



INTERNET OF THINGS (CSD513)

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IOT BASED FALL DETECTION SYSTEM

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Acknowledgement

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Once again, I extend my heartfelt thanks to everyone who has contributed to the successful completion of the project. Thank you for your support and encouragement.

Sincerely,

Arju Bano, Sonali Kumari

Abstract

When it comes to old age, it becomes necessary to monitor our old ones for their health and safety. Due to weakness and weak joints they have a great risk of falling down. Now it is important to know if an old person has fallen so that he/she can be helped on time. Also people on wheelchairs need to be checked for fall detection. For this purpose we propose a smart fall detection system. The system uses sensors to detect person movements. It can be mounted on a person's hand or wheelchair for detection. The sensor is connected to a microcontroller in order to constantly transmit the acceleration data. Now the system keeps monitoring for fall detection and abrupt movement changes in person. A sudden abrupt change with a jerk in the system is treated as a fall. Now in case the person did not fall and the alarm was false. System detects the person has fallen and automatically triggers an alert through Wi-Fi connection to alert the loved ones of the person about the situation instantly.

Content

I. Introduction

- Overview of the IoT fall detection system
- Description of the ESP8266 and MPU6050
- Importance of fall detection in healthcare

II. Problem Statement

III. Proposed Work

IV. Project Approach

V. Project Components

a. Hardware Components

- Overview of hardware components used in the system
- Description of the ESP8266 and MPU6050
- Screenshot diagram of the system
- Power supply requirements

b. Software Components

- Overview of software components used in the system
- Programming language and development environment used

VI. Architectural Diagram of workflow

VII. Conclusion

- Implications of the project for the field of IoT and healthcare
- Recommendations for further research and development

VIII. References

Introduction to Project

The Internet of Things (IoT) has revolutionized the way we interact with technology, making it possible to connect devices and sensors to the internet, allowing for remote monitoring and control. One area where IoT has shown great potential is in healthcare, particularly in the development of fall detection systems. Falls are a major health concern, especially for the elderly, as they can lead to serious injuries and even death. In this project, we have used the ESP8266 and MPU6050 to develop a fall detection system that can detect falls and alert caregivers or emergency services.

The ESP8266 is a low-cost, Wi-Fi-enabled microcontroller that is widely used in IoT applications. It provides a powerful platform for building connected devices and applications, and its built-in Wi-Fi connectivity makes it easy to connect to the internet. The MPU6050 is a 6-axis accelerometer and gyroscope sensor that can detect motion and orientation changes in real-time. By combining the ESP8266 and MPU6050, we have created a fall detection system that can accurately detect falls and alert caregivers or emergency services in a timely manner.

In this report, we will provide an overview of the fall detection system that we have developed. We will discuss the hardware and software components of the system, as well as the algorithms and techniques that we have used to detect falls. We will also discuss the results of our testing and evaluation of the system, including its accuracy and reliability. Finally, we will discuss the potential applications and future directions for this technology, including its use in healthcare and other industries.

Problem Statement

Falls are a major concern in healthcare, particularly for the elderly, and can lead to serious injuries and even death. Traditional methods of fall detection, such as personal alarms or sensors on the body, are often limited in their effectiveness and can be inconvenient for the user. Moreover, they may not be able to detect all types of falls, such as slips or trips, and may generate false alarms.

Therefore, there is a need for a fall detection system that is reliable, accurate, and non-intrusive, and can detect all types of falls. The system should also be able to alert caregivers or emergency services in a timely manner, allowing for prompt medical attention.

In this project, we aim to address these challenges by developing an IoT fall detection system using the ESP8266 and MPU6050. The objective is to create a fall detection system that is affordable, easy to use, and can be integrated into existing healthcare infrastructure. By developing such a system, we hope to improve the quality of life for elderly individuals and reduce the risks associated with falls.

