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Location based Service and Health Monitoring System for Heart Patient using IoT

Abhishek Mane[1], Vaibhav Dighe[1], Rushal Gawali[1], Sneha Sabale[1], Santwana Gudadhe[1]

Department of Computer Engineering, Pimpri Chinchwad College of Engineering Pune, Maharashtra, India[1]

ABSTRACT: In this paper, a healthcare monitoring system is proposed which works on the basis of patient's location and the nearby emergency assistance services like hospitals and ambulance services. The system can monitor the health of the patients using body sensors like ECG sensor temperature sensors and incorporate that data with the location of the person and can Healthcare systems are generally referred as the preventive measures to avoid fatal health related issues like heart attack or any sort of cardiac impacts which need to be prevented or cured in a specific amount of time. Preventing some health related issues is a better way of avoiding any fatal instances as we can insure health by preventing. Curative measures can also be taken to prevent the fatal instances but those measures have a time factor which affects the treatment of the patient. The emergency system must work according to the location of the patient as the time factor is very important in emergency situations.

KEYWORDS: Healthcare System, Internet of Things, Wearable device, Data mining android device.

I. INTRODUCTION

The Internet of Things is a collective term for any one of the many networks of sensors, processors, and computers connected to the Internet. Healthcare applications for the IoT can potentially deliver comprehensive patient care in various settings, including acute (in-hospital), long-term (nursing homes), and community-based (typically, in-home) IoT has the potential to accurately track people, equipment, specimens, supplies, or even service animals and analyse the data captured. With patients attached to sensors to measure vital signs and other biometric information, problems could be more rapidly diagnosed, a better quality of care can be given, and resources can be used more efficiently. Recent advances in the design of Internet of Things (IoT) technologies are spurring the development of smart systems to support and improve healthcare and biomedical-related processes. Automatic identification and tracking of people and biomedical devices in hospitals, correct drug-patient associations, real-time monitoring of patients' physiological parameters for early detection of clinical deterioration are only a few possible examples.

Healthcare systems are a very important part of the economy of any country and for the public health. In smart patient management monitoring and tracking system, the system will create unique identification numbers for each patient which will identify her/him in the health information system. This ID is then linked to all recordings of the patient's vital signs and saved in a database for further analysis and historical consultation. The system will also provide real-time patient monitoring of vital signs during their stay in an emergency and critical care unit in a hospital. It also alerts hospital staff if any abnormality is detected. When the biomedical data of any patient tends to be abnormal the unique ID of the patient will give away all the information and medical history of that patient and the patient will be treated as per requirements and the treatment and biomedical condition of the patient will get registered on the unique ID of the same patient. Patient information will be retrieved from the database using this ID.

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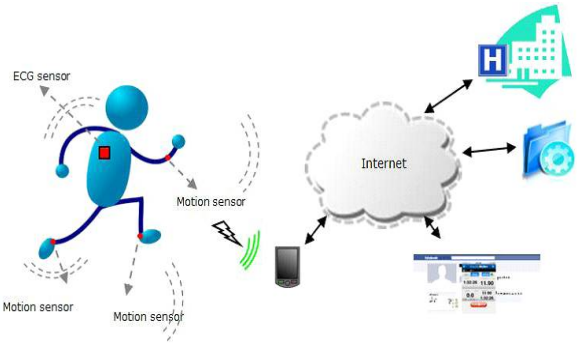

Fig. 1.IoT based health monitoring.

The system will provide a cost-effective means of increasing reliability, privacy and security in the management of healthcare records. Among others, Ultra-High-Frequency (UHF) Radio Frequency Identification (RFID), Wireless Sensor Network (WSN), and smart mobile represent three of the most promising technologies enabling the implementation of smart healthcare systems.

II. LITERATURE SURVEY

As IoT is the next revolution of internet and internet will evolve in internet-of-things this technology has grabbed the eyes of many, whether they are the developers or the users of the project. Various promising wireless technologies have been proposed.

