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Remote Safety Assistance and Health Monitoring System

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Abstract

Objectives: With the increase in the aging population, the health of the elderly has been a widespread concern. There rises a need to develop a system which does remote monitoring and safety assistance. **Methods:** In this proposed work, heart Beats per Minute (BPM), temperature, precise location of the patient, seizure detection and fall detection of the elderly individual is monitored continuously. The precise location of the aged individuals is achieved by means of Radio-Frequency Identification (RFID) technology. Seizure detection uses accelerometer sensor. Fall detection is identified using gyro sensor. Temperature and hearts beat per minute are calculated using heart beat sensor and lm35 sensor. **Findings:** The algorithms developed for the seizure and fall detection are tested on different conditions and the results are satisfactory. Fall detection algorithm completely differentiates between the fall and bend of the individual. Always a doctor or care takers cannot be present for monitoring. Hence there rises a need to send alert messages when the fall or seizure is detected. Alerts are sending to caretakers or doctors using internet. **Improvement/Applications:** The work can be further extended by monitoring several individuals at the same time and developing a mobile app for remote monitoring and assisting.

Keywords: Internet, IOT, RFID, Remote Monitoring, Seizure

1. Introduction

The evolution of sensing and activity systems leans towards extra mobile solutions. It takes the care to a further custom-built one and more feasible. Custom-built care offers observance of the patients in their own environments, i.e. the preparation of remote health observance systems.

This work helps in the usage of Internet of Things (IOT) for remote observance. These wireless technologies establish, locate, sense and connect individuals with devices, machines and things surrounding them. These new capabilities for linking web with everyday sensors and devices, styles of communication between individuals and things, exploitation of data capture, define an extension of the Internet to an IOT[1].

IOT is taken into account as one among the main communication system. Extensive research is currently going on this idea in several areas, such as Intelligent Transport Systems, building automation and specific in healthcare. As an example, IOT mobile health applications has been increasing gradually[2].This shows potential identification capacities in gathering of data anytime and anyplace.

The entire paper is gathered into 6 sections. Section II talks about the system architecture. Section III talks about the hardware modules used. Section IV talks about the working model of the proposed work. Section V concludes the topic.

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2. System Architecture

This paper presents a health monitoring and safety assistance System. The block diagram is shown in Figure 1. It fundamentally comprises of three sections. Initial section is responsible for collection of health parameters. Heart BPM, temperature, precise location, seizure detection and fall detection of the individual is observed with the help of raspberry pi. BPM is calculated by the principle of light modulation. Temperature of the individual is calculated by using LM35 sensor. Seizure detection is observed with the help of accelerometer sensor. Seizure is detected when continuous vibrations occur on human body. Precise location is found out by using RFID technology[4]. RFID reader is placed on the person body. Entrance of the each room is placed with the unique RFID tag. While person is entering the room, RFID reads the tag ID and updates the location[5]. Each unique tag ID is marked with unique location. Fall detection is identified by the large change in angle measurement given by the gyro scope sensor.

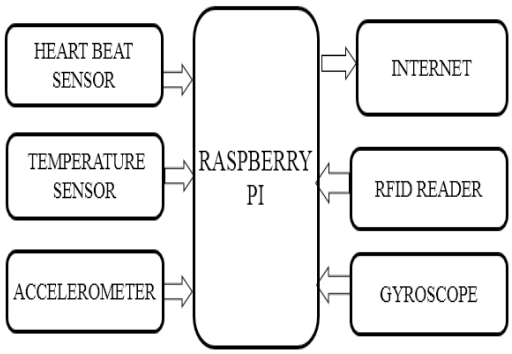

Figure 1. Block diagram.

Second section is responsible for uploading data into internet. All the sensor data are continuously uploaded into website for live monitoring.

Third section is responsible for sending alerts to the doctors and the caretakers[6]. Seizure and fall detection are not continuous actions, they occur suddenly[7]. When these actions occur, alert messages are sent to mobile phones using internet with the help of raspberry pi.

3. Hardware Modules

List of components used in the proposed work are EM18 RFID reader, heart beat sensor, ADLX335 accelerometer, LM35, MPU6050 gyro sensor and raspberry pi 2 board.

3.1 Heart Beat Senor

The Heart Beat device produces digital output of heart beat when a finger is placed on that. Once the detector starts operating, the LED present on the sensor starts flashing with each heartbeat[8]. The total number of flashes of the LED is given as the total heart BPM. The output of is connected to any controller to read the Heartbeat readings. It functions on the principle of light modulation by blood flow through the nerves of the finger at every pulse[9]. Heart beat sensor is shown in Figure 2.

Figure 2. EM18 RFID reader.

