International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 4 340 - 342

Wearable Internet of Things Medical Alert Device with Fall Detection and Real Time Posture Monitoring

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***Abstract*: -** This paper presents an overview about inexpensive fall sensor design. Impact of falls cannot be determined, if there is an aid which can call for help under this circumstances it would be of great help to the person in distress and we are trying to build this aid.

Keywords: - *IoT, fall detection, Health and Wellness, Wearable device, Arduino, Android, Web.*

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I. Introduction

Numerous researchers have performed fall detection using different techniques which makes it expensive. There is certainly a need for a low cost fall detection device. Concentrating everything, our intention is to develop a device which has its architecture distributed intelligently across various body positions like Chest, Thigh, and Knee.

II. Why IoT?

Internet is the best means of communication and it is the same all over the world and this makes the device more portable and along with it comes all the advantages of IoT. For a fall sensor to work efficiently and do its job there should not be any limitations with network connectivity. Thus, the user and the person who monitors the user can isolate and remain calm.

III. Methodology

Sensors are placed at three parts Upper torso, Thigh and knee. These parts are the one which change their orientation the most and makes differentiation of postures effortless.

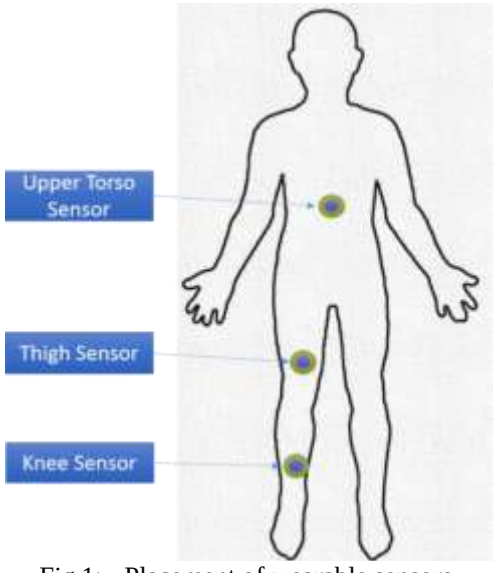

Fig 1: - Placement of wearable sensors

Accelerometers dispense analog values, these values are seized and converted into digital values. Microcontroller finds its angular acceleration by double differentiating the digital values obtained. We considerfall when the acceleration exceeds limiting threshold and different predefined thresholds are set for each posture and thus we can identify the posture in which the person is.

In sleeping posture all the sensors are aligned horizontally, in standing posture all the sensors are aligned vertically and in sitting posture the chest and knee are aligned vertically and thigh is aligned horizontally. In this way all the postures can be identified effectively.

IV. Hardware Implementation

The twin objectives of detecting the posture and fall is achieved by placing two 2ADXL 362 at chest, knee and 1 ADXL 335 at Thigh. 1 ADXL 335 used at thigh to reduce the costas the fall is detected by the Knee and Chest sensors because it is obvious. ADXL 362 is used because of it is capable of autonomous interrupt processing, without need for microcontroller mediation, and does the job independentlyand also it has adjustable threshold wake modes for motion activation. ATmega 328p is used because it can work in tandem with ESP 8266 – 12E. The second version can also be a microcontroller which is cost effective. ESP 8266 - 12E is used as IoT gateway, its function is to transmit data to the web. Data transfer between ATmega 328p and ESP 8266 - 12E takes place through Serial communication.