A) Wireless home health monitoring system

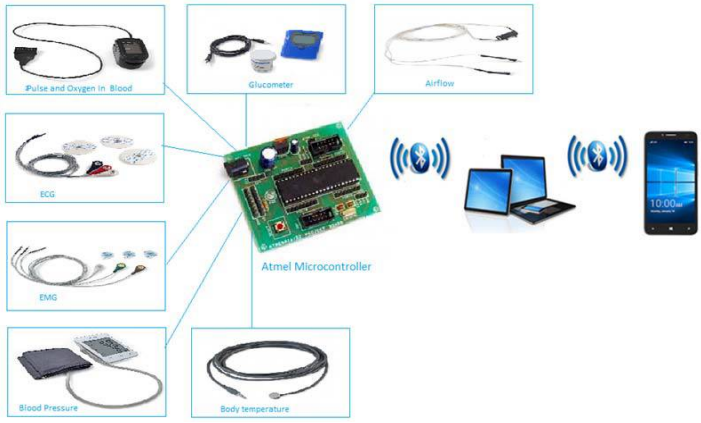

Fig. 2.Sensor network

The given system consists of devices like pulse and oxygen in blood (SPO2), airflow measurer, temperature measurer, ECG, glucometer, sphygmomanometer and EEG which are connected to the ATMEL microcontroller and board is connected to a Bluetooth module. The readings from these devices are sent wirelessly to the computer where the Lab VIEW software will process the data and generate graphs for a day, week and a month. The graphs are then sent from the computer to the mobile. In this system various sensors are used to measure various readings and monitor health by having supervision on factors such as oxygen saturation in the blood, respiratory rate, and body temperature, electrical activity of heart, blood glucose levels, blood pressure and health of muscles in the safety of our homes is

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monitored and recorded.

B) Continuous heart rate monitoring using smart phone

The overall diagram of the hardware in given system is shown in Fig. 3. The design consists of a microcontroller (MCU), AD8232 Heart monitor, three-lead electrode pads, HC-06 Bluetooth module, and a 0.1uF capacitor. The given system just uses heart rate sensors as the monitor and sends the data to ADC which then is converted to the digital form and sent to dragon board and the design is easily controlled by a smart phone application. The monitor used in this system is a very efficient sensor which works as the heart monitor for the system. It is an integrated signal conditioning block for ECG and other biopotential signals in the presence of noisy conditions, such as those created by motion or remote electrode placement. This design allows for ultra low power analog-to-digital converter (ADC) or embedded microcontroller to acquire the output signal easily.

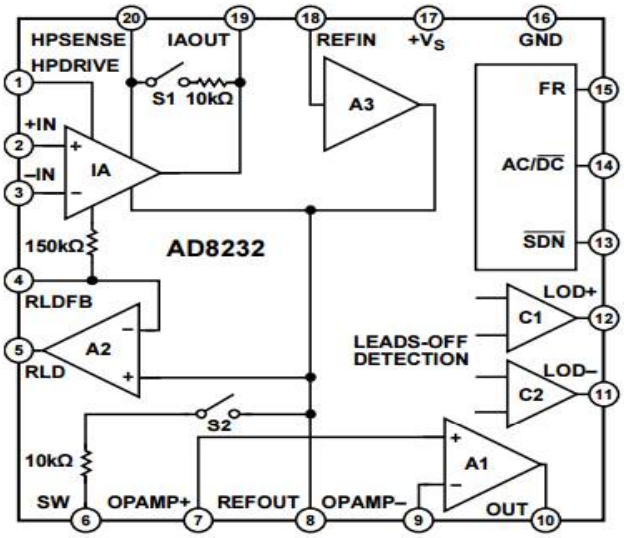

Fig. 3.Functional block diagram of AD8232

C) Location based emergency medical assistance system using openstreetmap

The given system uses OpenStreetMap (OSM) to locate where the healthcare centres are mapped taking the waypoints of them. The system is given a name as Location Based Medical Assistance (LBMA) which is integrated with afore mentioned OSM for the operation and location analysis of the emergency service. OSM is free for all users across the world. OpenStreetMap was founded in July 2004 by Steve Coast. The OpenStreetMap Foundation (OSMF) is an international not-for-profit organization supporting but not controlling the OSM project.

