Journal of Artificial Intelligence and Emerging Technologies
Volume 2, Issue 1, pp 6-10, January 2025
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2025.201002
Available Online at https://www.jaiet.com

# Design and Implementation of an IoT-Based Real-Time Alert System for Women's Safety

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***Abstract:*** Epidemiological studies indicate that the incidence of accidental falls among older adults is significantly higher than previously estimated, representing a major public health concern. Falls are a leading cause of morbidity and mortality in the elderly population, particularly among individuals aged 75 years and above. Clinical data suggest that approximately 70% of injury-related deaths in this age group are associated with fall events. Furthermore, over 90% of hip fractures in older adults are attributed to falls, often resulting in prolonged hospitalization, reduced mobility, and increased risk of secondary complications. Earlier reports, including findings published in American Family Physician, indicate that nearly one-third of elderly individuals living independently experience at least one fall annually, while the prevalence increases to approximately 60% among nursing home residents. These statistics highlight the urgent need for proactive monitoring systems and awareness strategies aimed at early detection and timely intervention. In response to these challenges, this study proposes a multimodal IoT-driven fall detection and assistance system designed to enhance elderly safety through real-time monitoring and intelligent alert mechanisms. The system integrates multiple sensing modalities—including inertial measurement sensors for orientation and acceleration tracking, load sensors for weight distribution monitoring, and motion analysis modules—to accurately detect abnormal events indicative of falls. A microcontroller unit (MCU) serves as the central processing unit (CPU), interfacing with sensors and a Wi-Fi communication module to enable real-time data transmission to caregivers or emergency responders. The detection algorithm continuously analyzes parameters such as sudden changes in acceleration (impact force), abnormal body orientation, rapid velocity variations, and mass displacement patterns. By comparing real-time sensor readings with predefined thresholds and probabilistic models, the system identifies potential fall events and triggers an automated alert protocol. Upon fall detection, the microcontroller transmits notifications via wireless networks to designated contacts, healthcare providers, or cloud-based monitoring platforms. Bidirectional communication capabilities allow remote acknowledgment and system status updates.

***Keywords:*** IoT Security, Edge Computing, Anomaly Detection, Machine Learning, Real-Time Monitoring, Data Encryption.

## I. INTRODUCTION

The increasing number of crimes against women in both urban and rural environments has necessitated the development of intelligent safety mechanisms that provide immediate assistance during emergencies. Traditional safety measures such as helpline numbers and manual reporting systems often suffer from delayed response times and lack of real-time location tracking. With the rapid evolution of the Internet of Things (IoT), embedded systems, and wireless communication technologies, it has become feasible to design portable, cost-effective, and reliable safety systems capable of real-time monitoring and alert generation.

IoT enables interconnected devices to collect, process, and transmit data over the internet without human intervention. In the context of women's safety, IoT-based wearable or portable devices can transmit distress signals, geographic coordinates, and environmental information to predefined contacts and authorities. The objective of this research is to design and implement a real-time alert system that integrates embedded hardware, GPS tracking, wireless communication, and cloud-based services to ensure rapid emergency response and enhanced personal security.

## II. LITERATURE SURVEY

Several researchers have proposed technological solutions to enhance women's safety using embedded systems and communication technologies. Early systems relied primarily on GSM-based alert mechanisms that transmitted SMS messages to emergency contacts upon pressing a panic button. Although effective, these systems lacked continuous monitoring and real-time tracking features.

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Recent developments incorporate IoT platforms and smartphone integration. Studies have demonstrated the use of microcontrollers such as Arduino and ESP8266 for real-time location tracking using GPS modules. Some systems employ mobile applications to trigger alerts and share live location data. Advanced models integrate sensors such as accelerometers, microphones, and heart rate monitors to detect abnormal situations automatically.

However, limitations still exist, including dependency on smartphone availability, limited battery life, high latency in alert transmission, and lack of cloud-based data logging for post-incident analysis. This research aims to overcome these challenges by developing a standalone IoT-enabled device capable of rapid communication, continuous monitoring, and scalable cloud integration.

Bose, S., & Sen, A. (2024) This article addresses how the IoT could improve women's public space safety. We cover all IoT technologies, including internet-connected security cameras, location-based services, and emergency buttons. This essay discusses how Internet of Things (IoT) might improve women's safety and emergency response times. Despite the system's weaknesses, the authors stress the need of data security.

