Fall Detection System and Body Positioning with Heart Rate Monitoring

G. Ahmed Zeeshan[1], Dr. R. Sundara Guru[2], M.Mounika[3]
[1]Assistant Professor, [2]Professor and Head, [3]M. Tech
[123]Department of Electronics and Communication Engineering
[13]Global Institute of Engineering and Technology, Moinabad, Hyderabad, Telangana, India
[2]SMVIT, Bangalore, Karnataka, India

Abstract- Nowadays healthcare technologies are slowly entering into our daily lives, replacing old devices and techniques with newer intelligent ones. Although they are meant to help people, the reaction and willingness to use such new devices by the people can be unexpected, especially among the elderly.A fall event is one of the main factors that influence the physical and psychological health of an elderly person. Injuries related to falls include physical damages like Heart attacks, bone fractures and general connective tissue lesions. A fall has also dramatic psychological consequences, since it drastically reduces the self-confidence and independence of affected people. Healthcare technology using wireless sensors has reached a high level of maturity and reliability and hence these devices are now being deployed in homes/nursing homes for use in managing people's health. The projected system are going to be a conveyable device mounted on the waist of user, having sensors consisting of measuring instrument. Thepropose fall detection system is considered different device to the prevailing detection approaches, since the device provides the comfy carrying, is a smaller amount advanced as compared to different devices, quick fall response and can be a lot of correct and economical. These systems overcome the limitation of restricted vary of object pursuit.

Keywords: Arduino UNO, Fall Detection, Wireless Sensors, Healthcare technology.

I. INTRODUCTION

There is numerous fall discoverion systems detect effectively, however not appropriate for real time application. The projected system are going to be a conveyable device mounted on the waist of user, having sensors consisting of measuring instrument. The propose fall detection system is considered different device to the prevailing detection approaches, since the device provides the comfy carrying, is a smaller amount advanced as compared to different devices, quick fall response and can be a lot of correct and economical. These systems overcome the limitation of restricted vary of object pursuit. Also at the same time wireless sensor i.e. Local Area Network (LAN) is created using NodeMCU connected with the MEMS sensor and the heart rate sensor whose values will be updates and the fast response will be provided according to the health problem. Wireless technology make our work more easy and efficient with the sensors connected to the body.

A. Remote Monitoring

The proposed system also includes an intelligent automation system where according to problem the alert and the precaution will be provided to the people, here Arduino Uno plays the major role which is programmed using embedded C and connected to the NodeMCU (Wi-Fi). The person can be monitored from remote area with the update of the health issues in the server. Transmission will be high, the unique feature is the reaction time of the health detection and response.

II. SYSTEM DESIGN&ARCHITECTURE

A. System Architecture

The proposed system is a combination of various sensors like Micro-Electro-Mechanical Systems (MEMS) and heat beat sensor to measure the fall detection and the heart rate of the person. NodeMCU is used as the Wi-Fi module which transmits the data from the Arduino using IEEE 802.11 b/g/n standard.

The remote controlling of the person's health is monitored by the web page which can be accessed by the IP address of the NodeMCU as it act as the server.

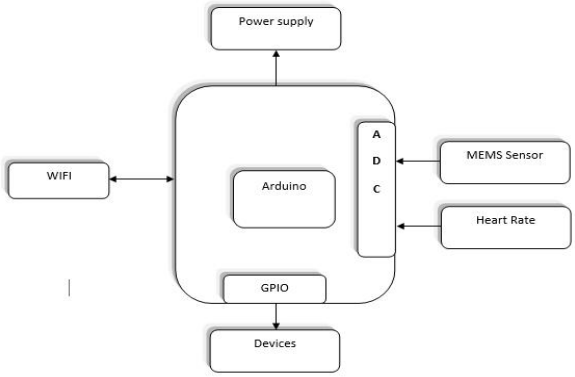


Fig.1: Block Diagram

The heart of this system is the core module which is realized using the Arduino UNO, its responsibilities include, and acquiring the power consumption, processing the acquired electrical devices, NodeMCU is requires to transmit the information to the user using IP protocol.

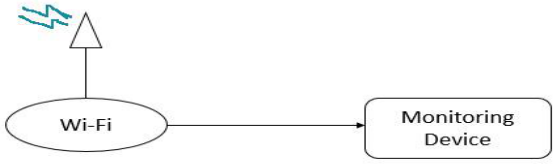


Fig.2: Monitoring system

III. SYSTEM DESCRIPTION

This section gives an overview of the various concepts, components and modules of the proposed system.

