



IOT SENSOR-BASED ABNORMAL BEHAVIOR DETECTION FOR ELDERLY PEOPLE

¹G Preethi, ²K Abhirami, ³K Divya Shree, ⁴S Liashini

Lecturer, Department of Information Technology
PSG Polytechnic College, Coimbatore, Tamilnadu

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Abstract

The core objective of this project is to design and implement an elderly people health tracking system. And monitor the health of the elder, when there is any abnormality discovered by the sensors, they immediately send warning message through in an application. The warning message are sent when the elder is in danger or when they move their location (their location is sent) through an application. This health monitoring system measures temperature, pulse, heartbeat of the human body. The measured data is in form of analogue signal and it converted to digital data. The measured data are saved in the database for the future use by the Arduino UNO. The database is cloud (private cloud). This project aims to monitors the health of an elder and the device is made as a wearable device which is very comfortable to use. When the patient is in hospital then the data's can be used to check whether really the patient has been sick for a while.

Keywords: *Arduino controller, power supply, heartbeat sensor, pressure sensor, temperature sensor, Wi-Fi module, Smart phone*

INTRODUCTION

The increased use of mobile technologies and smart devices in the health zone has brought on extraordinary effect on the world's critical care. Health specialists and doctors are using these technologies to create critical change in medicinal services during clinical settings. Likewise, many users are being served from the upsides of the M-Health (Mobile Health) applications and E-Health (social insurance upheld by ICT) to enhance, help and assist their well-being. The Internet of things is progressively permitting to coordinate gadgets for associating with the Internet and give data on the condition of health of patients and give data continuously to specialists who help. The main aim of this 'elderly Patient Monitoring System' is to build up a system fit for observing vital body signs, for example, body temperature, heart rate, pulse rate. To accomplish this, the system involves many sensors to screen fundamental signs that can be interfaced to the doctor's mobile or the web.

The gadget will exchange the readings from the sensor to cloud remotely and the information gathered will be accessible for analysis progressively. It has the capacity of reading and transmitting emergency signs to the cloud and then to guardian's Smartphone. These readings can be utilized to recognize the health state of the patient and as an alert system against the emergency health condition.

Elderly Patient Monitoring System can be characterized as the system utilized for observing physiological signs that incorporate the parameters like the blood pressure, body temperature, and heartbeat parameters, and so forth. Understanding and checking monitoring system is a piece of M-health innovation. It can be named as m-health or mobile health. These systems are utilized for the practice of medicinal and general health with the assistance of cell phones. These frameworks observation can be utilized nearby or remotely. Patient monitoring is relevant in various circumstances when a patient is in the accompanying conditions:

- In a life-threatening condition – for instance, when there is an indication of heart attack in a patient.
- In a situation leading to the developing of a risky life-threatening condition.
- In a critical physiological state

LITERATURE SURVEY

Shiyleela Patil [2] paper describes that patient are needed to wait in order to see a doctor and there are many patient which the doctor may not be able to take care off. So it recommends patient health monitoring system that will always keep monitoring the body temperature, pulse and heart rate. The wearied device will send results to phone using Bluetooth connection or NFC technology. This can able to give to cloud server using GSM and 3G. This paper also describes about the components used, Wi-Fi connectivity and the results are explained. The disadvantage of this paper is the abnormality of elderly patient is not detected in outside their house. And is unable to detect the location of the elderly patient.

Authors [3] stated that these wearable devices are used in order to minimize the concern of privacy. When some elders feel uncomfortable when there are surveillance in the private areas like bathroom and bedroom. So in order to reduce these concerns we use IoT sensors in a wearable device to watch the movements of the elders. In this paper they have used spatio-temporal approach. This paper suggests capturing motions of the elderly by placing motion sensors at their home to capture their daily activity as a motion data. In this they used Raspberry Pi for storing data. There are 6 levels of behavioral metrics which is used to see the body moments. In this paper they used sensors in each rooms of the house to detect the environmental temperature and elderly moments then use a wearable device in body of the elder to measure the body temperature, pulse, heart rate to detect any abnormality in time. The disadvantage of this paper is the abnormality of elderly patient is not detected in outside their house. And are unable to detect the location of the elder patient.