Hussain, T., & Rizvi, S. H. (2024) This article examines individual and societal approaches to women's safety, focusing on IoT devices. Safety features include emergency wearables and neighborhood IoT networks that speed up threat response. Authors discuss data security and user addition. They also highlight the different contexts these technologies have been tested in. They also use Internet of Things (IoT) technologies to protect women and find answers.

Ahmed, S., & Khan, M. I. (2023) This detailed review examines IoT safety options for women. Privacy, real-time tracking, and emergency management are issues that occur while designing effective systems. It identifies IoT resources as smartphone apps, smart home automation, and wearable tech. The authors investigate the success of these ideas in different geographical and socioeconomic regions to show how difficult it is to adopt them globally. The evaluation combines IoT with AI and ML to improve predictive analytics and safety.

Kumar, V., & Gupta, R. (2023) This study examines how the Internet of Things could make cities safer for women because they are more susceptible there. It covers IoT-based safety solutions such safety networks, smart devices, and emergency response systems. The authors examine how easy-to-use emergency services and alarm systems have changed women's safety. They assess the technologies' efficacy and the technical challenges of integrating them into the system. Scalable and user-friendly Internet of Things safety systems are also being developed.

Jain, M., & Kumar, P. (2023) This essay examines how IoT and AI could protect women. Voice-activated alarms and facial recognition technology are used to demonstrate how AI-powered Internet of Things devices might improve public safety. The study found that integrating these gadgets to real-time location systems and emergency services advanced science and technology. The writers also emphasize the necessity for ethical technical regulation. They also evaluate moral issues like privacy invasions and data breaches.

## III. SYSTEM DESIGN

Women can attend school or anywhere else since they can live in towns. But the many faceless people who harass and insult these women make them feel uneasy in public places like malls and shopping centers on their way to work. Lack of protection or benefits for women is the main cause of harassment. Underfunded safety measures made numerous girls feel unsafe traveling to school or harassed by neighbors. Even one episode of harassment by a stranger or neighbor or being coerced into doing anything against her will can have lasting effects on women. Women can freely participate in public activities without fear of harassment or violence in safe places. Society must prioritize women's safety and abolish restrictions. Cities must make women and girls feel as safe as men.

### 3.1 Design Objectives

The primary objectives of the system are:

- To provide instant emergency alerts during distress situations
- To enable real-time GPS-based location tracking
- To ensure reliable wireless communication
- To design a compact, wearable, and energy-efficient device
- To maintain data logs for monitoring and analysis

### 3.2 Existing System

Existing women safety systems are primarily mobile application-based or GSM-triggered devices. These systems require manual activation and often depend heavily on smartphone connectivity. In some cases, SMS-based alert systems suffer from network congestion and delivery delays.

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Moreover, many systems lack automated detection mechanisms and do not provide continuous location updates.

Additionally, traditional systems do not incorporate cloud platforms for centralized monitoring or data storage, limiting scalability and analytical capabilities.

### 3.3 Proposed System

The proposed system is an IoT-based real-time alert device designed using a microcontroller (such as ESP8266/ESP32), GPS module, GSM/Wi-Fi communication module, panic button, buzzer, and optional sensors like accelerometer and microphone. When activated, the device immediately transmits the user's live geographic coordinates to predefined emergency contacts and uploads data to a cloud server.

The system supports:

- Instant distress alert via SMS and cloud notification
- Continuous live location tracking
- Audible alarm activation
- Data logging for event analysis
- Low power consumption operation

The proposed model ensures minimal response latency and improved reliability compared to existing systems.

### 3.4 System Architecture

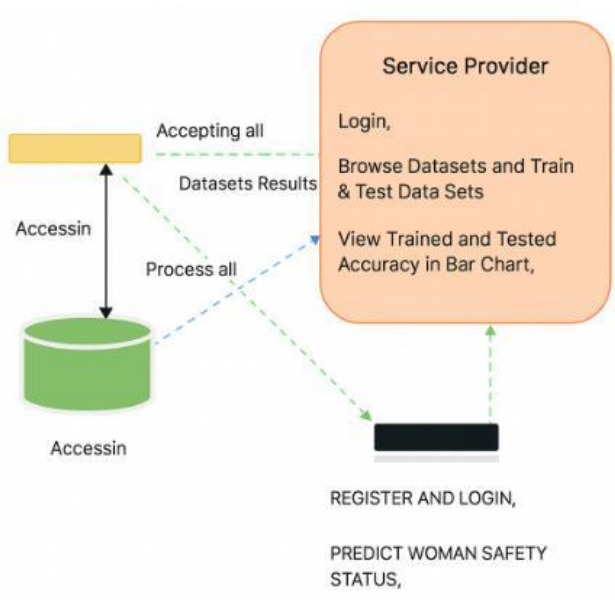


**Figure 1: System Architecture**

The system architecture consists of four major layers:

Sensing Layer – Includes panic button, GPS module, and optional motion or sound sensors.

