



**IOT BASED FAULT IDENTIFY FOR AGED PEOPLE**

##### A MINOR PROJECT- III REPORT

###### ***Submitted by***

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**BONAFIDE CERTIFICATE**

Certified that this **18ECP105L-Minor Project – III** report “**IOT BASED FAULT IDENTIFY FOR AGED PEOPLE”** is the bonafide work of “**YUVASHREE R (21BEC252), SRUTHIKAA KV (21BEC212), SUGANYADEVI S (21BEC220), SOWMIGA B (21BEC207)”** who carried out the project work under my supervision in the academic year **2023 -2024- ODD SEMESTER**.

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**PROJECT COORDINATOR**

**INSTITUTION VISION AND MISSION**

**Vision**

To emerge as a leader among the top institutions in the field of technical education.

**Mission**

**M1:** Produce smart technocrats with empirical knowledge who can surmount the global challenges.

**M2:** Create a diverse, fully -engaged, learner -centric campus environment to provide quality education to the students.

**M3:** Maintain mutually beneficial partnerships with our alumni, industry and professional associations

**DEPARTMENT VISION, MISSION, PEO, PO AND PSO**

**Vision**

To empower the Electronics and Communication Engineering students with emerging technologies, professionalism, innovative research and social responsibility.

**Mission**

**M1:** Attain the academic excellence through innovative teaching learning process, research areas & laboratories and Consultancy projects.

**M2:** Inculcate the students in problem solving and lifelong learning ability.

**M3:** Provide entrepreneurial skills and leadership qualities.

**M4:** Render the technical knowledge and skills of faculty members.

**Program Educational Objectives**

**PEO1:** **Core Competence:** Graduates will have a successful career in academia or industry associated with Electronics and Communication Engineering

**PEO2:** **Professionalism:** Graduates will provide feasible solutions for the challenging problems through comprehensive research and innovation in the allied areas of Electronics and Communication Engineering.

**PEO3:** **Lifelong Learning:** Graduates will contribute to the social needs through lifelong learning, practicing professional ethics and leadership quality

**Program Outcomes**

**PO 1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO 2: Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO 3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO 4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO 5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO 6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO 7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO 8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO 9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO 10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO 11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO 12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**Program Specific Outcomes**

**PSO1:** Applying knowledge in various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of Engineering application.

**PSO2:** Able to solve complex problems in Electronics and Communication Engineering with analytical and managerial skills either independently or in team using latest hardware and software tools to fulfil the industrial expectations.

|  |  |
| --- | --- |
| **Abstract** | **Matching with POs,PSOs** |
| **advance algorithm, detect,**  **emergency, environmental hazard, identify potential fault, communication, safety and privacy** | **PO1,PO2,PO4,PO5,PO7,**  **PO8,PO9,PO10,PO11,PO12**  **PSO1,PSO2** |

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**ABSTRACT**

The aging population is growing worldwide, leading to an increased demand for technologies that enhance the safety and well-being of elderly individuals. This paper presents an innovative approach to fault identification in the context of IoT (Internet of Things) for aged people. The primary objective is to develop a comprehensive system that leverages IoT devices and advanced algorithms to detect and respond to common issues faced by the elderly, such as falls, health emergencies, and environmental hazards.The proposed system integrates various sensors, wearable devices, and smart home components to continuously monitor the elderly's activities and environment. Data collected from these sources are processed in real-time to identify potential faults or emergencies. Machine learning algorithms, including anomaly detection and predictive analytics, play a crucial role in recognizing deviations from regular patterns and predicting potential problems.Furthermore, the system's architecture incorporates a robust communication framework to enable seamless interaction between the elderly, caregivers, and healthcare professionals. Alerts and notifications are triggered when a fault is detected, ensuring rapid response and assistance.The research also delves into the ethical and privacy considerations associated with implementing such a system. Striking a balance between safety and privacy is of paramount importance, and the paper discusses the measures in place to protect the elderly's sensitive data.

