Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 11 Issue 44 (September 2026) PP. 101-114

JOURNAL OF INFORMATION SYSTEM AND TECHNOLOGY MANAGEMENT (JISTM)
www.gaexcellence.com/jistm

GLOBAL ACADEMIC EXCELLENCE

A HUMAN-CENTRIC RESIDENTIAL SAFETY SYSTEM FOR INDEPENDENT ELDERLY INDIVIDUALS

Noor Hafizah Khairul Anuar[1]*, Nor Diyana Md Sin[2], Suhaili Beeran Kutty[3], Norhalida Othman[4], Nur Amalina Muhamad[5]

[1]Faculty of Electrical Engineering, Universiti Teknologi MARA, Johor Branch Pasir Gudang Campus, Malaysia
noorhafizah2575@uitm.edu.my https://orcid.org/0000-0002-7724-2492
[2]Faculty of Electrical Engineering, Universiti Teknologi MARA, Johor Branch Pasir Gudang Campus, Malaysia
diyana0366@uitm.edu.my https://orcid.org/0000-0003-3162-6009
[3]Faculty of Electrical Engineering, Universiti Teknologi MARA, Johor Branch Pasir Gudang Campus, Malaysia
suhaili88@uitm.edu.my https://orcid.org/0000-0003-4201-5529
[4]Faculty of Electrical Engineering, Universiti Teknologi MARA, Johor Branch Pasir Gudang Campus, Malaysia
halida8142@uitm.edu.my https://orcid.org/0000-0002-6770-5684
[5]Faculty of Electrical Engineering, Universiti Teknologi MARA, Johor Branch Pasir Gudang Campus, Malaysia
amalina0942@uitm.edu.my https://orcid.org/0000-0001-7180-4477
*Corresponding Author

Article Info:

Article history:
Received date: 23.07.2026
Revised date: 02.08.2026
Accepted date: 20.08.2026
Published date: 07.09.2026

Abstract:

The number of ageing individuals who live alone increases the necessity of holistic residential safety measures. This research paper portrays the human-centred smart home safety system combining environmental hazards detection, as well as activity monitoring. The system incorporates the use of gas, flame, temperature and humidity sensors, along with (ultrasonic-based) occupancy tracking to check high-risk areas, especially bedding and toilet areas. The core of the solution is an ESP32 microcontroller that allows real-time data collection, local notifications, and IoT-based features through the Blynk and Telegram platforms. To test the performance of the system, a prototype residential model was created, which showed experimental outcomes displaying that the average alert latency was about 1.97 seconds, which means that the system is nearly able to respond to emergencies in real-time. The

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 11 Issue 44 (September 2026) PP. 101-114

To cite this document:

Anuar, N. H. K., Md Sin, N. D., Kutty, S. B., Othman, N., & Muhamad, N. A. (2026). A Human-Centric Residential Safety System for Independent Elderly Individuals. *Journal of Information System and Technology Management, 11* (44), 101-114.

DOI: 10.35631/JISTM.1144007

proposed system can offer a cost-effective, non-invasive, and practical way of improving the safety of the residence by integrating both environmental sensing and time-based analysis of activities. The results prove the practicability of incorporating the multi-sensor monitoring system into the IoT connectivity to ensure the safety of independent living of older citizens.

Keyword:

Elderly Safety, Fire Hazard, Fall Risk, IoT

Introduction

The quick rise in the elderly population has heightened the need to find solutions to help the elderly population live safely and independently. The rising number of the ageing population has become a worldwide issue that studies in various countries have underscored. The longer life expectancy in England has resulted in increased health-related issues in the elderly (Nunoo & Eze, 2024). While in China, the great increase in population of the elderly has put the social security system and economic sustainability under great pressure (Wu & Deng, 2011). On the same note, in Taiwan, ageing has been seen to be an irreversible trend that still influences social structures and lifestyles (Yang & Sun, 2016). The number of elderly people is also growing at an alarming rate in Malaysia, and the country is shifting to an ageing society, which means that the technology needs to help the elderly population live their lives; however, usability issues among ageing users should also be taken into account (Sin et al., 2014). Although independent living encourages autonomy and quality of life, it also raises the risk of safety in the lives of elderly people in homes, particularly when no one is around to help them. These instances indicate that population ageing is an international trend that needs proper measures to curb the challenges that it presents.