Proposed Work

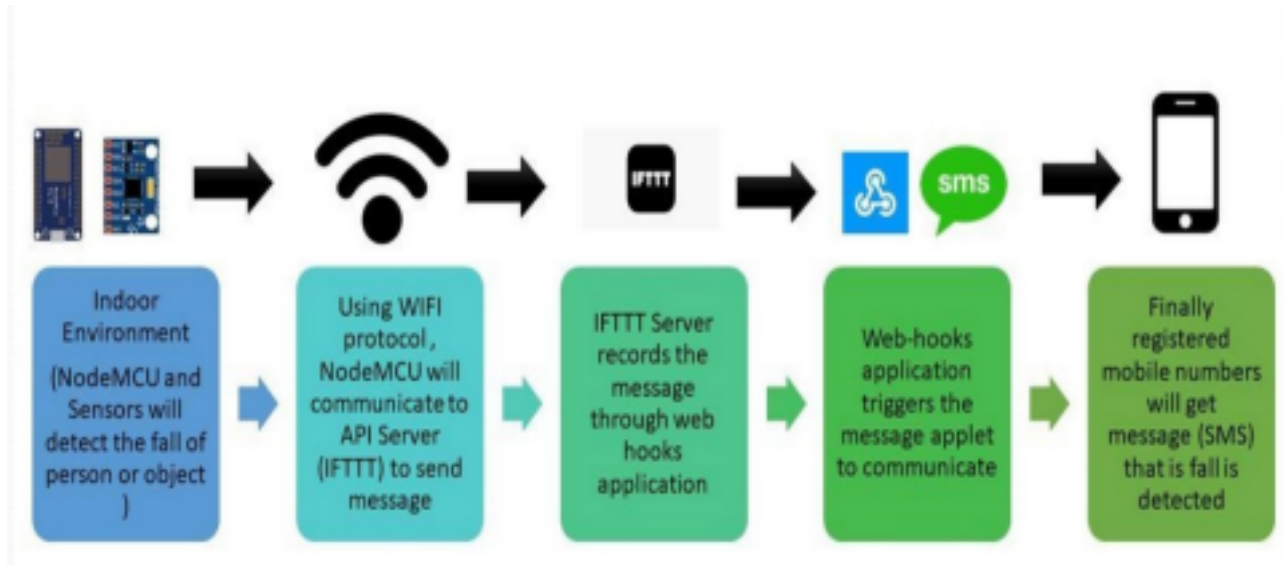
To address the challenges of fall detection in healthcare, we propose an IoT fall detection system that utilizes the ESP8266 and MPU6050. The system comprises a wearable device that contains the MPU6050 sensor and the ESP8266 microcontroller. The sensor is capable of measuring acceleration and rotation, allowing us to detect falls by analyzing changes in the orientation and motion of the device.

The ESP8266 is programmed to analyze the sensor data and trigger an alert if a fall is detected. The device is also equipped with Wi-Fi connectivity, allowing it to communicate with a remote server or a mobile application. In case of a fall detection, the device can send an alert to the caregiver or emergency services, providing real-time information about the location and status of the user.