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**LIST OF ABBREVIATIONS**

|  |  |  |
| --- | --- | --- |
| **ACRONYM** |  | **ABBREVIATION** |
| IOT | - | Internet Of Things |
| LCD | - | Liquid Crystal Displays |

FTDI - Future Technology Devices International

Limited

UID - Unique Identifiers

CHAPTER 1  
INTRODUCTION

Aging is a universal aspect of human life, a continuous journey marked by the accumulation of wisdom, experience, and cherished memories. However, it is also a phase characterized by a myriad of unique challenges, encompassing physical limitations, healthcare concerns, and societal dynamics. One of the most pressing issues in the context of aging is the increased susceptibility of older individuals to accidents and emergencies, which often arise from a complex interplay of factors. These factors include reduced mobility, cognitive decline, medical conditions, and frailty. Recognizing and addressing these faults, or potential hazards, that pose a risk to the elderly is a matter of critical importance, not only to guarantee their safety but also to maintain their independence and overall quality of life.

The process of fault identification for aged people is a multifaceted endeavor that demands a comprehensive understanding of the diverse issues they face. It involves identifying and rectifying physical obstacles within living spaces, acknowledging the potential for medical emergencies, and addressing broader societal challenges that affect the elderly population. This comprehensive approach is essential to promote an environment in which aging individuals can live with dignity, security, and vitality.

In this extensive guide, we embark on a journey to explore the essential dimensions of identifying and mitigating faults for the elderly. We will delve deep into the practical strategies, solutions, and preventive measures that can significantly enhance the well-being of our aging population. Our overarching goal is to empower the elderly to age gracefully and securely in their homes and communities, free from unnecessary risks and barriers. By comprehensively addressing the concerns of the elderly, we aspire to foster a society that values, respects, and supports its aging members, ensuring their place in the broader social tapestry remains strong and cherished. Through this extensive exploration, we hope to shed light on the nuanced complexities of aging and equip individuals, families, and communities with the knowledge and tools to promote the safety and welfare of our elderly citizens.

**1.1 OBJECTIVE**

The primary objective for identifying faults in the context of aging is to enhance the safety, well-being, and quality of life of elderly individuals. This overarching goal can be broken down into specific objectives, including:

Accident Prevention: To identify and address potential hazards and risks in living environments, thereby reducing the likelihood of accidents and injuries among the elderly.

Independent Living: To enable elderly individuals to maintain their independence and autonomy by mitigating physical and environmental barriers that may impede their daily activities.

Healthcare Preparedness: To recognize potential health issues and medical emergencies promptly, allowing for early intervention and ensuring that the elderly receive appropriate medical attention.

Social Inclusion: To combat social isolation and loneliness by identifying faults related to limited social interaction and access to community resources, thus fostering a sense of belonging and connectedness.

Empowerment: To empower aging individuals and their caregivers with the knowledge, skills, and resources necessary to navigate the aging process with confidence and resilience.

Community Support: To encourage communities to become more age-friendly, advocating for inclusive spaces, services, and policies that cater to the needs of elderly residents.

Promote Dignity: To ensure that elderly individuals are treated with dignity and respect, free from discrimination and neglect, in all aspects of life.

Educational Outreach: To educate and raise awareness among individuals, families, healthcare professionals, and policymakers about the unique challenges and vulnerabilities that the elderly face, promoting a more compassionate and informed society.

Research and Innovation: To support ongoing research and innovation in the field of aging, facilitating the development of new technologies, solutions, and best practices that benefit the elderly population.

Quality of Life Enhancement: Ultimately, the core objective is to improve the overall quality of life for the elderly, allowing them to age with grace, security, and fulfillment, in an environment that values and supports their contributions to society.

* 1. **HARD WARE COMPONENTS REQUIRED**

# 1.Power supply

# 2.Node MCU

# 3.Alarm

# 4.IOT

# 5.LCD Display

6.Wifi Module

7.Position detection sensor

**1.POWER SUPPLY:**

Power supply is an integral parts a vital role in every electronic system and hence their design constitutes a major part in every application. In order to overcome mal-operation which results due to fluctuations in the load and discontinuity in the supply proper choice of power supply.

**2.NODE MCU:**

NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). Strictly speaking, the term "NodeMCU" refers to the firmware rather than the associated development kits.