3.2 EM-18 RFID

EM18 reader is used as a receiver for RFID cards or tags. It reads out the information of cards when card is near to the reader[10]. EM18 module is shown in Figure 3.

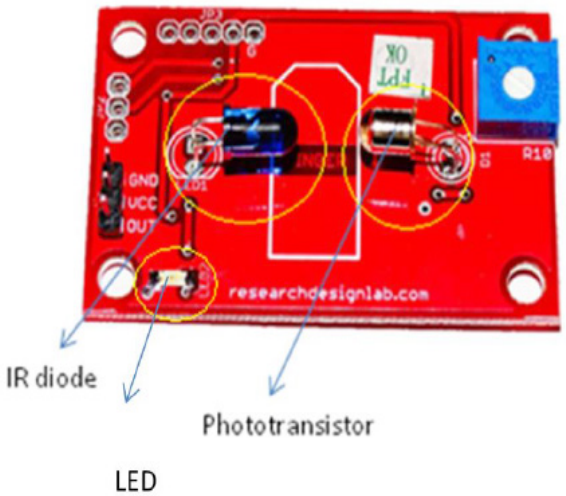

Figure 3. Heart beat sensor.

3.3 ADLX335

The ADXL335 is a 3-axis acceleration menstruation system. This sensor produces signals of analog voltages which are proportional to acceleration. The accelerometer can measure the static acceleration of gravity in tilt-sensing applications as well as dynamic acceleration resulting from motion, shock, or vibration[11].Accelerometer is shown in Figure 4.

Figure 4. ADLX335.

3.4 LM35

LM35 gives output voltage values which are proportional to the temperature in centigrade scale[12].LM35 is shown in Figure 5.

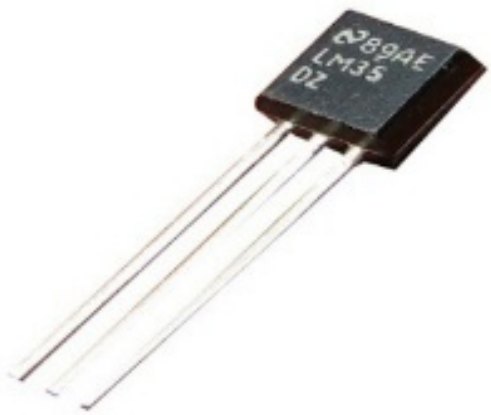

Figure 5. LM35.

3.5 MPU6050

The MPU-6050 is serious very little piece of motion process tech by combining a MEMS 3-axis rotating mechanism and a 3-axis measuring device on identical semiconducting material die in conjunction with an on board Digital Motion Processor™ (DMP™) capable of process complicated 9-axis Motion Fusion algorithms, the MPU-6050 will away with the cross-axis alignment issues that may sneak up on separate components[13].MPU6050 is shown in Figure 6.

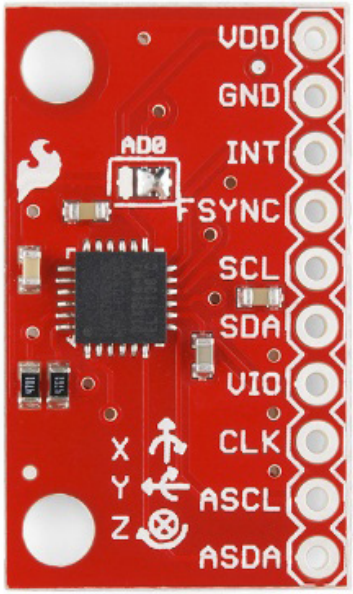

Figure 6. MPU6050.

3.6 Raspberry PI2

The raspberry pi has a BCM2835 SOC, which has ARM1176JZF-S 700MHz processor and a 1GB of RAM[14]. Raspberry PI2 is shown in Figure 7.

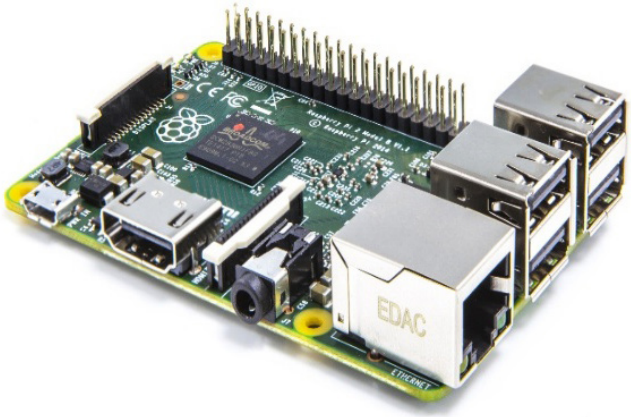

Figure 7. Raspberry Pi2.