Residential fire hazards, commonly due to unattended cooking, gas leakage and forgotten electrical equipment, are one of the most significant risks that elderly people who live alone face. The decline of memory and physical constraints further contribute to the increase in the chances of such occurrences and decrease the capacity to react proficiently when faced with an emergency (Byun, 2019; Karemaker et al., 2021). Moreover, most of the fire safety strategies are usually not sufficient, and the training and awareness on the safety equipment and safety management practices among the residents are still limited. Conventional fire safety devices, such as standalone smoke alarms, are restricted to local alerts and may fail when the elderly are unable to react or when no immediate assistance is available. These restrictions underline the necessity of a more active fire safety system to ensure an early response to the situation, remote monitoring, and quick rescue.

The latest developments of Internet of Things (IoT) technologies make continuous sensing, real-time data transfer, and automated notification services possible, which is promising as a solution to the home safety of elderly people. IoT and wearable devices will be able to aid continuous monitoring of health conditions and activity, aid caregivers with remote monitoring and earlier identification of abnormal conditions, thus increasing the quality of life of independent elderly people (David Chung Hu et al., 2018; Kotronis et al., 2018; Tun et al., 2021). Nevertheless, most current smart home technologies are also expensive and difficult to install and set up and usually target the typical user without considering age-related factors like decreased cognitive capacity and usability issues. All these make them less accessible and less useful to elderly customers, and a low-cost, simplicity-focused, and human-centred IoT-based solution, which will meet the unique needs of elderly clients, is desirable.

The given work suggests a Human-Centric IoT Fire Safety System that should assist in the independent living of seniors. The system is constructed with an ESP32 microcontroller because the cost is affordable, low power consumption, and has in-built Wi-Fi. Gas, flames, and temperature sensors are used to sense fire hazards and push the information to the Blynk apps to store data in real-time as well as view the data visually. Emergency messages are received through Telegram, which those messages are sent to caregivers, family members or emergency contacts in real time. This work aims to come up with a stable, cost-effective, and people-friendly fire safety system that will increase the security of the people in their residences, as well as help the elderly to live independently and securely.

Literature Review

Earlier researchers have investigated how Internet of Things (IoT) technologies can be used to support elderly people in improving their lives, safety, and security. These papers indicate how sensor-based monitoring, automation, and remote notification systems can be effective, but also show gaps that may inspire new studies. Studies related to monitoring the living alone elderly have been conducted in Thailand due to the increasing trend of elderly individuals living alone, which may lead to higher risks of falls and injuries. The study applied a wireless sensor network (WSN) based monitoring system with WLAN, mobile phones, and RFID technology to monitor daily activities, detect falls, provide home automation, and send emergency alerts (Suntiamorntut et al., 2011).

A number of smart home automation technologies have been suggested to enhance the security of residences with environmental sensing and remote control. As an example, an automated home management system that saves money combines fire detection, motion detection and environmental sensing with cloud-based notification to have all safety aspects covered and provide real-time access (Rubesh Kumar et al., 2025). Although efficient, these systems tend to use complex hardware platforms like Raspberry Pi and various subsystems, which adds complexity to the systems, difficulties in installation, and maintenance for elderly users.

Other work is dedicated to the safety of the elderly in the smart home, specifically by combining the gas, flame, and temperature sensors with IoT systems and mobile apps. Such systems show that low-cost solutions are possible based on a microcontroller like Arduino or

NodeMCU and mobile apps to provide real-time alerts and remote monitoring (Anjum et al., 2024). The majority of the design's focus, however, on general home automation, and not on emergency-based safety services, and usually assume that the elderly users can engage in communication with mobile applications in emergency situations, which is a technologically advanced feature.

Protecting elderly people by falling or experiencing special health conditions is another popular wearable-based safety solution. To illustrate, the ResQ smart safety band combines sensors and a microcontroller to provide automated fall-detection and heart-rate-abnormality monitoring, plus alert-escalation to emergency contacts on a cloud system (Dev V. Savla et al., 2020). These wearable IoT devices enable real-time and continuous tracking, as well as sending notifications even when the user is incapacitated, which makes them very efficient in personal health and activity monitoring. Yet, these solutions are more oriented towards physiological and movement-related risks and not environment-related hazards, such as fire, gas leakage, and unsafe living conditions, which are still a serious threat to elderly people living alone.