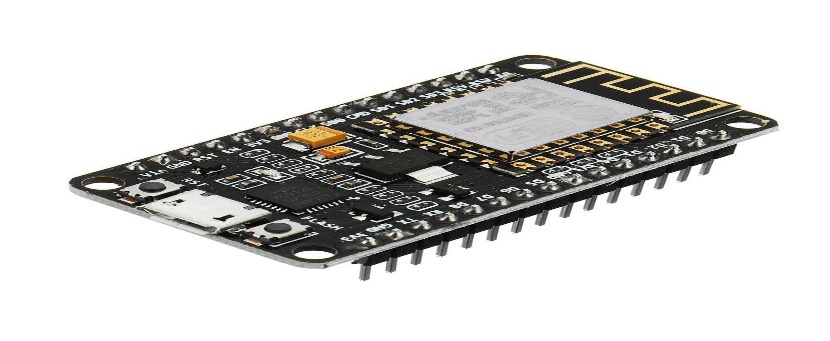


Figure 1: Node MCU

**3.ALARM:**

A **buzzer** or **beeper** is a signaling device.It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise).

**4. IOT:**

The internet of things, or **IOT**, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer.

An Internet of Things (**IOT**) gateway is a physical device or software program that serves as the connection point between the cloud and controllers, sensors and intelligent devices.

**5.LCD DISPLAY**:

Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal.

An LCD consists of two glass panels, with the liquid crystal material sand witched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed polymeric layers are present in between the electrodes and the liquid crystal, which makes the liquid crystal molecules to maintain a defined orientation angle.

One each polarisers are pasted outside the two glass panels. These polarisers would rotate the light rays passing through them to a definite angle, in a particular direction



Figure 2: LCD Display

**6.WIFI MODULE:**

Wifi modules or wifi microcontrollers are used to send and recieve data over Wi-Fi. They can also accept commands over the Wi-Fi. Wi-Fi modules are used for communications between devices. They are most commonly used in the field of Internet of Things..

The **ESP8266 module** works with 3.3V only, anything more than 3.7V would kill the module hence be cautions with your circuits. The best way to program an **ESP-01** is by using the FTDI board that supports 3.3V programming. If you don’t have one it is recommended to buy one or for time being you can also use an Arduino board. One commonly problem that every one faces with ESP-01 is the powering up problem. The module is a bit power hungry while programming and hence you can power it with a 3.3V pin on Arduino or just use a potential divider. So it is important to make a small voltage regulator for 3.31v that could supply a minimum of 500mA.



Figure 3:Wifi Module

7.**POSITION DETECTION SENSOR**

A position sensor is a device that measures the position or displacement of an object relative to a reference point. These sensors are essential in various applications, including robotics, automotive systems, and manufacturing, to provide feedback on the object's location. They come in different types, such as linear and rotary sensors, proximity sensors, optical sensors, magnetic sensors, and ultrasonic sensors. Position sensors enable precise control and automation by relaying data on an object's location, ensuring accuracy and safety in many industrial processes. These sensors are used for applications like motor control, navigation systems, object detection, and feedback mechanisms in machinery and equipment.

**CHAPTER 2**

LITERATURE REVIEW

Correlation-Based Fault Detection :The following research papers proposed sensor failure detection systems based on either sensor-appliance, sensor-sensor or sensor-activity correlations. Failure Sense [17] was presented by Munir and Stankovic to detect fail-stop and non-fail stop mutliple-sensor failures. It is based on exploiting the correlation between the trigger of motion sensors and activation/deactivation of electrical appliances. The correlation is represented by the smallest interval of sensor ﬁring after and before a turn on/off event within 5 min, denoted by IA and IB, respectively. The distribution of IA and IB is modelled by Gaussian mixture model(GMM), whose parameters are estimated from the training data using the expectation maximization(EM) algorithm. Online failure detection takes place by monitoring the sensor appliance behavior represented by IA and IB. A failure is reported when a deviation occurs in the distribution beyond predeﬁned thresholds for each sensor-appliance pair. The thresholds are computed using the training dataset. Evaluation was performed on three real-home datasets with around two thirds of the dataset used for training and one third for testing. Fail-stop failure was simulated by removing all the readings of a sensor after its randomly assumed day of failure. For the obstructed-view failure, simulation took place for two of the homes by randomly removing a 10-day period during which sensor view is considered to be obstructed, and for the third home, physical obstruction of the view of 5 motion sensors was done during the data collection phase. Simulation of the moved-location failure was done by replacing the readings of failed sensor with the readings recorded by the sensor at the newly moved location. The evaluation metrics used are the precision and recall of failure detection,where they represent the percentage of the true failure alerts from the total observed failure alerts,and the percentage of the true failure alerts from the sensor failures, respectively. Experiments of the fail-stop, obstructed-view and moved-location failures produced approximately 82.8%, 90.5% and86.8% average precision, with an average recall of 92.86%, 84.4% and 89%, respectively. The effect of increasing the number of sensors that experience fail-stop failures on the percentage of failure detection has been also examined, showing an average of 86.6% sensor failure detection. On the other hand,a limitation of the proposed approach is that the average median failure detection latency is 22.08 h.