A. ARDUINO UNO

Arduino is a single-board microcontroller meant to make the application more accessible which are interactive objects and its surroundings. The hardware features with an open-source hardware board designed around an 8-bit Atmel AVR microcontroller or a 32-bit Atmel ARM. Current models consists a USB interface, 6 analog input pins and 14 digital I/Opins that allows the user to attach various extension boards.The Arduino Uno board is a microcontroller based on the ATmega328. It has 14 digital input/output pins in which 6 can be used as PWM outputs, a 16 MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and a reset button. This contains all the required support needed for microcontroller. In order to get started, they are simply connected to a computer with a USB cable or with a AC-to-DC adapter or battery. Arduino Uno Board varies from all other boards and they will not use the FTDI USB-to-serial driver chip in them. It is featured by the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.It also supports serial communication using Tx and Rx pins.

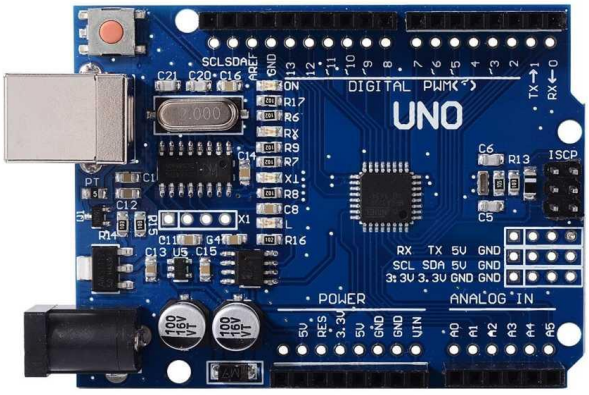


Fig.3: ARDUINO UNO

B. Node MCU

NodeMCU is an open source LUA based firmware developed for ESP8266 Wi-Fi chip. By exploring functionality with ESP8266 chip, NodeMCU firmware comes with ESP8266 Development board/kit i.e. NodeMCU Development board.NodeMCU is an inexpensive and powerful development chip that have good I/O capabilities with GPIO pins and can also communicate with other devices using WiFi. This makes it ideal for our use to prototype in small-scale IoT applications.

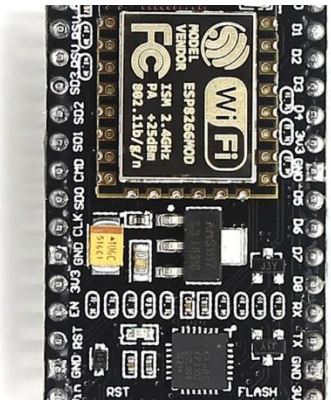


Fig.4: NodeMCU

In this we will be using serial communication i.e. Tx and Rx to communicate with the Arduino-UNO.

C. Micro-electro-mechanical Systems

Micro-electro-mechanical Systems (MEMS) Technology is one of the most advanced technologies that have been applied in the making of most of the modern devices like video projectors, bi-analysis chips and also car crash airbag sensors. This concept was first explained by Professor R. Howe in the year 1989. Since then many prototypes have been released and revised and has thus become an integral part of the latest mechanical products available in the market today.

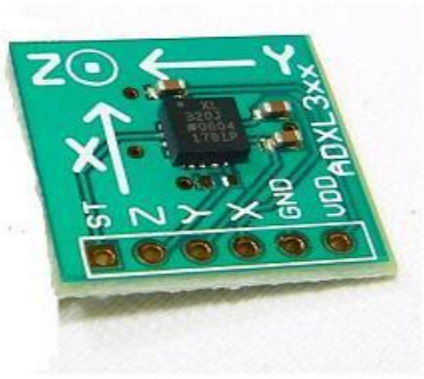


Fig.5: MEMS

An accelerometer is an electromechanical device that is used to measure acceleration and the forceproducing it. Many types of accelerometers are available in the market today. They can be divided according to the force (static or dynamic) that is to be measured. Even today, one of the most commonly used one is the piezoelectricaccelerometer. But, since they are bulky and cannot be used for all operations, a smaller and highly functional device like the MEMS accelerometer was developed. Though the first of its kind was developed 25 years ago, it was not accepted until lately, when there was need for large volume industrial applications. Due to its small size and robust sensing feature, they are further developed to obtain multi-axis sensing.

D. **Heart Beat Sensor**

Heart rate data can be really useful whether you're designing an exercise routine, studying your activity or anxiety levels or just want your shirt to blink with your heart beat. The problem is that heart rate can be difficult to measure. But this sensor make our work more easy and accurate. The Pulse Sensor Amped is a plug-and-play heart-rate sensor for Micro-control. It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live heart-rate data into their projects.It essentially combines a simple optical heart rate sensor with amplification and noise cancellation circuitry making it fast and easy to get reliable pulse readings. Also, it sips power with just 4mA current draw at 5V so it's great for mobile applications.

Fig.6: Heart Beat Senor.

IV. HARDWARE IMPLEMENTATION

This section emphasizes on the actual hardware implementation of the proposed system, the various modules, components, peripherals and the interconnections between them are discussed here.

