Rapid Med: A Highly Secured IoT Based Modern Emergency Care System Using Body Sensor Network

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Abstract— **In the modern health care environment, the usage of IoT technologies brings convenience of physicians and patients, since they are applied to various medical. The body sensor network (BSN) technology is one of the core technologies of IoT developments in healthcare system, where a patient can be monitored using a collection of tiny powered and lightweight wireless sensor nodes. The main objective of this project is to transmitting the patient's health monitoring parameters through wireless communication in an emergency situation. However, the development of the new technology in healthcare applications without considering security makes patient privacy vulnerable. In this paper, we also discuss the major security requirements in BSN-based mobile healthcare system. Subsequently, we propose a highly secured IoT-based modern emergency healthcare system using Body Sensor Network, called Rapid Med, which can efficiently accomplish those requirements.**

Index Terms— **Internet of Things (IOT), Security issues, Ardino Microcontroller, Body Sensor Network, data privacy, data integrity, Authentication**

I. INTRODUCTION

The body sensor network (BSN) technology is one of the most imperative technologies used in IoT-based modern healthcare system. It is basically a collection of low-power and lightweight wireless sensor nodes that are used to monitor the human body functions and surrounding environment. Since BSN nodes are used to collect sensitive (life critical) information and may operate in hostile environments, accordingly, they require strict security mechanisms to prevent malicious interaction with the system and body sensor network helps to people providing healthcare services like medical data access, medical monitoring and communication with family members, doctors and emergency unit in emergency situations through SMS [11]. It also provides fully remote method to acquire and detect and monitor the physiological signals without any interruption in patient's normal life. The body sensor network improves life quality.

The present monitoring system sensor is placed beside the monitors or PC, which have limitation of patient's bed. But in modern system we used wireless network and wireless devices which removes the limitation of patient's bed. To make human life more comfortable body sensor networks are an emerging technology in existing research and have the potential to transform the way of human life (*i.e.*, make life more comfortable). A wireless sensor is the smallest unit of a network that has unique features, such as, it supports large scale deployment, mobility, reliability *etc.*

The modern health technologies using Body Sensor Networks are mainly focusing on the reliability, cost effectiveness, power consumption. Most of them only address the requirement for security and privacy. The implementation of healthcare applications without considering security makes patient privacy vulnerable [4]. The security of the patient health information is one of the issues. At present day the human life is uncomfortable to understand the critical conditions of human body easily and quickly. The body sensor network helps to people providing healthcare services like medical data access, medical monitoring and communication with physician in emergency situations through SMS [1].

II. PROPOSED SYSTEM

The paragraph gives a detailed idea of the body sensor network technology is one of the most imperative technologies used in IoT-based modern healthcare system. Rapid Med can efficiently accomplish various security requirements of the BSN based healthcare system.

BSN nodes are used to collect sensitive (life-critical) information and may operate in hostile environments, accordingly, they require strict security [2]. The Rapid Med uses the 3 tier architecture which consist of four sensors that are used to take the physiological parameters from the patient body. Each sensor node is integrated with bio-sensors

such Blood Pressure (BP), Temperature sensor. These sensors collect the physiological parameters and forward them to a coordinator called Local Processing Unit (LPU), which can be a portable device such as PDA [1].

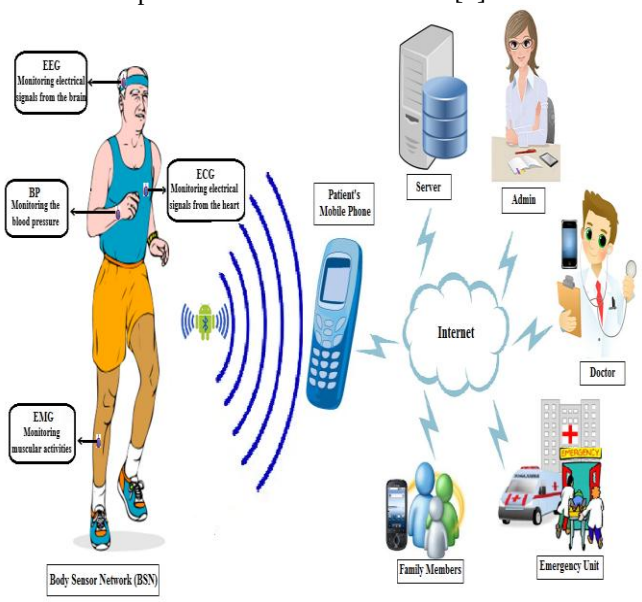


Fig 2.1 System Architecture

The Arduino Microcontroller, Bluetooth module, Local Processing Unit and the transmission network all are consist in second layer. The LPU unit sends reading updates to the server periodically. This server maintains an action table based on received data and based on the action table it takes appropriate response based on the incoming sensor data. The server maintains the data in the data base in the third tier. At the time of contacting a person's send the analyze data with highlight the variation of parameter. Architecture of health monitoring shown in fig 2.1 which consist of two different node with sensing parameter such as BP and temperature.

A. Pulse Sensor

To measure the blood pressure which is pressure on wall of arteries when heart contract and relax BP sensor are used. The systolic is high blood pressure on wall of arteries when heart is contract and diastolic is low blood pressure when heart is relaxed. Use the correct cuff size for accurate reading. The Wireless Blood Pressure Monitor includes a Medium cuff. If cuff size is too large then it will produce a reading that is lower than the correct blood pressure and if cuff size is too small then it will produce a reading that is higher than the correct blood pressure**.**

B. Temperature Sensor (LM35)

The LM35 series are precision integrated circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range.