Model-Based Fault Detection : The following researchers have used model-based fault detection based on localization systems.An indoor human localization (IHL) system with fault detection focusing on hardware as well as human-made single faults was presented by Veronese et al. [31]. The IHL system consists of three main components; an RF-based localization subsystem, an off-the-shelf modular wireless home automation sub system and a fault detection subsystem. The types of sensors chosen for home automation were contact sensors and passive infrared (PIR) sensors. A model-based fault detection approach was applied based on the concept proposed by Isermann [48] which states that a fault can be detected using the dependencies between different measured signals. The activation of the home automation sensors and its features were used to estimate the resident’s location. Also, the position of the residentis estimated independently with the localization subsystem. The fault detection subsystem compares the two estimated location areas, and ﬂag a fault whenever there is no intersection between the two

Sensors 2018,18, 1991 9 of 19areas. Experimental work was done, where 19 ﬁxed LAURA anchors and 7 Z-wave devices were ﬁx edacross the rooms of the university building. Two fault scenarios were considered; forgotten worn device and blinded PIR motion detector. As a continuation of the work, multi-user simulation was conducted using three virtual users trajectories, the faults could be detected in the presence of multiple users with speciﬁcity and sensitivity above 90% [32].

**CHAPTER 3**

**EXISTING METHOD**

Existing methods for IoT-based fault identification in the context of aged individuals encompass a diverse range of technologies and strategies. Wearable devices equipped with sensors, such as accelerometers and gyroscopes, are often utilized to monitor physical activity and detect falls. These devices can transmit real-time data to caregivers or healthcare professionals, enabling rapid response in case of an incident. Smart home systems integrated with IoT technology are another prevalent approach, as they can detect deviations from daily routines, changes in environmental parameters, or even the absence of expected actions, which may signal potential issues. Furthermore, remote monitoring solutions allow for continuous health tracking through various sensors, such as blood pressure monitors, glucose meters, and heart rate sensors. Machine learning algorithms are frequently employed to analyze the collected data and identify anomalies, providing valuable insights into an individual's well-being. While these methods exhibit substantial promise, challenges concerning data privacy, cybersecurity, and the need for user-friendly interfaces remain areas of active research and development, underscoring the importance of refining existing approaches to ensure their effectiveness and acceptance among the elderly population.

**CHAPTER 4**

**PROPOSED SYSTEM**

The proposed system for IoT-based fault identification in aged individuals seeks to leverage cutting-edge technology to enhance the safety and well-being of seniors. This system integrates wearable devices, smart home automation, and remote monitoring into a comprehensive framework. Wearable sensors, like fall detection and vital sign monitoring, provide continuous data on an individual's physical health and activity. Smart home sensors monitor the living environment, detecting deviations from routines and anomalies in real-time. This data is collected and analyzed using advanced machine learning algorithms, enabling the system to recognize patterns associated with potential health issues or emergencies. When a fault or anomaly is detected, the system can trigger alerts to caregivers or healthcare providers, ensuring rapid response and intervention. Moreover, user-friendly interfaces and mobile applications provide the elderly with a sense of control and ease of use. The system's adaptability and customization allow it to be tailored to the specific needs of each individual, addressing the unique challenges that come with aging. This proposed system aims to provide seniors with greater independence and peace of mind while offering caregivers and families an invaluable tool for ensuring the safety and well-being of their elderly loved ones. However, successful implementation requires addressing issues related to data privacy, security, and seamless integration into daily life, which will be crucial for the system's acceptance and effectiveness.

CHAPTER 5

WORKING PRINCIPLE

The working principle of an IoT-based fault identification system for aged people revolves around continuous data collection, analysis, and timely response. Wearable devices, such as smartwatches or pendants equipped with sensors, continuously monitor the individual's vital signs, physical activity, and even their immediate surroundings. These devices transmit data to a centralized hub, often located within the smart home environment. Simultaneously, smart home sensors monitor various aspects of the living space, such as motion, temperature, and appliance usage. The collected data is then processed by machine learning algorithms capable of detecting anomalies and patterns indicative of potential health issues or emergencies.