In a larger context, human-centred designs of elderly residential settings focus on overall safety, usability, and less cognitive load to facilitate self-sufficiency. The Ubi-Liven model emphasises the significance of integrating safety and healthcare services in daily living conditions smoothly by means of IoT, cloud computing, and data analytics without the need to constantly engage with a user (Qun Jin et al., 2016). These methods seek to help improve the quality of life through the delivery of context-sensitive support to elderly people. Nevertheless, most of the implementations, regardless of their conceptual strength, are still high-level, complex or infrastructure-intensive and expensive, which constrains their feasibility, scalability and cost-effectiveness when applied to real-life residential environments, particularly low-cost home environments.

Moreover, several IoT-powered human safety systems are based on panic buttons or manual triggers to trigger an emergency alert (Khokher et al., 2023). This is less appropriate for the elderly who may have memory failures, panic or physical constraints in critical situations, hence struggle with the system to operate effectively. This is further constrained by the usability problem that comes with the ageing mechanism, in which sophisticated communication and user-specific action may hamper the ability to respond promptly. Thus, automated and unobtrusive IoT solutions, which can identify risks and raise alerts without needing direct user intervention, are needed.

Overall, current research shows good technical sensing, connectivity, and alert capabilities. Nevertheless, notable weaknesses persist, such as system complexity, dependence on human intervention, scarcity of service-based alert escalation and inadequate attention to fire-specific risks within senior housing facilities. These shortcomings are the direct reason why the Human-Centric IoT Fire Safety Service was proposed, focusing on automatic hazard detection, being low-cost and using ESP8266, requiring little user dependence, and providing the necessary emergency notification to family members and caregivers. The proposed system will overcome these limitations, resulting in a highly accessible, reliable, yet practical fire safety solution, which is specifically designed to suit independent senior living.

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 11 Issue 44 (September 2026) PP. 101-114

Research Methodology

The research methodology outlined in this paper covers multiple aspects, includes the design of system architecture, hardware implementation, IoT integration and connectivity, user interface development, and the processes involved in hardware prototyping and fabrication.

System Architecture

The system architecture diagram has the input layer, processing layer, output layer, and IoT connectivity layer (see Figure 1). The sensor layer contains several sensors that monitor safety against environmental disorders and the activity of residents. A gas detector, MQ-2, detects combustible gases and smoke, and an IR flame sensor allows quick fire detection based on the infrared wavelength sensing.

A DHT22 sensor is a device that will measure temperature and humidity in the air to detect unusual warm situations. In the meantime, the presence of the elderly residents and the amount of time they spend inactively is monitored through ultrasonic sensors to identify possible falls or abnormal routines. The processing layer is made of an ESP32 microcontroller, which has dual-core processing power and Wi-Fi connectivity.

The local output layer will offer immediate feedback in the form of a piezo buzzer, LED status indicators, and a 16×2 I2C LCD showing real-time readings of the system and warning messages. To support remote protection, the IoT layer will provide a connection between the ESP32 and the Blynk platform so that the conditions in the surroundings can be monitored on a smartphone dashboard in real time. When it comes to critical conditions, the system will combine a Telegram Bot API to send instant, encrypted notifications to the caregivers. This person-oriented design emphasises the safety of the elderly since it is based on constant supervision, quick interventions and an easy connected process with caregivers, therefore it can contribute to independent living and at the same time ensure the presence of individual protection and confirmation.

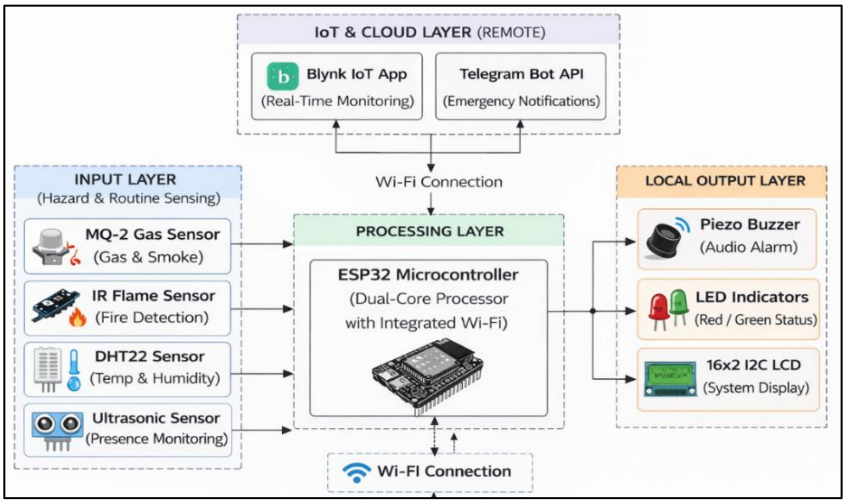


Figure 1: The Architecture Diagram of the Fire Safety Alert and Monitoring System

