS) –** provides applications to work with health data.
- **Platform as a Service (PaaS) –** provides tool for networking, database management, and virtualization.
- **Infrastructure as a Service (IaaS) –** provides physical infrastructure for storage and servers.

5. IOT HEALTHCARE SECURITY

Nowadays IoT is becoming an emerging technology as it is rounding up almost all over and all phases of today's technology being used. But IoT in the field of medicine is emerging in its technologies and in the way of security issues as well. IoT ends up giving many technical prescriptions for the doctors and patients for diagnosing and monitoring the health periodically. But the security is the big potential problem as it carries the patient's personal medical details in which the sensors are ease to hack by the hackers today. Hence, the big challenge for the IoT based healthcare services is to overcome the hacker's ability and to protect the patient's vital distinctive data and to store them on to a database which can be done by the following security encryption requirements.

a. Security Requirements

Security requirements in the field of medicine concerns on the security of the patient's details and on the communicative system occur between the IoT gateways and the care advisors where the chances of trapping the details are possible.

1. Confidentiality

The term confidentiality involves the inaccessibility of the patient's personal medical aided data for unauthorized users. Only those who are authorized can access the patient's data. Only authorized users are permitted to use or to analyze the data. Even eavesdroppers cannot able to trap the data possibly. This is about the confidentiality for the benefit for the patients and in the health care services.

2. Authentication

Authentication includes creating a ID to each sensor device in which it identifies each user of peer and can unlock the device when the authenticated user tries of unlocking it with which it is communicating.

3. Availability

Availability ensures that how long a IoT healthcare services survive either by local and global server or by cloud services to identify and authorize people access the sensor when it is required even under denial-of-service attacks.

4. Data Freshness

Data freshness ensures that it holds all the new data being updated every day. It also ensures that it never holds any repeated data or duplicate data on to its database and no advisory replays old messages.

b. Security Challenges

Memory Limitations

The device actuated via a system software, an application binary, an embedded operating system in most of the IoT aided healthcare devices have literally low range of device memory. Thus memory may insufficiently execute complicated security protocols.

c. A Threat Model

Due to large number of attack surfaces, the IoT health services, networks and devices are extremely unguarded to security issues on IoT healthcare services. There are three plots in IoT healthcare which makes the services unharmful anyway. The scenarios ensures that the cloud networks, native networks and the cloud services are been expanded. Then it ensures the way of reporting between the IoT networks, devices and its application, cloud services. The last scenario explicitly entails the device hardware and software limitations.

d. Attack Taxonomy

Attack taxonomy includes the attacks such as attacks based on the information disruptions, attacks based on host and network properties. DVD

e. Proposed Security Model

IoT in the field of healthcare services are not so robust to security as it is easy influenced to any security issues as it carries personal data of a patient. It is harder to identify and to diagnose all the disease, vulnerabilities, attacks and threats associated with it. The security goals designed

to achieve are design with the dynamic properties. Security plans should have ability diagnose to unseen or unpredictable problems that have to emerge.

6. CONCLUSION

As per the census, the range of death rate is 8 people die per 1000 population. Among that ¾ th are due to the medical issues and improper treatment. Scientists all over the world started traverse over many technological solution to intensify healthcare provision that complements existing services by the potential of the IoT. Thus, the IoT in the field of healthcare services started exploring new technologies to literally identify and to inspect the disease in patient's body via sensor which literally collects patient's individual data and store it in a database. The doctor can access such data with an authentication and can diagnose them with ease and security. There is a gateway communication between the doctor and the patient as the doctor only can access such personal details of the patient, no other third person can access the data without an authorization. There are many IoT applications are there in the world. But the IoT based healthcare services needs safety and security as it holds patient's personal details. Therefore the proposed system has satisfied those intense security issues with great effort by using the new technologies and serves as a tool for patients to use it with ease.

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