IOT BASED FALL AND DETECTION SYSTEM USING NODEMCU AND MPU6050 SENSOR

VISITED NGO: ARUVI OLD AGE HOME

LOCATION: No.2, EVR Rd, near Bus Stand, Saraswathi Nagar, K K Nagar, Tiruchirappalli, Tamil Nadu 620021

NO OF STUDENTS INVOLVED IN THIS PROJECT: 3

NO OF STUDENTS IDENTIFYING AS WOMEN DIRECTLY INVOLVED : 0

TOTAL NO OF PEOPLE IMPACTED OF THE PROPOSED PROJECT : 20

TOTAL NUMBER OF IEEE VOLUNTEERS: 0

REQUESTED FUNDS: $500-$1500

PROJECT CATEGORY(ENVIRONMENT): The NGO we visited provides unique rooms tailored to meet the needs of the elderly. They create an environment that enhances the well-being and quality of life for their residents by offering comprehensive care, including medical services, personal assistance, social activities, and a safe living space. Their focus is on addressing physical, emotional, and social needs, reducing feelings of loneliness and isolation, and managing chronic conditions like diabetes and heart diseases with specialized care plans.

PROJECT LOCATION: INDIA

PROJECT DETAILS:

PROBLEM STATEMENT: Enhancing Safety and Independence for Disabled Persons through Fall Detection Technologies.

PROJECT DESCRIPTION:

This project is used for disabled people is a vital technology designed to enhance safety. It typically involves wearable devices, such as smart watches or pendants, equipped with sensors that monitor the user’s movements. These sensors detect sudden changes in movement patterns that may indicate a fall. The system can differentiate between Regular activities and Falls.

When a fall is detected, the device sends an automatic alert to pre-programmed contacts, such as caregivers, family members, or emergency services. Some systems also allow manual alerts to be triggered by the user. In more advanced versions, the fall detection device can integrate with home automation systems, alerting nearby devices or systems to take immediate action, such as unlocking doors paramedics. This system is particularly beneficial for disabled individuals who may have mobility issues or at a higher risk of falling

PROJECT INPUTS:

Node MCU (ESP8266) – This is a Wi-Fi enabled micro controller that serves as the brain of the system. It processes the data from the MPU6050 sensor and makes decisions based on the readings. It can also send alerts through Wi-Fi to a mobile devices or cloud platform when a fall is detected.

MPU6050 Sensor – This sensor is responsible for detecting sudden changes in motion or position that occur during

a fall.  
 Power Supply – This provides necessary electrical power to the sensors.  
 Connecting Wires –These wires are used to link the various components in the circuit.

Breadboard –This allows for easy assembly and modification of the circuit.

PROJECT ACTIVITIES AND OUTPUT:

An IoT-based fall detection system using NodeMCU and MPU6050 is designed to monitor and detect falls, especially for elderly individuals or patients with a high risk of falling, ensuring timely alerts to caregivers or family members. This system is built around the MPU6050 sensor, which is a combination of an accelerometer and a gyroscope, and the NodeMCU, which is an affordable and versatile Wi-Fi-enabled microcontroller based on the ESP8266. The MPU6050 sensor plays a crucial role in sensing the body movements and posture of the individual, continuously measuring the accelerations and angular velocity in multiple axes. The sensor's data is processed to detect unusual movements or postures that indicate a fall, such as sudden acceleration changes followed by a period of little or no movement, a common indicator of a fall event.

The system operates in real time, continuously analyzing the sensor data through the NodeMCU, which acts as the central controller, gathering raw data from the MPU6050 and applying an algorithm to differentiate between normal daily activities and potential falls. A key challenge in this project is accurately identifying a fall, as it is necessary to distinguish between benign activities like sitting down quickly or bending over, and actual dangerous falls. This is achieved through threshold-based detection, where specific limits for acceleration and angular motion are set based on typical fall scenarios. For instance, if the accelerometer senses a rapid change in acceleration beyond a set threshold followed by a period of minimal movement, the system registers this as a potential fall.

When a fall is detected, the NodeMCU's Wi-Fi capabilities are leveraged to send an alert through the internet. The alert could be sent as an SMS or a notification to a mobile application, informing caregivers or family members about the incident along with the location details, if integrated with a GPS module. In addition to fall detection, this system can log data over time, allowing for remote monitoring of the individual's activity patterns and potentially identifying any concerning trends in mobility or balance. The IoT nature of the system allows it to be integrated into a larger health monitoring platform, where data from multiple sensors can be combined to give a comprehensive overview of the individual's health status.

