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IOT BASED CLOUD ENABLED REAL-TIME PATIENT HEALTH MONITORING SYSTEM

Prof. Sachin N Gore[*1]

[*1]Department of Electronics & Telecommunication Engineering, Kala Vidya Mandir Institute of Technology (Polytechnic), Malad, Mumbai-95, India.

ABSTRACT

Technology can never replace humans because the ultimate decision-making authority always lies with the individual. He or She can, However in the course of time opt for technological solutions that simplify their work and bring about efficiency. Convenience. Efficiency. Automation. The three words that define everything the Internet of things (IoT) stands for. IoT is a game-changer Technology that has been creating quite a buzz in almost every industry, but has it found acceptance in Healthcare. Health Experts are increasingly taking advantage of the benefits these technologies bring, thus generating a significant improvement in Health Care in clinical setting & out of them. E-Health Care (Support by ICT) to improve, help and assist their Health. The aim of this Paper is to develop an Architecture based on ontology capable of Health Monitoring & workout routine recommendations to patients with chronic diseases.

Keywords: Health Monitoring, IoT, E-Health.

1. INTRODUCTION

According to the constitutions of World Health Organization (WHO) the highest attainable standard of health is a fundamental right for an individual. Health is one of the global Challenges for Humanity .A recent healthcare system should provide better healthcare services to people at any time anywhere in an affordable and patient friendly manner. Currently, the healthcare system is going to change from a traditional approach to a modernized patient centered approach .Here we are proposing a new way where patient and doctors able to communicate through mobile application and web application. In the proposed system we present a health monitoring system that uses the sensors for collecting data from patients, intelligently predicts patient's health status and provides feedback to doctors through their mobile devices having android application .The patients will participate in the health care process by their mobile devices and thus can access their health information from anywhere any time. Internet of Things (IoT) visualizing a world where several objects can sense, communicate and share information over a Private Internet Protocol(IP) or Public Networks. The interconnected objects collect the data at regular intervals,analyse and used to initiate required action, providing an intelligent network for analyzing, planning and decision making.IoT connecting objects to the Internet and using that connection for control of those objects or remote monitoring.IoT is creating a brilliant, invisible network which can be sensed, controlled and programmed. The entire concept of IoT stands on sensors, Gateway and wireless network which enable users to communicate and access the application/information. To keep people effective and healthy, a readily accessible modern healthcare system is prerequisite.

2. INTERNET OF THINGS

Internet of Things is defined as things having identities and virtual personalities operating in smart spaces using intelligent interfaces to connect and communicate within social, environmental, and user contexts. It can be considered the Future of Internet, Where every object is connected to other objects. Every object is given a unique identity in the network. This allows remote access of devices through the network, anytime and at any location. IoT enabled objects communicate with each other, access information over the Internet, and interact with users creating smart and at any location. IoT enabled objects communicate with each other, access information over the Internet, and interact with users creating smart, pervasive and always connected environments. IoT also enables machine to machine (M2M) communication which allows machines being controlled by the Internet and by other machines. This can revolutionize the way technology is used, as machine takes control of machines overcoming he constraints that people face while communicating with digital systems. IoT makes the concept of pervasive computing and ubiquitous computing a reality by allowing objects equipped with sensors to communicate with humans and assisting them in every step. Healthcare Needs IoT to turn data into actions, to improve patient health, to promote preventive care, to enhance patient satisfaction & Engagement, to advance care management, to advance population health management.

3. RELATED WORK

Most proposed frameworks for remote health monitoring leverage a three tier architecture: a Wireless Body Area Network (WBAN) consisting of wearable sensors as the data acquisition unit, communication and networking and the service layer[1]. For instance [2] proposes a system that recruits wearable sensors to measure various physiological

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parameters such as blood pressure and body temperature. Sensors transmit the gathered information to a gateway server through a Bluetooth connection. The gateway server turns data into an observation and measurement file and stores it on a remote server for lateral retrieval by clinicians through the internet .Utilizing a similar Cloud based medical data storage, a health monitoring system is presented in [3] in which medical staff can access the stored data online through content service application. Targeting a specific medical application, WANDA [4] an end to end remote health monitoring and analytics system is presented for supervision of patients with high risk of heart failure. In addition to the technology for data gathering, storage, and access, medical data analysis and visualization are critical components of remote health monitoring systems. Accurate diagnoses and monitoring of patient's medical condition relies on analysis of medical records containing various physiological characteristics over a long period of time. Dealing with data of high dimensionality in both time and quantity makes data analysis task quite frustrating and error prone for clinicians. A device utilizing the IoT scheme is uniquely addressed and identifiable at anytime and anywhere through the internet.IoT based devices in remote health monitoring systems are capable of the conventional sensing tasks but can also exchange information with each other, automatically connect to and exchange information with Health institutes through the Internet, Significantly simplifying set up and administration tasks. As exemplified in [5], such systems are able to provide services such as automatic alarm to the nearest healthcare institute in the event of a critical accident for a supervised patient.