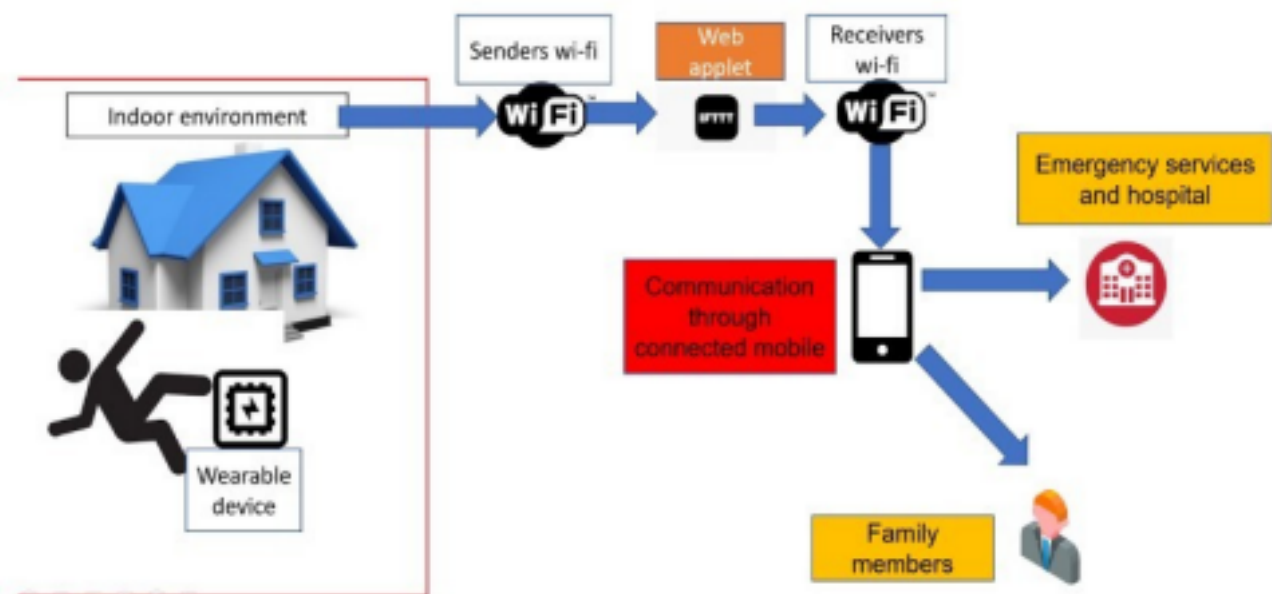
We have developed an algorithm that uses machine learning techniques to analyze the sensor data and detect falls with high accuracy. The algorithm utilizes a set of thresholds for acceleration and orientation changes, allowing us to distinguish between normal activities and falls. The system is also designed to minimize false alarms by setting appropriate thresholds and by incorporating an optional confirmation step, where the user can cancel the alert within a specified time frame. The proposed solution offers several advantages over traditional fall detection systems. It is non-intrusive, easy to use, and affordable. The system is also capable of detecting all types of falls, including slips and trips, and can generate real-time alerts, allowing for prompt medical attention.

As a result, the proposed IoT fall detection system offers a reliable and effective solution for fall detection in healthcare. It combines the power of IoT to provide accurate and timely fall detection, which can significantly reduce the risks associated with falls and improve the quality of life for elderly individuals.

Project Approach



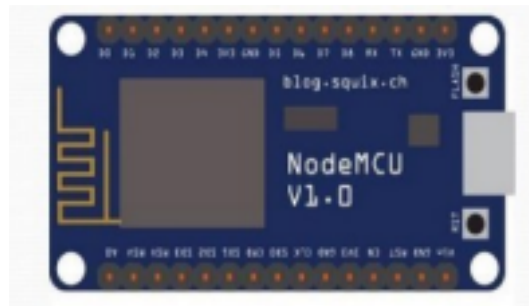
Hardware Implementation



Project Components: Hardware

NodeMCU ESP8266

NodeMCU esp8266 is a low cost open source IOT platform.. ESP8266 chip having 32- bit LX106 RISC microprocessor which operates at 80 to 160 MHz adjustable clock frequency and supports RTOS. It also has 128kb ram and 4mb flash memory, which gives easy connectivity and fast working. ESP8266 Integrates 802.11b/g/n HT40 WiFi transceiver not only connected with the network but also supports self configuration for the network. This make chip very versatile and it will connect according to wifi's configuration for protocols.



MPU6050

MPU6050 is a six axis gyroscope plus accelerometer motion sensing device. In this device the 3- axis combined to work as a gyroscope and remaining as an accelerometer. Due to 6-axis motion sensing it gives accurate information about motions like falling. It is compatible with many IOT chips like NodeMCU. MPU6050 is made for fast and slow motions, so it gives precise information.