When a deviation or fault is identified, the system triggers alerts or notifications to caregivers, family members, or healthcare professionals through mobile applications or other communication channels. This real-time response ensures that appropriate action can be taken promptly, such as sending help in the event of a fall or providing medical assistance for sudden health concerns. User-friendly interfaces and customizable settings allow the elderly individuals themselves to be involved in the system's operation, granting them a sense of control and autonomy.

The core principle is to harness the power of IoT to continuously monitor an aged individual's well-being, proactively detect faults, and swiftly respond to emergencies, thereby enhancing their safety, independence, and overall quality of life. To be effective, this system requires seamless integration into the daily routines of the elderly, data security, and privacy safeguards, and adaptability to cater to the unique needs and preferences of each user.

CHAPTER 6

**RESULT AND DISCUSSION**

The results and discussion of IoT-based fault identification systems for aged people highlight the significant potential and ongoing challenges in this evolving field. The implementation of such systems has shown promise in improving the safety and well-being of seniors, primarily through the early detection of anomalies, falls, and health issues. These systems, equipped with wearable devices and smart home sensors, enable continuous monitoring and data collection, which can be analyzed by machine learning algorithms to identify patterns and deviations associated with potential faults. This proactive approach allows for timely responses and interventions, minimizing the risks associated with aging.

However, several key points emerge from the discussions within this context. Data privacy and security remain paramount concerns, given the sensitive nature of health-related information. Ensuring robust encryption, access control, and ethical data handling practices is essential. Moreover, the adoption and usability of these systems by elderly individuals require careful consideration. Interfaces must be user-friendly, non-intrusive, and customizable to accommodate varying degrees of technical familiarity among the aged population.

Another crucial aspect is the need for interoperability and standardization to ensure that data from various devices and systems can be seamlessly integrated, providing a holistic view of an individual's health. The affordability and accessibility of these systems are vital, especially in healthcare environments with varying socioeconomic backgrounds.

The results and discussions in this domain underscore the potential of IoT-based fault identification for aged people while underscoring the necessity for ongoing research and development to address these challenges and make such systems more effective, user-friendly, and widely accessible. This will require interdisciplinary collaboration and a commitment to the ethical and secure use of technology for the benefit of elderly populations.

**CHAPTER 7**

**CONCLUSION**

In conclusion, IoT-based fault identification systems designed for aged people hold great promise in significantly enhancing the safety and quality of life for seniors. By harnessing the power of wearable sensors, smart home technologies, and advanced machine learning algorithms, these systems enable continuous monitoring, early fault detection, and timely responses. The proactive nature of such systems in identifying anomalies, falls, and health issues is invaluable in addressing the unique challenges that come with aging.

Nonetheless, as this field advances, several crucial considerations need to be addressed. Data privacy, security, and ethical data handling practices are paramount, ensuring that the personal health information of elderly individuals remains protected. User-friendly interfaces and customization are essential to ensure the elderly can comfortably embrace these technologies.

Interoperability, standardization, affordability, and accessibility must also be prioritized to make these systems widely available and adaptable across diverse healthcare environments. As the aging population continues to grow, there is an urgent need for further research and development, interdisciplinary collaboration, and a commitment to ethical and secure technological solutions that empower seniors to live independently and confidently. IoT-based fault identification systems have the potential to revolutionize the care of aged individuals, improving their well-being while providing peace of mind to families and caregivers.

In the evolving landscape of fault identification for the elderly, the future holds promising advancements blending technology, healthcare, and social initiatives. Innovations will likely focus on leveraging sophisticated health monitoring technology, such as AI-driven wearable devices and sensors capable of continuously tracking vital signs, movement patterns, and anomalies in daily activities. AI algorithms will play a pivotal role in analyzing data to detect deviations or irregularities that could signify potential health concerns. Remote health monitoring, integrated with telemedicine, will offer real-time insights for healthcare professionals, providing personalized care and timely interventions. Smart home solutions equipped with sensors and AI will contribute to identifying hazards or changes in routines, ensuring safety and well-being. Concurrently, social support systems, community-driven initiatives, and ethical considerations regarding privacy and autonomy will shape the landscape, promoting not only physical health but also mental well-being. Collaboration among technology developers, healthcare experts, and community organizations will be integral in developing comprehensive fault identification strategies, fostering a future that prioritizes the holistic care of the elderly.

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