4. SYSTEM ARCHITECTURE

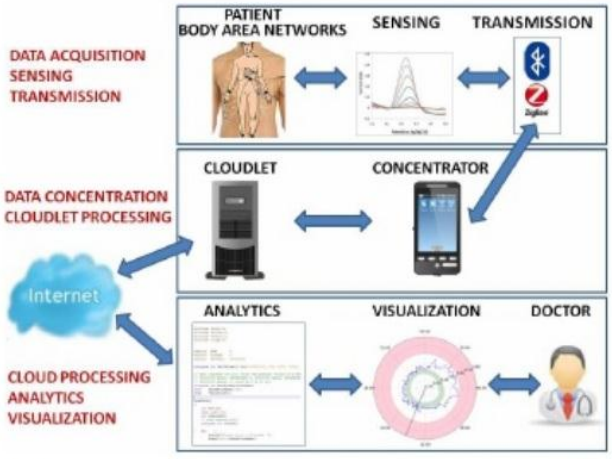

Fig. 1. Components of a remote patient monitoring system that is based on an IoT-Cloud architecture.

Figure-1: Illustrates the system architecture for a remote health monitoring system, whose major components we described next

Data Acquisition is performed by multiple wearable sensors that measure physiological biomarkers, such as ECG, Skin Temperature, respiratory rate, EMG muscle activity and gait(posture).The sensors connect to the network through an intermediate data aggregator or concentrator, which is typically a smart phone located in the vicinity of the patient.

The Data Transmission components of the system are responsible for conveying recordings of the patient from the patient's house or any remote location to the Data center of the Healthcare organization (HCO) with assured security and privacy, ideally in near real-time .Typically, the sensory acquisition platform is equipped with a short range radio such as Zigbee or low-power Bluetooth, which it uses to transfer sensor data to the concentrator. Aggregated data is further relayed to a HCO for long term storage using Internet connectivity on the concentrator, typically via a Smartphone's Wi-Fi or cellular data connection. Sensors in the data acquisition part form an Internet of Things (IoT)-based architecture as each individual sensor's data can be accessed through the internet via the concentrator. Often a storage/processing device in vicinity of a mobile client, sometimes referred to as a cloudlet, is used to augment its storage/processing capability whenever the local mobile resources do not fulfill the application's requirements. The Cloudlet can be a local processing unit (such as a desktop computer) which is directly accessible by the concentrator through Wi-Fi network .In addition to providing temporary storage prior to communication of data to the cloud, the cloudlet can also be used for running time critical tasks on patient's aggregated data. Moreover, the cloudlet can be used to transmit the aggregated data to the cloud in case of limitations on the mobile device such as temporary lack of connectivity or energy.

Cloud Processing has three distinct components: storage, analytics and visualization. The system is designed for long term storage of patient's biomedical information as well assisting health professionals with diagnostic information.

Cloud based medical data storage and processing: Data aggregated by the concentrator needs to be transferred to the cloud offers benefits of scalability and accessibility on demand, both by patients and clinical institutions. Also utilized with analytics and visualization, cloud hosting and processing can reduce costs at HCOs and provide better diagnostic information.

Analytics: Compared with the lab and office based measurements that are the workhorses of current clinical medical practice, wearable sensors can readily incorporate multiple physiological measurements and enable gathering of data with much finer temporal sampling over much longer longitudinal time scales. These rich datasets represents a tremendous opportunity for data analytics: machine learning algorithms can potentially recognize correlations between sensor observations and clinical diagnoses, and by using datasets over longer durations of time and by pooling across a large user base, improve medical diagonostics. As in other big data applications. The use of analytics here can improve accuracy, allow earlier detection, enable personalization, and reduce cost by reducing expensive lab procedures that are unnecessary. Analtics on wearable sensor data can conceptually utilize a wide range of pattern recognition and machine learning techniques that have matured significantly and are now commonly available as toolboxes in several software packages.

Visualization: It is impractical to ask physicians to pore over the voluminous data or analyses from IoT based Sensors. To be useful in clinical practice, the results from the Analytics Engine Need to be presented to physicians in an intuitive format where they can readily comprehend the inner-relations between quantities and eventually start using the sensory data in their clinical practice. Visualization is recognized as an independent and important research area with a wide array of applications in both science and day to day life. Given that color is a key discriminative attribute of our visual perception, it is unsurprising that color plays a key role in information visualization .Color distance and color category have been shown to be effective in allowing rapid identification and comprehension of differences in visually presented data.

5. CONCLUSIONS

As health care services are important part of our society, automating these services lessen the burden on humans and eases the measuring process. Also the transparency of this system helps patients to trust it. The objective of developing Cloud based monitoring system is to reduce health care costs by reducing physician's office visits, hospitalizations, and diagnostic testing procedure. Many further improvements can be made in our system to make it better and easily affordable.

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