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 11 Issue 44 (September 2026) PP. 101-114

Hardware Implementation

Figure 2 shows the entire schematic form of the designed system. The schematic combines the protection of environmental hazards and monitoring of occupant activities into one embedded ESP32-based system. The microcontroller ESP32 serves as the central processing unit, controlling the multi-sensor data acquisition, real-time decision making and activation of alerts. The hazard detection subsystem consists of an MQ-2 gas sensor and an IR flame sensor to detect combustible gases and open flames, respectively. To increase the reliability of environmental assessment, a DHT22 sensor is installed to track the temperature and humidity in the environment. In elderly activity tracking, the HC-SR04 ultrasonic sensor will be used to measure the distance, detecting abnormal inactivity behaviour, whereas the HC-SR501 PIR sensor will be used to detect the presence of human motion. The alert devices are a piezo buzzer (driven by a transistor to amplify current) and an LED indicator to provide an immediate alert. An LCD module based on I2C offers real-time display of the system status. The circuit also provides adequate 5 V power allocation, 3.3 V logic compatibility and grounding of common ground to achieve the stability of operation and signal integrity.

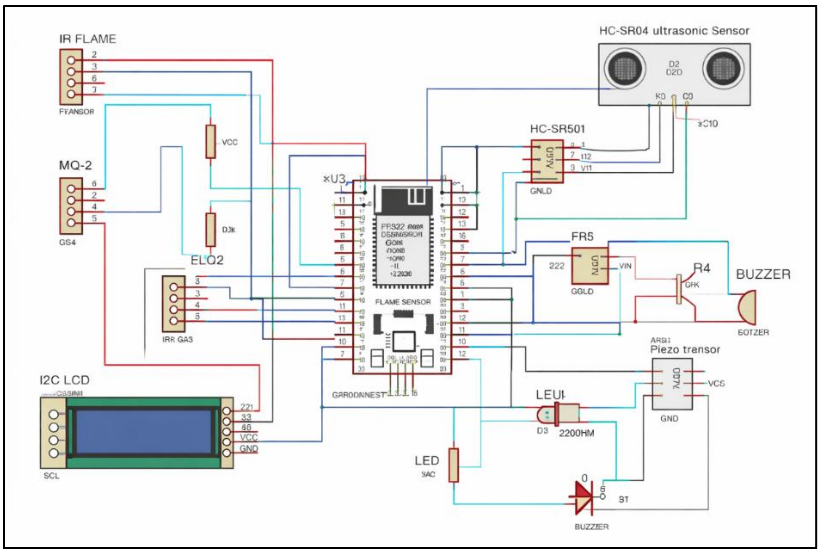


Figure 2: The System Design Schematic Diagram

Table 1 is given below to summaries the hardware parts and the functional roles they perform. The hardware configuration has been thoroughly integrated to provide consistent multi-parameter monitoring to help detect hazards early and act promptly, according to the environment suitable for the elderly to live independently.

Table 1: The Summary of Component Functionality in the Developed System

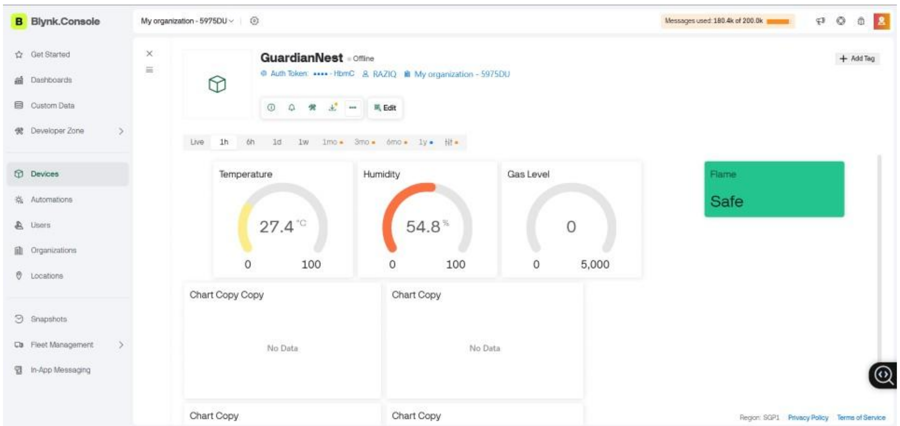
Component	Functionality
ESP32 Microcontroller	Central processing unit with integrated Wi-Fi for data acquisition, processing, and IoT communication
MQ-2 Gas Sensor	Detection of combustible gases and smoke concentration
IR Flame Sensor	Rapid detection of open flame presence