Mehmet Tastan stated that the devices should provide continuous monitoring of health, which are very expensive and are needed to be operated by trained personal but these devices allow elder to interact socially instead of hospitalized life. After analyze is completed then the records of health monitoring system are sent to mobile via Bluetooth. The heart rate can be between 60 to 100 beat per min, but in athletes have even 50 to 40 bear per min. The pulse rate is calculated depending on the oxygen saturation in the finger blood. This sensor responds to variations in light intensity and the amplitude of the output signal depends on the amount of light. This paper says about the heart rate and the pulse rate calculation of the health monitoring system. And how the calculations can be understood. The disadvantage of this paper is unable to detect the location of the elder patient.

PROPOSED SYSTEM

The objective of this project is to overcome the design and implementation of a smart patient health tracking system. Heart beat sensors, Temperature sensor and blood pressure sensor are embedded on the patient body to sense the temperature, pressure, and heartbeat of the patient. These 3 sensors are connected to arduino control unit, which calculates the values of all the sensors. The values from the analog signal are converted to digital values then the values are displayed in the LCD display. These calculated values are then transmitted to an IoT private cloud through arduino controller by Wi-Fi. From the private cloud the values are then accessed by the guardian and doctor at any other location from an application. Thus based on the temperature and heart beat values, the doctor can decide the state of the patient and appropriate measures can be taken if the values are abnormal. This also has a feature of sending warning message to the patient's guardian is also included. When there is an abnormal behavior it sends warning message with the user's location to their respective guardian. The location of the elder user can be traced using their mobile phone. The GPS is inserted to the smart device so the device location can be seen by the user's guardian when the user is in danger. This feature guarantees the safety of elder. And this is a wearable device (coat) and can be used easily.

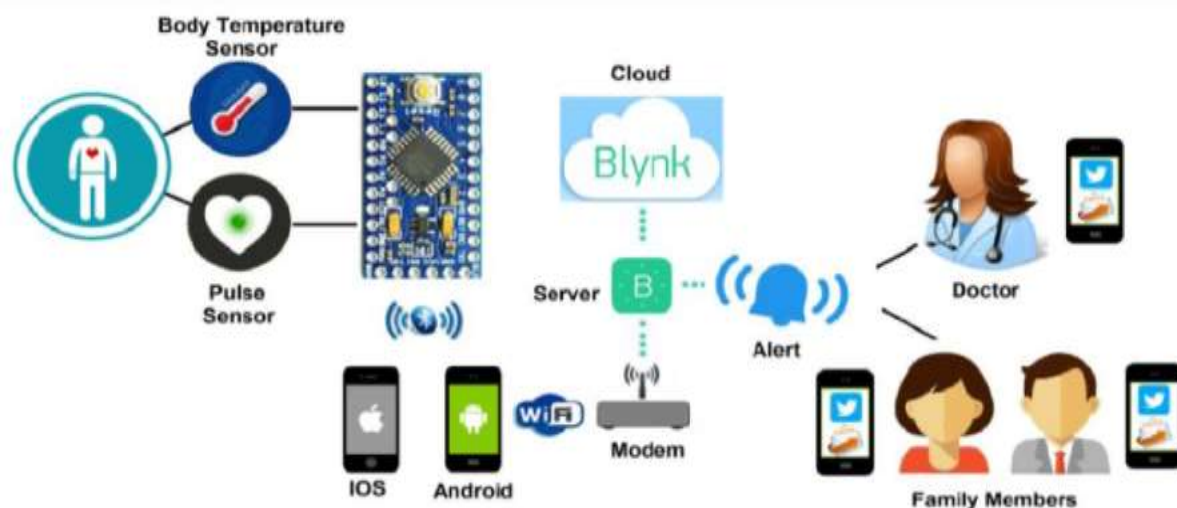


Fig 1 Proposed Structure of System

This figure shows how an elderly patient health monitoring system works, first it collects the sensor data from body temperature sensor, pulse sensor and heart rate sensor then it send the data to the Arduino micro controller then the processed data in the Arduino is sent to raspberry pi 3 controller for saving the data in the cloud. If the sensors data are abnormal then a alert message is sent to either the patients consulting doctor or their guardian.

SYSTEM DESIGN

Elderly patient monitoring system has 3 sensors. The first one is a temperature sensor, the second is the Heartbeat sensor and the third one is pulse sensor. This project is very useful since the guardian can monitor elderly patient health parameters just by visiting app. And nowadays many IOT apps are also being developed. So now the doctor or family members can monitor or track the patient's health through the Android apps.