For LBMA, they have taken the waypoints of healthcare centres from Garmin GPS tracker around Chittagong city. The waypoints consist of longitudes and latitudes of different healthcare centres. Then the waypoints from GPS are loaded through Map source software and subsequently imported them into Java OSM software.

D) An IoT based robust healthcare model for continuous health monitoring

Robust-Healthcare model is proposed in this work which ensures the collection of data from IoT sensors and send it to the server. The raw data is analysed at server and necessary actions are taken on it. Robust-Healthcare model consists of the five layers as demonstrated in the Fig. 4. And the topology of this model is basically related to the layered structure and arranged accordingly and the peers are connected forming the Internet of Things network.

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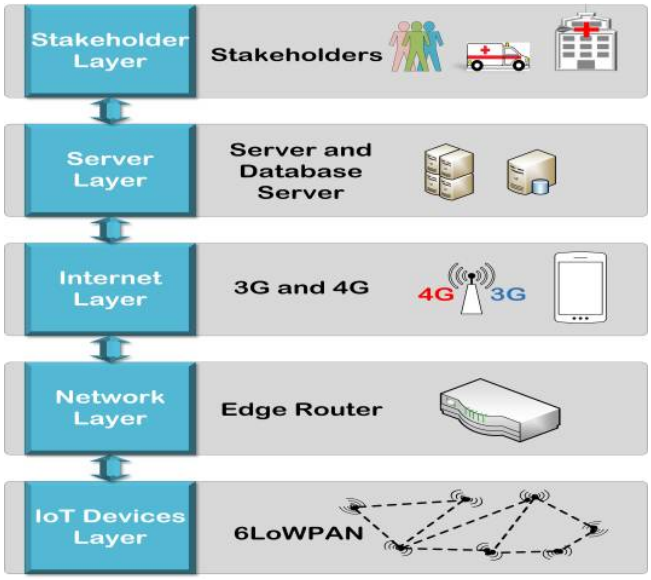

Fig. 4.Layers of Robust-Healthcare model

E) Design of Low-Cost, wearable remote health monitoring and alert system for elderly heart patients

The given system is proposed for remote monitoring of elderly patients living independently and having cardiac issues which need to be monitored to insure the better health of the elderly patient and avoid fatal incidences regarding the health of the patient.

The system is based on embedded board arduino uno and arduino nano which are integrated with the sensors deployed on the body for monitoring various factors like pulse rate, body temperature and blood oxygen level. The simple sensor used to measure the pulse rate of the patient is shown in Fig. 5.

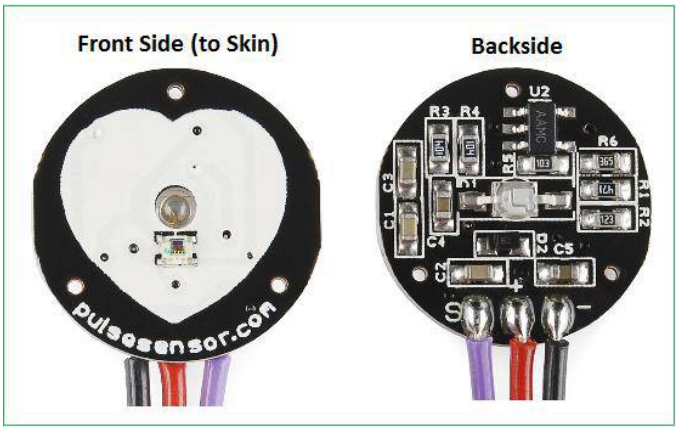

Fig. 5.Pulse sensor

III. MODEL OF IOT BASED HEALTH MONITORING

This system is divided into three sub layers which are Data acquisition, Data transmission, and Data processing. We are now going to study all the three sub layers of it. Data acquisition:- This is the first step of gathering the information of patient by various IOT sensors. Data acquisition is performed by multiple wearable sensors that measure physiological

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biomarkers. The sensors connect to the network though an intermediate data aggregator or concentrator. Concentrator is typically a smart phone located in the vicinity of the patient.