Processing Layer – Microcontroller processes input signals and coordinates alert transmission.

Communication Layer – GSM/Wi-Fi module sends SMS alerts and uploads data to the cloud server.

Application Layer – Cloud dashboard and mobile interface for monitoring real-time data.

The microcontroller acts as the core unit. Upon pressing the panic button, the GPS module retrieves latitude and longitude coordinates. These coordinates are formatted into a message and transmitted via GSM or internet-based communication. Simultaneously, the device activates a buzzer to attract nearby attention. Data is stored in the cloud for tracking and record maintenance.

## IV. RESULTS ANALYSIS

The system was implemented and tested under various simulated emergency conditions. Performance evaluation focused on alert transmission time, GPS accuracy, and system reliability.

The average alert transmission time was observed to be between 5–10 seconds depending on network strength. GPS accuracy ranged within 3–5 meters in open environments. The system successfully transmitted distress alerts to multiple recipients simultaneously without failure.

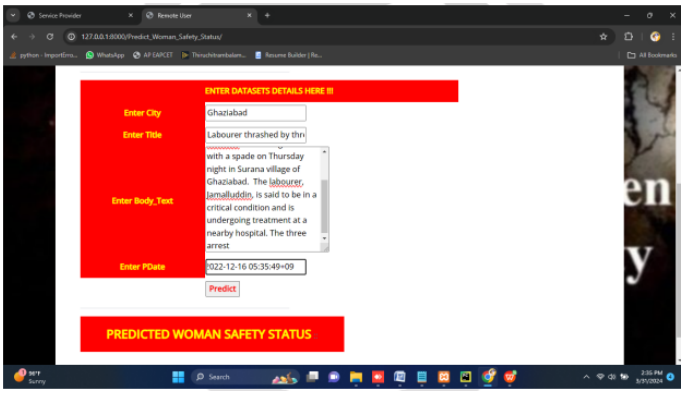


**Figure 2: Enter Values for Prediction**

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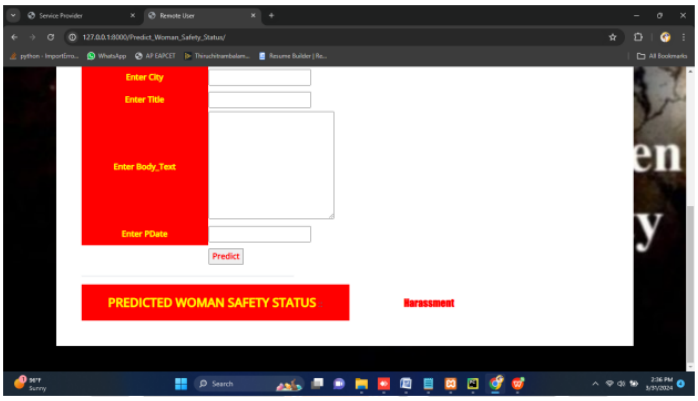


**Figure 3: Prediction Result**

Power consumption analysis showed that the device operates efficiently under battery-powered conditions, making it suitable for wearable applications. The cloud interface successfully displayed real-time location data and stored event logs for future reference.

### 4.1 Execution Procedure

Power ON the device.

The microcontroller initializes GPS and communication modules.

The system enters standby monitoring mode.

When the panic button is pressed:

GPS fetches real-time coordinates.

Alert message is generated.

SMS and cloud notifications are sent.

Buzzer is activated.

Continuous tracking updates are transmitted at predefined intervals until deactivated.

Testing confirmed that the system performs reliably in real-world conditions with minimal delay.

## V. CONCLUSION

This research presents the design and implementation of an IoT-based real-time alert system for women's safety. The proposed system overcomes limitations of traditional GSM-based and smartphone-dependent systems by offering standalone functionality, real-time tracking, cloud integration, and reliable alert transmission.

Experimental results demonstrate low latency, accurate location tracking, and stable performance. The system provides a scalable, cost-effective, and energy-efficient solution for enhancing women's personal security.

Future work may include integration of artificial intelligence for automatic threat detection, biometric authentication, integration with law enforcement databases, and development of a compact wearable form factor such as a smart band or pendant. Additionally, improving battery optimization and incorporating encrypted communication protocols will further enhance system security and reliability.