To operate IOT based health monitoring system project, you need a Wi-Fi connection. The microcontroller or the Arduino board connects to the Wi-Fi network using a Wi-Fi module. This project will not work without a working without a Wi-Fi network. You can create a Wi-Fi zone using a Wi-Fi module or you can even create a Wi-Fi zone using Hotspot on your Smartphone. The Arduino board continuously reads input from these 3 sensors. Then it sends this data to the private cloud by raspberry pi 3 controller and data is sent to a particular URL/IP address. Then this action of sending data to IP is repeated after a particular interval of time. For example, in this project, we have sent data after every 1 minute.

Design of the elderly patient health monitoring system for the researchers is the hot topic. The elderly patient health monitoring system is used every field such as hospital, home care unit. This the elderly patient health monitoring system used for chronicle diseases patients who have daily check-up. So, design a system as portable device. And we have designed a wearable device which is easy to use. Different platform like Microcontroller, ASIC, FPGA, PIC

microcontroller is used to design the system based on this performance. The integration of different medical instrument on the single system on-chip is main achievement for researcher by using different biomedical sensor.

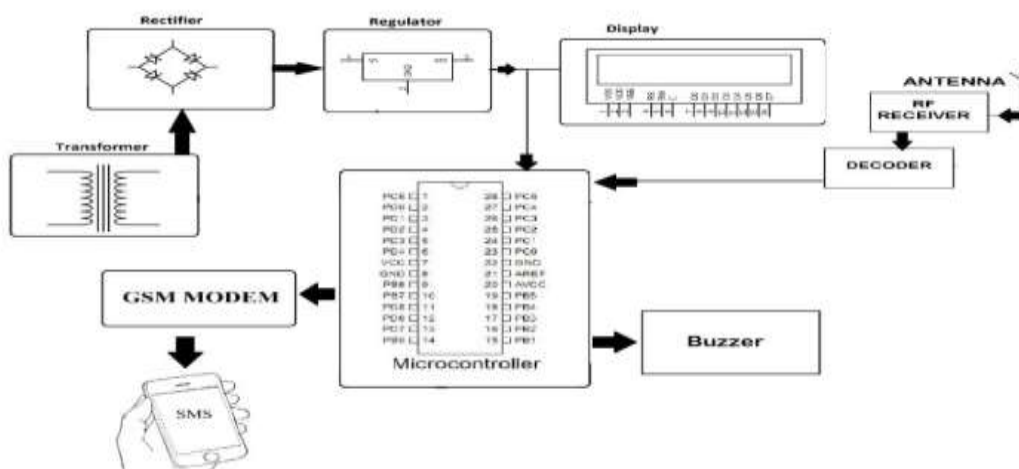


Fig 2 System design

WORKING PRINCIPLE

This project proposes a model of Elder Patient Health Monitoring System, with different components like pulse, body temperature, and heartbeat detection using pulse sensor, heartbeat sensor and temperature sensor. The sensors utilized as a part of this project are, Heart beat sensor, Body temperature sensor, and blood oxygen level. These sensors work autonomously of each other. The measured reading from the sensor is broke down for the patient and is made accessible to the specialist or to any concerned individual in the type of the web or smart phones.

The power supply is 230v and is converted to 5v for Arduino board controller. The coding for temperature sensor, heartbeat sensor and pulse sensor are coded in arduino controller. The power supply is given 4 processes such as Transformer, Rectification, Smoothing, and Regulating. The calculated data are stored in the private cloud and data are retrieved when needed. The temperature, pulse, and heartbeat are analog signal which should be converted to digital signal for displaying in the LED display. When the analog signal is converted into digital signal the data are stored in the cloud. For accessing cloud, we need Wi-Fi. For the retrieval of data from the cloud we use an application with the help of Wi-Fi.

Figure 3 shows the working principle of health monitoring system. In the monitoring device it has analog front end (the signals from the electrodes) are connected to the microcontroller arduino. Then the sensors (temperature, pulse, and heartbeat sensors) are connected to the microcontroller arduino. Then power supply is given through the analog front end and to microcontroller, and another is given to the wireless communicator. After calculating the values in the microcontroller, the values are saved in the cloud using wireless communication. Through Wi-Fi Smartphone can be connected to view the data.