Data transmission:-Components of this system are responsible for record reports of the patient from the patient's remote location to the data centre. Aggregated data is further delayed for long term storage. The cloudlet is a local processing unit (such as a desktop computer) which is directly accessible by the concentrator through Wi-Fi network. 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.

Data processing:-Cloud Processing has three distinct components. Storage for storing patient's information. Analytics that use the sensor data along with e-Health records help in diagnoses for a number of health conditions and diseases. Visualization methods that make the data and analyses accessible to them in a readily digestible format are essential if the wearable sensors are to impact clinical practice.

The Fig. 6. depicted how to infer the Information and knowledge for the prediction of chronic disorders from the wearable Health Care devices. This architecture is a layered one in which a flow of task is easily understood .In tier-1 raw data is acquired from IoT healthcare devices monitoring wearable device which has many sensors. Including EEG sensor, galvanic skin response sensor, ECG Sensor, accelerometer and a skin temperature sensor etc. In tier-2 information is concluded from the data by filtering, processing categorizing, and data if there is much irrelevant and redundant information existing or noisy and unreliable data. In tier-3 the analysis or predication phase, we need to design algorithms for prediction purpose of chronic diseases by the means of various mining techniques with the data that we have gathered and come to some valid conclusions. By this we can conclude on a particular flow of the treatment of the patient and know each and every detail of the patient which is required for the purpose of treatment.

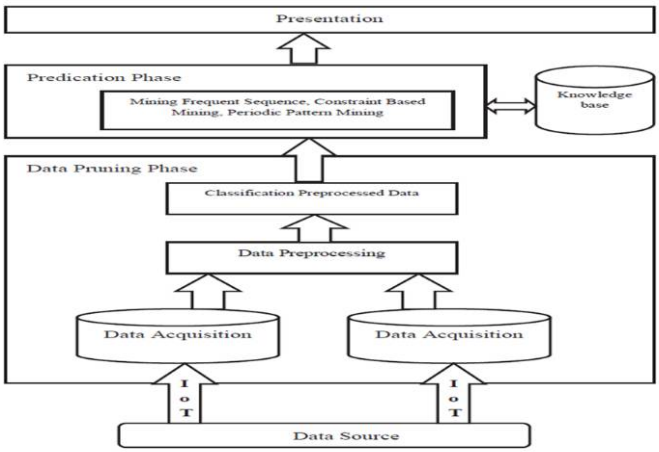

Fig. 6.Layered Architecture of Health monitoring system.

In case of emergency when a patient's pulse rate tends toward abnormal rate from normal rate then it can be predicted that the patient will surely need medical assistance immediately. The system will notice the change in pulse rate at the beginning predicting the further incidence. When such abnormal pulse rate is encountered the system will send a text message alert to the ambulance service of the hospital and also to the relatives of the patient. This text will hold the location of the patient and the highest reading encountered by the sensor at that time.

When the emergency situation occurs the system uses the location co-ordinates of the patient by using the GPS module attached to the embedded board that we are using. The location co-ordinates are immediately uploaded to the server or cloud database along with the abnormal readings of the patient. Then according to the location co-ordinates of the patient the nearby emergency services like ambulance service or hospital service are contacted for help.

The nearby hospitals and emergency services must be calculated with maximum accuracy and minimum time delay. For this purpose we use the KNN algorithm which helps us to find the nearest service with maximum accuracy and low

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time delay. Then the contact information of the services is fetched and the service is contacted by sending the location co-ordinates of the patient in need and the biomedical data of the patient for required treatment of the patient.

IV. CONCLUSION

The development of a wireless health monitoring system for heart patients which can monitor the abnormalities in the pattern of the heart rate of a patient can be of great help as the patients suffering from cardiac diseases require immediate help in case of any heart related problems as the time is a major factor affecting the effectiveness of the treatment that means the treatment required for the heart patients must be given within a stipulated time period as it may prove useless after certain amount of time.

To further reduce the time delay between the incident and the treatment received by the patient for the cause the use of location co-ordinates of the patient prove to be of good use as the nearby emergency services like ambulance service or hospital service can respond immediately to the location of the patient.

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