4. Working Model

4.1 Health monitoring system

Here heartbeat sensor, temperature sensor, accelerometer, gyro sensor and RFID reader is connected to raspberry pi. Connection Figure is shown in Figure 8. The results of heart BPM, accelerometer coordinates, RFID reader and gyro scope are shown in Figure 9, Figure 10, Figure 11 and Figure 12 respectively. As shown in Figure 13, to run each sensor independently all the sensor runs in different terminals of raspberry pi. Whenever there is a continuous vibration, the coordinate values of the accelerometer changes. These variations are used to detect seizure. The seizure detected graph is shown in Figure 14.

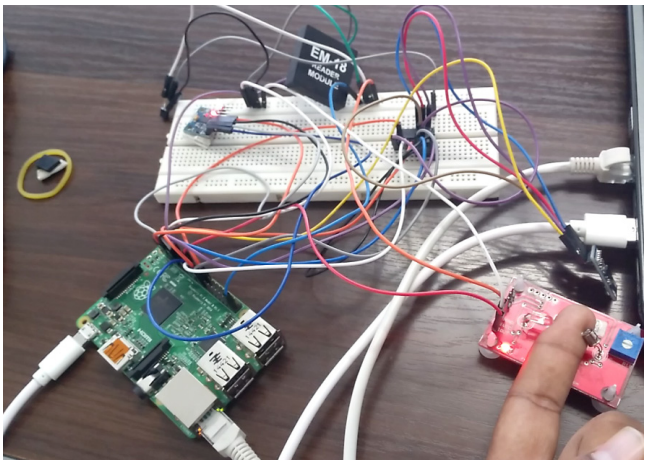

Figure 8. Implementation.

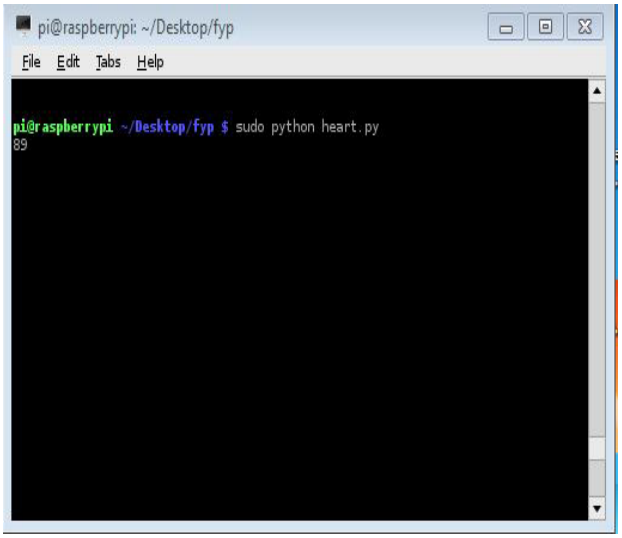

Figure 9. BPM values in terminal

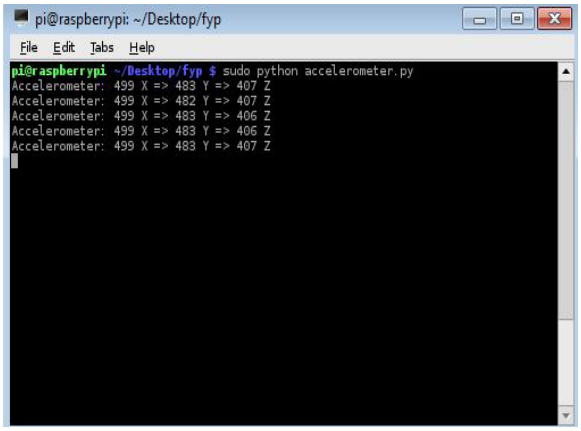

Figure 10. Accelerometer values in terminal.

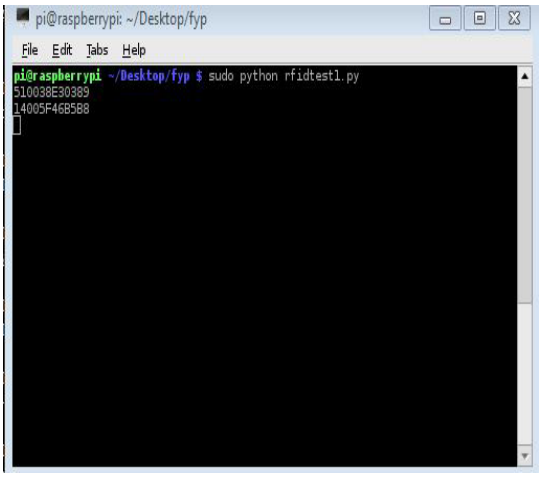

Figure 11. RFID tag values in terminal.