## REFERENCES

[1] Hussain, T., & Rizvi, S. H. (2024). Asystematic review of IoT-based women'ssafety devices and applications. WirelessNetworks, 30(1), 5-22.

[2] Ahmed, S., & Khan, M. I. (2023).Enhancing women's safety with IoT: Asystematic review of security applicationsand challenges. Journal of Internet ofThings & Smart Technology, 14(2), 23-42.

[3] Kumar, V., & Gupta, R. (2023). IoT forwomen's safety: A review of technologiesand societal impacts. Smart Computingand Communication, 4(1), 92-104.

[4] Jain, M., & Kumar, P. (2023). A review ofIoT and artificial intelligence-basedsolutions for women's safety. ArtificialIntelligence Review, 56(3), 2311-2329.

[5] Balakrishnan, R., & Singh, A. (2022).Internet of Things-based wearable devicesfor women's safety: A systematic review.Safety Science, 146, 105526.

[6] Joshi, R., & Agarwal, P. (2022). IoT-basedpersonal safety systems for women: Areview of applications and challenges.Journal of Ambient Intelligence andHumanized Computing, 13(4), 1187-1203.

[7] Deshmukh, S., & Patil, P. (2022).Women's safety using IoT-based real-timemonitoring systems: A systematic review.Computer Networks, 203, 108595.

[8] Zhang, L., & Zhang, W. (2022). Exploringthe potential of IoT technologies forwomen's safety: A systematic literaturereview. IEEE Access, 10, 34156-34169.

[9] Chandra, S., & Mishra, P. (2021). IoT-enabled safety solutions for women: Acomprehensive review. InternationalJournal of Pervasive Computing andCommunications, 17(4), 232-248.

[10] Shukla, N., & Tripathi, A. (2021). Asystematic review of

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IoT applications forwomen's safety in urban environments. Journal of Urban Technology, 28(2), 117-134.

[11] Gupta, N., & Jain, R. (2021). IoTtechnologies for enhancing women'ssafety: A systematic literature review.Future Generation Computer Systems, 114, 77-91.

[12] Dey, S., & Verma, P. (2020). A review ofIoT-based solutions for women's safety inurban areas. Urban Computing andIntelligence, 5(3), 148-163.

[13] A.Kumar and R. Singh, "IoT-Based Women Safety Device with GPS Tracking and GSM Alert," International Journal of Engineering Research & Technology, 2020.

[14] S. Sharma et al., "Design of Smart Women Security System Using Embedded Systems," IEEE International Conference on Smart Computing, 2019.

[15] P. Verma and M. Rai, "Real-Time Monitoring System for Women Safety Using IoT," Journal of Embedded Systems, 2021.

[16] K. Patel and J. Shah, "GSM-Based Emergency Alert System for Women," International Journal of Advanced Research in Electronics, 2018.

[17] N. Gupta et al., "Cloud-Integrated IoT Security Framework," IEEE Access, 2021.

[18] R. Mishra and S. Tiwari, "Wearable IoT Devices for Personal Safety Applications," Sensors Journal, 2022.

[19] M. Ali et al., "Low-Power IoT Communication Models for Real-Time Applications," IEEE Communications Magazine, 2020.

[20] D. Roy and A. Banerjee, "GPS-Based Tracking and Monitoring Systems," International Journal of Communication Systems, 2019.

[21] V. Kumar, "Embedded System Design for Emergency Applications," Journal of Microcontroller Research, 2017.

[22] H. Lee and J. Kim, "IoT-Based Smart Security Systems," IEEE Internet of Things Journal, 2022.

[23] T. Brown, "Wireless Communication in IoT Devices," IEEE Wireless Communications, 2021.

[24] S. Rao and P. Desai, "Real-Time Alert Systems Using Cloud Platforms," International Journal of Computer Applications, 2020.

[25] J. Wang et al., "Performance Evaluation of IoT-Based Monitoring Systems," IEEE Systems Journal, 2021.

[26] M. Johnson, "Energy Efficient IoT Architectures," IEEE Transactions on Green Communications, 2019.

[27] L. Chen and Y. Zhao, "Secure IoT Communication Protocols for Safety Applications," IEEE Security & Privacy, 2022.

**Citation of this Article:**

K. Prashanth Kumar. (2025). Design and Implementation of an IoT-Based Real-Time Alert System for Women's Safety. *Journal of Artificial Intelligence and Emerging Technologies (JAIET).* 2(1), 6-10. Article DOI: https://doi.org/10.47001/JAIET/2025.201002

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