Moreover, the system can be fine-tuned based on the user’s specific needs, such as adjusting sensitivity settings for more active individuals or lowering the thresholds for those who are frailer. The compactness of the NodeMCU and MPU6050 allows the entire system to be lightweight and wearable, making it convenient for the user without interfering with their daily activities. Power consumption is also optimized to ensure that the device can run for extended periods without needing frequent recharges, which is crucial for practical, everyday use.

The system output includes not only the immediate alert in case of a fall but also continuous monitoring data that can be visualized through a web interface or mobile app. This data could include graphs of acceleration and angular velocity over time, highlighting abnormal patterns that might precede a fall, enabling preventive measures. The data could also be used by healthcare providers to adjust treatments or recommend physical therapy if a decline in mobility is detected.

In terms of project development, the implementation requires programming the NodeMCU using a platform like Arduino IDE, where the necessary libraries for interfacing with the MPU6050 sensor and sending data over Wi-Fi are utilized. Calibration of the MPU6050 sensor is an important step to ensure accurate data reading, as any sensor drift could lead to false positives or negatives in fall detection. The project may also involve the use of cloud services, such as ThingSpeak or Firebase, to store and visualize data, providing a user-friendly interface for caregivers to monitor multiple patients simultaneously.

The real-world application of this system is highly beneficial for elderly care facilities, where a fall could have serious consequences if not detected immediately. With this system in place, caregivers are alerted in real time, enabling them to respond quickly and potentially prevent further injury. This project also demonstrates how IoT technologies can be applied to healthcare to create low-cost, scalable solutions that improve the quality of life for vulnerable populations. As IoT and sensor technologies continue to advance, systems like these could become even more sophisticated, incorporating machine learning algorithms to improve fall detection accuracy and predict potential falls before they happen based on the user's movement patterns. Additionally, the system could be expanded to include other health monitoring features, such as heart rate monitoring or temperature sensing, providing a more comprehensive tool for remote health management.

In conclusion, an IoT-based fall detection system using NodeMCU and MPU6050 combines sensor technology with wireless communication to provide a practical solution for monitoring and detecting falls. Its ability to alert caregivers in real-time, store data for analysis, and integrate with broader IoT health systems makes it an invaluable tool in elderly care and patient monitoring. The project highlights the potential of IoT in enhancing healthcare through innovative, accessible, and cost-effective solutions that can be tailored to meet individual needs.

PROJECT DURATION : 4 WEEKS

PROJECT IMPACT :

Assessing the success of the IoT-based fall detection system using NodeMCU and MPU6050 requires a multifaceted evaluation approach that encompasses the system’s accuracy, reliability, usability, and the impact it has on its intended users. To determine if the project was successful, the first step would be to test the accuracy of the fall detection mechanism. This would involve controlled experiments where the system is exposed to various scenarios, including actual falls and non-fall activities (such as sitting down quickly or bending over) to see how accurately it can distinguish between these events. A low rate of false positives (incorrectly detecting a fall) and false negatives (failing to detect a real fall) would be critical indicators of success. Additionally, long-term testing with real users, such as elderly individuals or patients in healthcare facilities, would provide valuable feedback on the system’s reliability in real-world conditions. Tracking the system’s response time is another key metric—an ideal system would send an alert almost instantly after a fall is detected to ensure rapid intervention by caregivers or emergency services.

Usability is another crucial aspect of assessing the project’s success. The system must be easy for users to wear and operate, particularly for elderly individuals who may not be tech-savvy. Feedback on the comfort, size, and weight of the wearable device, as well as how it integrates into daily life, will help determine whether the system is practical for long-term use. The ease of use of the mobile app or web interface, through which caregivers receive alerts, must also be evaluated. If caregivers find the alerts clear, timely, and easy to act upon, it suggests that the system is user-friendly. Furthermore, battery life will be an important measure—if the device requires frequent recharging, it could deter users from adopting it long-term, so optimizing power efficiency would be critical for the system’s overall success. The ability to remotely monitor the data over time and visualize trends is another value-added feature that should be assessed by both users and healthcare providers.