C. Ardino Microcontroller

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

D. Bluetooth Module (HC-05)

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature).

The second layer of this system explains the interaction between BSN, smart objects and LPU. Whenever the LPU detects any abnormalities then it immediately provides alert to the person who is wearing the bio-sensors. For example, in general BP More than 120 over 80 and less than 140 over90 is normal, when the BP of the person reaches above/below the normal range, the LPU will provide a gentle alert to the person through the LPU devices (e.g. beep tone in a mobile phone)and also send the details to concerned family member. If required this data can also be forwarded to the physician.

III. ALGORITHM

Step 1: Read the sensor output.

Step 2: Check the sensor output with the normal value.

Step 3: If the sensor output is normal nothing to do.

Step 4: If the sensor output is abnormal but not severe.

Step 4. a : Inform to family members and doctor.

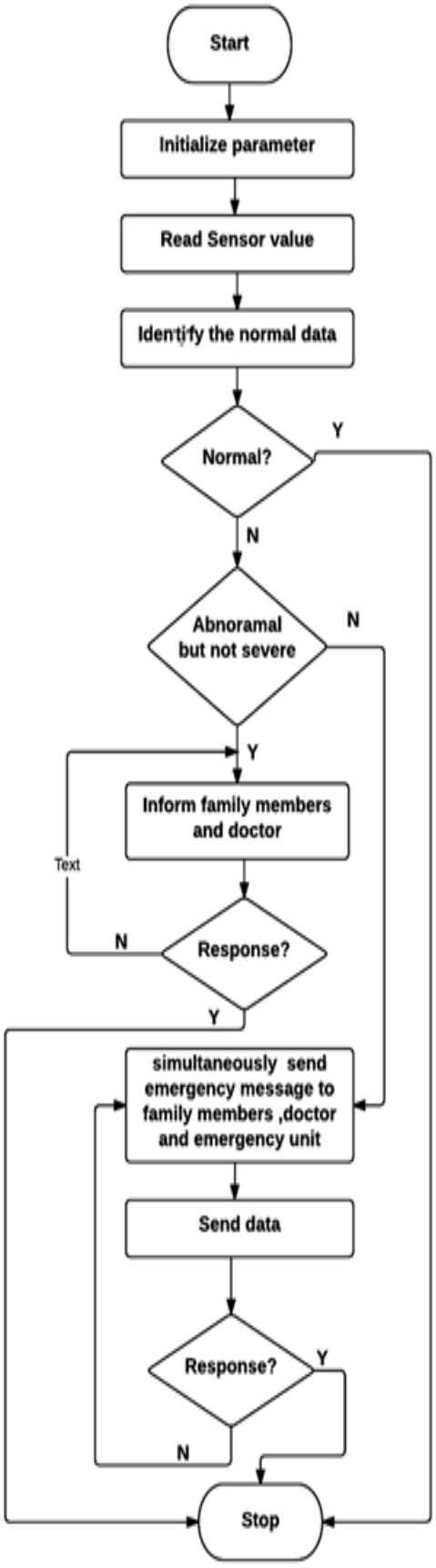
Step 5: If the sensor output is abnormal and severe.

Step 5. a : Inform to emergency unit, family members and doctor simultaneously.

Step 6: Send the data to all.

Step 7: If response from any one is not get repeatedly send the data to the person until get the response.

IV. FLOW CHART



V. EXPERIMENTAL RESULTS

Fig 5.1 Result of remote health app

Figure 5.1 shows the heart rate of patients in remote health app. This data will be uploaded in data base in every interval of time. When an abnormality occur the SMS will be send to the family members, doctors and emergency unit in a particular interval until a respond will get back.

It is very suitable for real-time and effective requirements of the high speed data acquisition system in IoT environment. Different types of sensors can be used as long as they are connected to the system. Finally, by taking real time monitoring of health care monitoring in IoT environment as an example, the system is verified and achieved good effects in simulation output [11].

VI. FUTURE SCOPE

In our system the body parameters are measured using two sensors. In future we include more sensors for the body parameters measurements, to develop a health care application that is used to monitor the patients' deep brain stimulations, heart regulations and motions etc. When an emergency situation occurs the message will be provided automatically to the family members, doctors and emergency care unit in our system with the varying parameters. In future we consider the location and the history of patient, they are more helpful to the doctor to give good treatment to the patient [10].

In future, a health care application can be implemented, that provides all medical facilities.

VII. CONCLUSION

The security and emergency care issues in healthcare applications are described using body sensor network. All most all the popular BSN based research projects acknowledge the issue of the security and the privacy issues. Subsequently, we found that even though most of the popular BSN based research projects mention the issue of the security, but they fail to embed strong security services that could preserve patient privacy [8], [9]. And also we found that when an emergency situation occurs the care of each health care application is not efficient. Here we propose a secure IoT based healthcare system using BSN, called Rapid Med, which can efficiently accomplish various security

requirements such as Data Privacy, Data Integrity, Data Freshness and Anonymity of the BSN based healthcare system through two phases, registration phase and authentication phase. In registration, the Rapid Med server issues security credentials to a LPU through secure channel. The next authentication phase, where before provide the system services the user must be login to system using a username and a password.

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