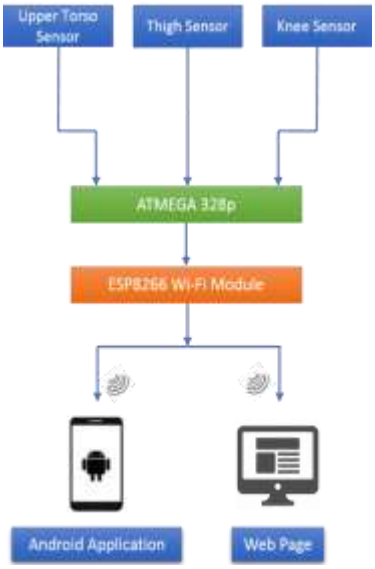

Fig 2: - Basic Hardware signal and data flow diagram

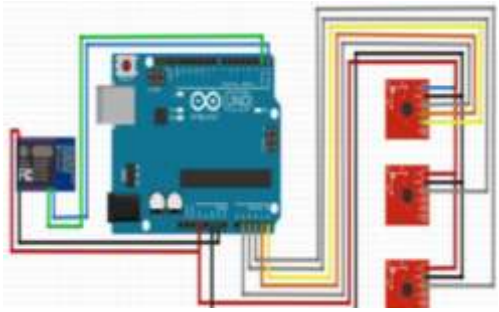

Fig 3: - Actual hardware connections

V. Software Implementation

ATmega 328p is programmed to receive the values from the accelerometers. Accelerometers are calibrated to give a particular value for a particular angle of the accelerometer. The values of all the postures available in the microcontroller is used to recognize all the postures in real time. After identification of the posture and fall only under fall situations, the data is transmitted to ESP 8266 – 12E through serial communication and then the received data is transmitted to web using SOAP message. Then ESP 8266 - 12E calls the web service and logs into the database and the transmitted data is stored. The website is programmed to retrieve the data from database and display it on the home page. Similarly the data from the database is also seen on the database and the application is programmed to show a notification under fall situations.

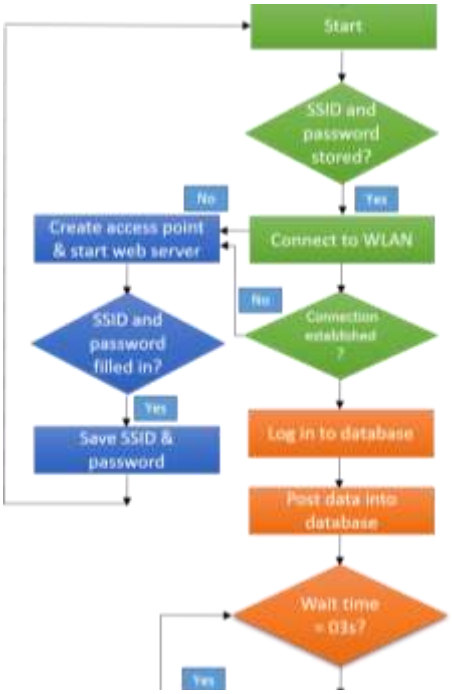

Fig 4: - Flowchart explaining functionality of ESP 8266 – 12E

Tools Used

- Arduino IDE: - It is used to program ATmega 328pand ESP 8266 – 12E
- HyperTerminal: - It is used to monitor the data which is being sent by the ATmega 328p and ESP 8266 – 12E on the computer.
- Visual Studio: - It is used to develop the web page.
- Android Studio: - It is the best tool for Android application development.

VI. Results

The results are pretty much accurate. Setting different levels of thresholds for falls and classifying them based on their impact did the fall.

VII. Conclusion and Future work

With good intelligence and low cost, it is a humble attempt to build a fall sensor which is useful for the society. There is always a scope for improvement mainly, making the system even more efficient by using just symbols and reducing the size of data transmitted to web. Walking, running, and the speed of the person can also be measured by using different thresholds and measuring accelerations at the same time

with the help of better versions of Accelerometers. GSM module information in the mobile phone of the user can be used to locate the user so that the emergency services can be sent immediately.

This project can be taken to a whole new level by embedding the sensors inside clothing, and make the system work like magic. It also has its advantages like there is no need to wear an additional device over the body which makes some people irritate and also it is a good way of presentation.

VIII. Acknowledgement

We would like to thank our HOD Mr. Chandrashekar B. M, Electronics and Communication, Jyothy Institute of Technology, Bengaluru, Karnataka, India for his continuous encouragement and his endless inputs which made us finish the project successfully.

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