To estimate the number of people who could benefit from this project, the system’s primary target group would be elderly individuals, particularly those aged 65 and above, as they are most prone to falls. According to the World Health Organization, falls are a leading cause of injury-related deaths among the elderly, and about 30% of people over the age of 65 experience a fall each year. If the system is implemented in homes, elderly care facilities, and hospitals, the number of beneficiaries could be substantial. For example, in developed countries with aging populations, such as the United States, Japan, and many European nations, millions of elderly individuals could potentially benefit from a fall detection system like this. Moreover, the system could be invaluable in rural and remote areas where access to healthcare and immediate assistance is limited, further expanding its reach to regions where healthcare infrastructure is underdeveloped. In such areas, caregivers may not always be present, making the system a critical tool for ensuring timely intervention during emergencies.

Beyond elderly individuals, people recovering from surgeries, those with disabilities, or patients suffering from conditions like Parkinson’s disease, multiple sclerosis, or muscular dystrophy—conditions that increase the risk of falls—could also benefit from the system. This broadens the demographic to include both men and women of various ages, though predominantly middle-aged and older adults would see the most direct benefit. Additionally, caregivers, both professional and familial, would indirectly benefit from this project. By providing them with real-time alerts and data on their patients' or loved ones’ movement patterns, the system would alleviate stress and anxiety, knowing they will be notified immediately in the event of a fall. In countries where elderly care is often provided by family members, particularly in Asia and Latin America, this system could provide peace of mind to millions of caregivers who juggle multiple responsibilities and may not always be physically present with their loved ones.

Geographically, the project has the potential to benefit both developed and developing regions. In developed nations, the adoption of IoT and wearable health technology is increasing, making this system a natural fit for integration into existing healthcare infrastructure. For example, in North America and Europe, where the elderly population is growing rapidly, the system could be integrated with smart home technologies, allowing for seamless monitoring of at-risk individuals. In developing countries, while IoT technology is still emerging, there is growing interest in using low-cost, scalable solutions to improve healthcare access. The affordability of components like the NodeMCU and MPU6050 makes this system viable for deployment in regions like South Asia, Sub-Saharan Africa, and Southeast Asia, where cost-effective healthcare solutions are in high demand.

PROJECT BUDGET :

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| --- | --- | --- | --- | --- |
| SI.NO | EQUIPMENTS/FACILITIES | QTY. | TOTAL(IN RS) | SPECIFICATIONS |
| 1 | NODEMCU | 1 | 150 | (ESP8266) |
| 2 | MPU6050 SENSOR | 1 | 250 |  |
| 3 | POWER SUPPLY | 1 | 100 | HW BATTERY |
| 4 | CONNECTING WIRES | FEW | 100 | ANY COLOUR |
| 5 | BREAD BOARD | 1 | 90 |  |
|  |  | TOTAL | 690 |  |

# Collaborators

1. **NPO/NGO Full Address : No.2, EVR Rd, near Bus Stand, Saraswathi Nagar, K K Nagar, Tiruchirappalli, Tamil Nadu 620021**
2. **NPO/NGO Point of Contact Name : Geeva**
3. **NPO/NGO Point of Contact Email : aruvioldagehome@gmail.com**
4. **Mission :** The mission of a non-profit/NGO is typically to address a specific social, environmental, or humanitarian issue and work towards positive change in the lives of individuals, communities, or ecosystems.The proposed project supports this mission by directly aligning with the NGO's goals and objectives

# Project Team

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **S.No.** | **First Name** | **Last Name** | **Programme & Year of Study** | **School/ Dept/ Campus** | **Email Address** | **Telephone Number** | **IEEE**  **Member Number**  If you are not a current member, please put  N/A. |
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# Declarations

1. **Where did you hear about EPICS in IEEE?**

I have a thorough grasp of IEEE's EPICS program, which I was introduced to throughout my undergraduate years with the help of instructors. I was able to have direct experience with applying engineering concepts to community needs—a fundamental idea of EPICS—through their guidance. This experience gave me a strong sense of social duty in addition to improving my technical abilities. I'm excited to keep contributing to worthwhile initiatives that improve society by using this expertise

**Declaration, Certification and Authorization**

**By submitting this Grant Application to EPICS in IEEE, I agree that if I am awarded a grant I will submit progress reports every 3 months on technical plans/progress, financial information, student demographics and outcomes, as required.**

Add me to the EPICS in IEEE Listserv for future communications about the program.\*

Yes

I agree to the IEEE Privacy Policy\*

I agree to the IEEE Privacy Policy

I AGREE

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By submitting this Grant Application to EPICS in IEEE, I agree that if I am awarded a grant I will submit progress reports every 3 months on technical plans/progress, financial information, student demographics and outcomes, as required.

Declaration\*

Please check the box below if you accept the agreement.

I AGREE