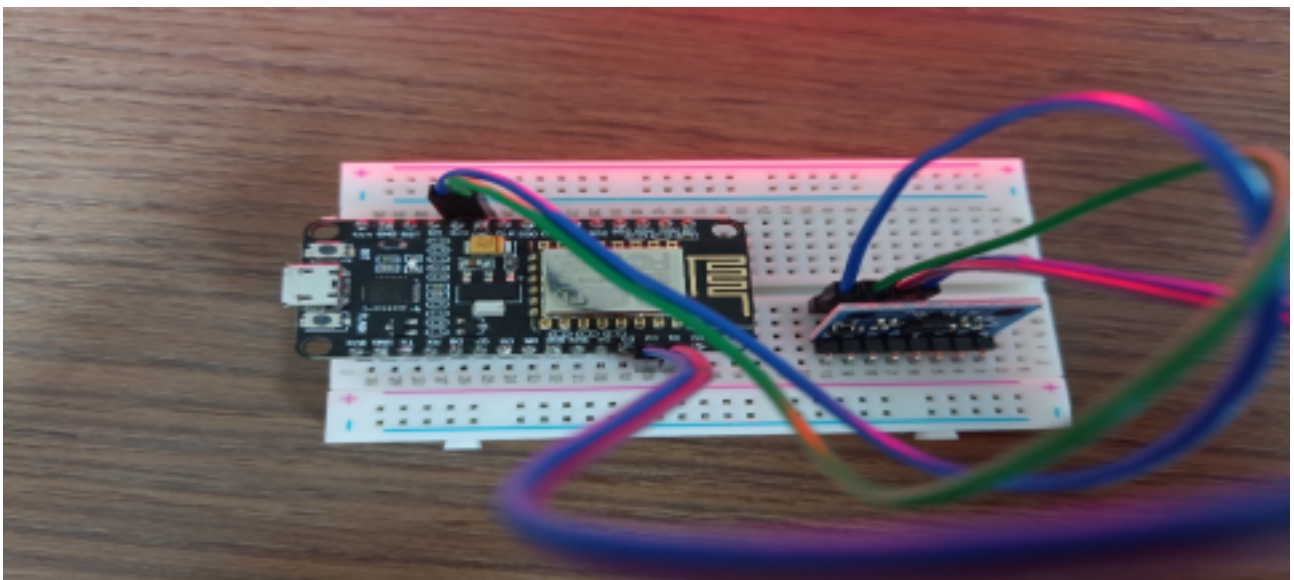
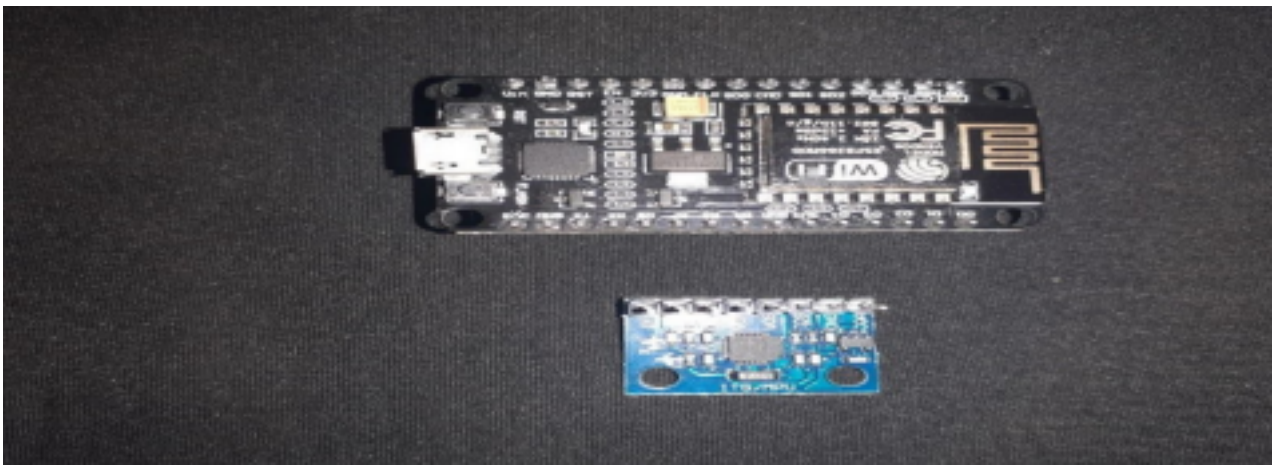


Jumper Wires

There are male to male as well as male to female jumper wires for IoT modules to jump between headers on the board.



