Arduin0 Based Fall Detection and Tracking of Elderly

Dr. G.R. Patil¹, Subham Kumar Sharma², Vikas Kumar Lathar³ & Vipul Tiwari⁴

¹Professor, Department of Electronics and Telecommunication Engineering, Army Institute of TechnologyPune, Maharashtra, India
²,³,⁴Student, Department of Electronics and Telecommunication Engineering, Army Institute of TechnologyPune, Maharashtra, India

Abstract: With the advancement and development in medical field, resulting in increase in life expectancy. So demand for health care of elderly rises. As we know that, elderly people are suffering from diseases that require attention and in most cases fall leads to many casualties. So hiring the personal care taker is costly and elderly needs attention in case of medical emergency. The purpose of this project is to design a device which will track the location of patient using Global Positioning System and send the details using wireless network (GSM) and send the detail to their care takers in case of fall. Design consists of sensors like GY-521 MPU-6050 (tri-axial accelerometer and gyroscope), pulse rate using IR sensor and temperature sensor.

1. Introduction
Fall of elderly always led to serious health issues like disabling fractures that could lead to death due to complications. Fracture is the most common injury in an unintentional fall and there is a possibility that patient body gets paralyzed. At this phase of life an elderly may face various physical and mental complications. So they require constant care and precaution for their health. The concept behind our design is to detect the fall, track the location and give information to caretaker.

2. System Overview
In context of problems faced by elderly, we have developed a system that has two parts. Detection Module and Tracking Module. In this system, Arduino Mega 2560 microcontroller board based on ATMega 2560. Along with this a GPS and GSM module is employed. The pulse Rate and Temperature of concerned person are fed to microcontroller through sensors. The analog data from sensors are calibrated and converted into digital data by the inbuilt ADC. The location is also tracked using GPS. When sensor detects the fall, at very instant Pulse Rate, Temperature and location of a person (in coordinates) are send to the caretaker. Figure 1 illustrates the block diagram of system.

3. Hardware and Software Description
The hardware used in the system comprises major component as Arduino Mega 2560, Accelerometer and Gyroscope sensor (GY-521 MPU Tri-axial accelerometer gyroscope module), Pulse Rate sensor, Temperature Sensor. The detailed explanation of sensors is given in subsequent sections.

3.1 Accelerometer Gyroscope Sensor
The GY-521 MPU-6050 sensor contains a MEMS accelerometer and a MEMS gyro in a single chip. It contains 16-bits analog to digital conversion hardware for each channel. Therefore it captures the x, y, and z channel at the same time. The sensor uses the I2C-bus to interface with the Arduino. The values from the sensor are used to determine threshold range for fall.
3.2 Pulse Oximetry

This sensor uses optical sensors to measure the variation in blood volume at fingertip with each heart beat. The sensor consists of an infrared light-emitting diode (IR LED) and a photodiode, placed side by side as shown in Figure 2. The IR diode transmits an infrared light into the fingertip (placed over the sensor unit), and the photodiode senses the portion of the light that is reflected back. The intensity of reflected light depends upon the blood volume inside the fingertip. As a result of which the amount of reflected infrared light detected by the photodiode varied with each heart beat. By proper signal conditioning, this little change in the amplitude of the reflected light can be converted into a pulse. The pulses can be later counted by the microcontroller to determine the heart rate.

![Figure 2: Pulse oximetry sensor](image)

3.3 Temperature Sensor

The Temperature sensor used to measure temperature of elderly is LM35. This integrated circuit gives a precise output voltage which is linearly proportional to centigrade temperature. LM35 is rated to operate over a −55°C to +150°C temperature range.

4. Result

The fall of an elderly is detected by the accelerometer gyroscope sensor. Also values from Pulse Oximetry Temperature sensor and co-ordinates form GPS are send to the caretaker as shown in Figure 3.

![Figure 3: Fall detection](image)

5. Conclusion

The various constraints such as Fall Detection, Pulse Rate, Body Temperature and location has been send to caretaker’s mobile as a SMS. This system is designed for the elderly to minimize the effort of caretaker but notify in case of emergency.

6. References