The first stage of the implementation is to prepare Arduino Uno with the development of the set of instructions with the embedded C, here it is given a power supply of 5Volts.

The MEMS and Heart-Beat sensor is used to monitor the Fall-Detection and the heartbeat of the person which is than connected to the Arduino UNO microcontroller which take all the data from the sensors and is connected to the NodeMCU with the serial communication, where NodeMCU collect all the information and transmits it as a wireless communication medium.

Using Embedded C programming language the set of instruction is given in such a way that it will automatically collects the information from the sensor and transmits it using the IEEE 802.11 standard.

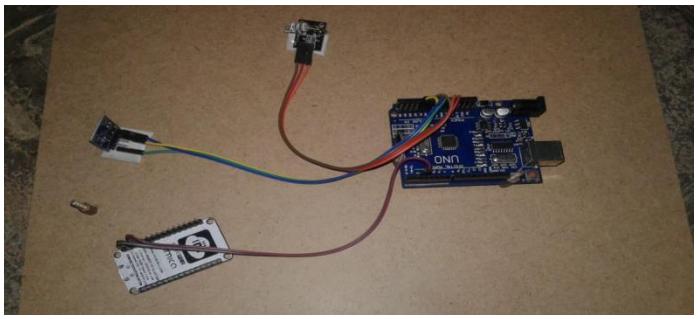
V. PRINCIPLE OF OPERATION

The main purpose of this project is to monitor the health condition of the person with wireless medium using IEEE 802.11 standard. Here NodeMCU which consist of the ESP8266 module is used. The ESP8266 SoC contains a fully functional WiFi Stack and TCP/IP Stack that allows any Microcontroller to get connected to WiFi Network.With Software Development Kits (SDKs), you can directly program the ESP8266's on-chip Microcontroller, without the need for an external Microcontroller. Now Embedded C programming language is used to program the Arduino UNO it is given with set of instruction which will collect the information from the sensors and send it to the NodeMCU using serial communication. Now NodeMCU will act as server, the information which it received from the serial communication will transfer through the IP protocol a small web page is designed in which the sensor values will keep on updating according to the patient conditions and also will give the alert whenever the patient is feeling abnormal. This way patient health can be monitored easily using the wireless technology.

VI. CONCLUSION

There is numerous fall discoverion systems detect effectively, however not appropriate for real time application. The projected system are a transportable device mounted on the waist of user, having sensors consisting of measuring system. The propose fall detection system are often thought to be various device to the present detection approaches, since the device provides the comfy sporting, is a smaller amount advanced as compared to different devices, quick fall response and can be a lot of correct and economical. These systems overcome the limitation of restricted vary of fall-detection tracking. Mainly it make work easier by using the wireless transmit medium to monitor the health condition of the person.

VII. RESULT



VIII. REFERENCES

[1]. From Fall Detection to Fall Prevention: A Generic Classification of Fall-Related Systems by Kabalan Chaccour, Rony Darazi, Amir Hajjam El Hassani and Emmanuel Andres, published in IEEE Sensors Journal (Volume: 17 , Issue: 3 , Feb.1, 1 2017).

[2]. N. El-Bendary, Q. Tan, F. C. Pivot, A. Lam, "Fall detection and prevention for the elderly: A review of trends and challenges", *Int. J. Smart Sens. Intell. Syst.*, vol. 6, no. 3, pp. 1230-1266, Jun. 2013.

[3]. Y. S. Delahoz, M. A. Labrador, "Survey on fall detection and fall prevention using wearable and external sensors", *Sensors*, vol. 14, no. 10, pp. 19806-19842, 2014.

[4]. N. Otanasap, "Preventive Fall Detection System on Smartphone Using Dynamic Threshold", *ICDAMT2016. Proceeding of International Conference on Digital Arts Media and Technology*, 2016.

[5]. Jia-Luen Chua, Yoong Choon Chang, Wee Keong Lim, A simple vision-based fall detection technique for indoor video surveillance, Springer-Verlag, vol. 9, pp. 623-633, 2015.

[6]. Edouard Auvinet, Franck Multon, Alain Saint-Arnaud, Jacqueline Rousseau, Jean Meunier, "Fall Detection With Multiple Cameras: An Occlusion-Resistant Method Based on 3-D Silhouette Vertical Distribution", *IEEE Transactions On Information Technology In Biomedicine*, vol. 15, no. 2, pp. 290-300, March 2011.

[7]. Damien Brulin, Yannick Benezeth, Estelle Courtial, "Posture Recognition Based on Fuzzy Logic for Home Monitoring of the Elderly", *IEEE Transactions on Information Technology In Biomedicine*, vol. 16, no. 5, pp. 974-982, 2012.