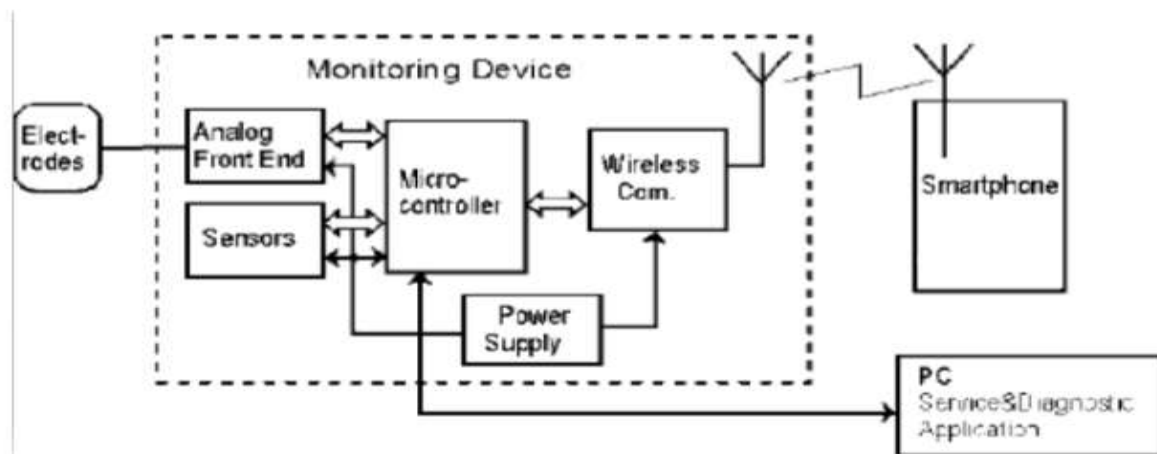


Fig 3 Working principle

RESULTS AND DISCUSSION



Fig 4 Prototype of project



Fig 5 Measuring heartbeat, temperature and pressure

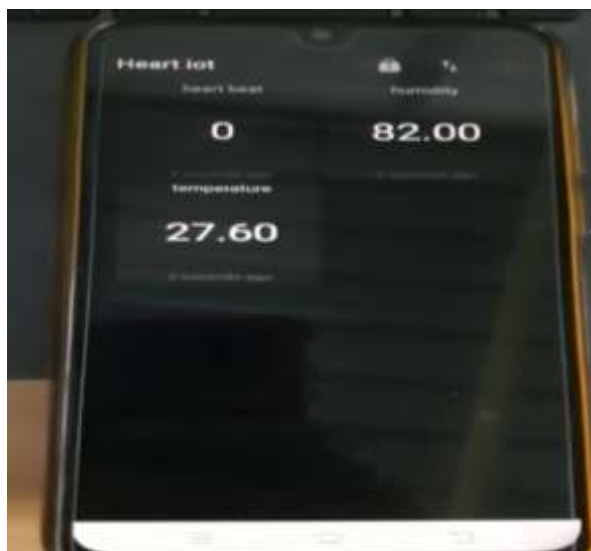


Fig 6 Guardian View



Fig 7 Output Display

The main objective of the experiment was successfully achieved and all the individual modules like Heartbeat detection module, Pulse detection module and temperature detection. and remote viewing module gave out the intended results. The designed system modules can further be optimized and produced to a final single circuit. More important fact that came up during project design is that all the circuit components used in the elderly patient remote health detection system are available easily. With the development in the integrated circuit industry, Micro Electro Mechanical Systems (MEMs) and microcontrollers have become affordable and have increased processing speeds, miniaturized and power efficient.

This has led to increased development of embedded systems that the healthcare specialists are adopting and also patients. These embedded systems have also been adopted in the Smartphone technology. And with increased internet penetration in most developing countries through mobile phones, and with use of Internet of things (IoT) will become adopted at a faster rate.

The Remote Health Care system utilizes these concepts to come up with a system for better quality of life for people in society.

FUTURE ENHANCEMENTS

This system is implemented using temperature sensor, heartbeat sensor, and pulse sensor to sense the abnormality of the elderly human body. This health monitoring system uses GPS and finds the location of user and send's the location to their respective guardian. When there is any abnormality in the health monitoring system sensor then send's warning message to the guardian. In future, this system can be used in hospitals and homes of elderly people.

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