Hardware Components: NodeMCU(top) and MPU6050(bottom)



Project Components: Software

1. Arduino IDE:

Programming for NodeMCUesp8266 can be done by using arduino IDE and programming language. It is basically based on computer languages C, C++ and java. So in the NodeMCU chip we are going to program using an Arduino IDE.

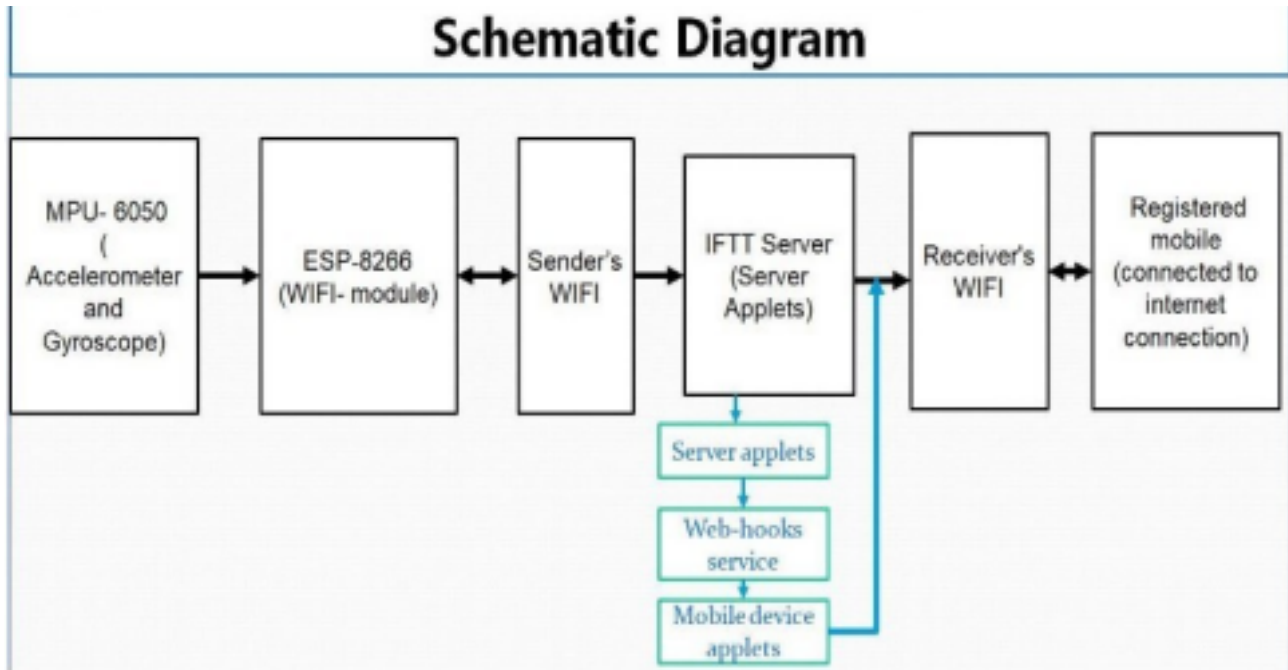
2. IFTTT:

IFTTT(If This Then That) is a freeware web-based service to create condition based applets which provides wireless communication over the web servers. It is easy to handle, modify and upgrade also.



Software Implementation(screenshots)

Architectural Diagram



Conclusion

Our project's aim was to find a suitable yet cheaper alternative to expensive fall detection modules available in the market. Currently in the market such fall detecting IOT devices are very expensive, so we decided to make it at least affordable for elderly. We built a device for fall detection of delicate materials in industries like glassware. Sometimes during transportation of delicate and expensive materials like glassware, tubes are destroyed or damaged, so this can help detect the fall by sending a notification via IFTTT server to the registered mobile number. If a fall is detected, an alert is activated immediately. The results of experiments have shown high success rates in fall detection in terms of accuracy, precision and gain, which is because we have calibrated in x, y as well as z axes all the coordinates for a better configuration to detect fall. Finally, the system can also be enhanced to provide services built on the cloud. From a medical perspective, there can be a storage service. That would enable healthcare professionals to access falls' data to perform further analysis.

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