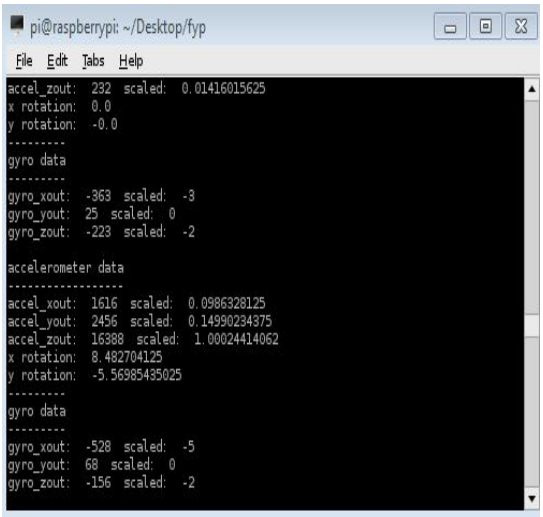

Figure 12. Gyro values in terminals.

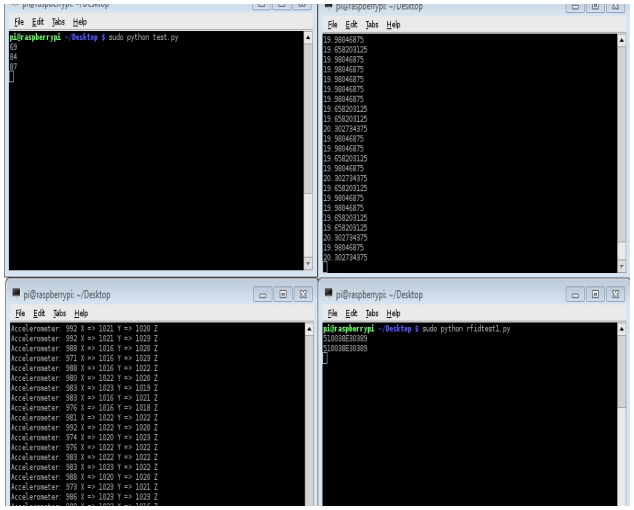

Figure 13. Display of sensor values.

Figure 14. Seizure detection graph.

4.2 Remote Monitoring

As shown in Figure 15, all the sensor values are uploaded continuously into a website for live monitoring. All the sensor data are sent into website for live streaming with the timestamp.

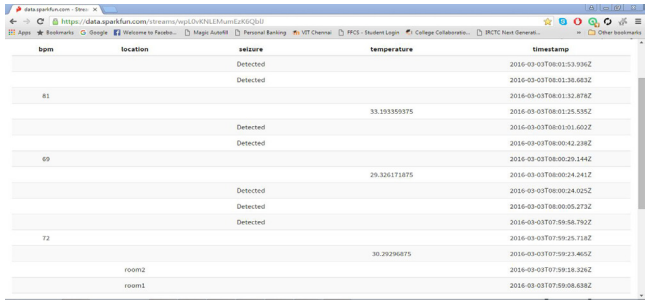

Figure 15. Values in website.

4.3 Alert mechanism

Alert message are sent to doctor or care takers mobile phones when seizure and fall detection occurs by using internet with the help of raspberry pi. This is shown in Figure 16.

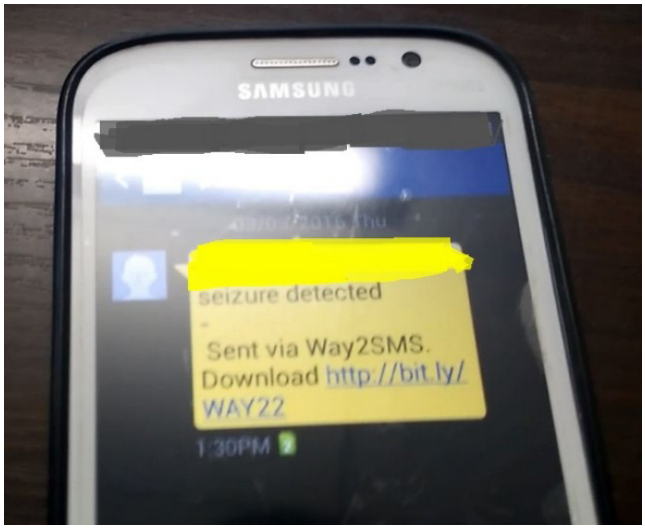

Figure 16. Alert message.

5. Conclusion

Manual effort is reduced to a greater extent due to the remote health monitoring and safety assistance system. Always doctor need not be present near the patient or aged personality to look after them Efficient and quick actions can be taken for improving the health of the individuals who are staying alone without human supervision.

6. Acknowledgement

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7. References

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