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 11 Issue 44 (September 2026) PP. 101-114

HC-SR04 Ultrasonic Sensor	Distance measurement for inactivity and fall-risk monitoring
HC-SR501 PIR Sensor	Motion detection for human presence monitoring
DHT22 Sensor	Ambient temperature and humidity monitoring
2C LCD Module	Real-time display of sensor readings and system alerts
Piezo Buzzer & LED	Local audible and visual alert mechanisms
Blynk & Telegram Bot	Remote monitoring and emergency notification to caregivers

IoT Connectivity and User Interface

After the hardware integration mentioned above, the system includes an Internet of Things (IoT) platform, which is used to provide remote monitoring and the detection of abnormal activity, as well as emergency notification. Figure 3 illustrates the IoT connectivity architecture of the proposed system, integrating real-time visualisation via the Blynk platform and instant alert transmission through a Telegram bot. The ESP32 microcontroller functions as the communication gateway, continuously acquiring environmental and activity-related data and transmitting processed information to the cloud-based Blynk dashboard through Wi-Fi connectivity. The Blynk interface provides real-time visualisation of temperature, humidity, gas concentration, flame detection status, and occupancy monitoring. In addition to hazard detection, the system evaluates inactivity duration using ultrasonic and motion sensors. In case abnormal inactivity is observed, like excessive time used in the bedroom or toilet zone, the system sends notification alerts using the Blynk application to notify the caregivers. In the case of critical safety incidents, such as a gas leakage or flame detector, the system automatically sends Telegram-based emergency alerts. Such a two-fold IoT system can guarantee the 24/7 monitoring of both environmental risks and elderly activity patterns, thus improving safety, responsiveness, and assistance in living on their own.



Blynk Apps Dashboard

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 11 Issue 44 (September 2026) PP. 101-114

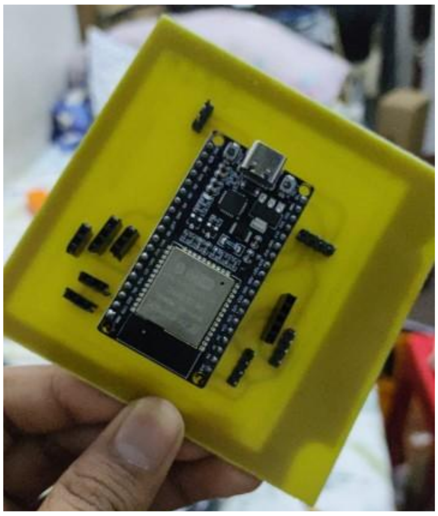
Blynk App Notification

Telegram Bot Notification

Figure 3: IoT Connectivity (a) Real-time Monitoring of Blynk Dashboard (b) Blynk Application Notification for Abnormal Activity (c) Telegram Bot Interface for Hazard Detection.

Prototyping and Fabrication

The prototyped system is implemented and experimentally validated in Figure 4. The completed ESP32 hardware module and the small 3D-printed system enclosure are shown in Figures 4(a) and 4(b), respectively, and this shows that the system has been well integrated into a practical system to implement in homes.



The Printed Circuit Board Hardware

The 3D-printed enclosure Box

Figure 4: Prototype Development of the Developed System: (a) Printed Circuit Board of an ESP32-based Hardware (b) Integrated 3D-printed Enclosure Box with LCD Interface

Meanwhile, Figure 5(a) illustrates a hazard detection system inside a simulated kitchen setting, where gas and flame sensor modules are located to detect any possible fire hazards. Such an arrangement confirms the ability of the system to identify dangerous situations in the high-risk zones in the house.

Figures 5(b) and 5(c) depict the positioning of ultrasonic sensors in the bedding and toilet, respectively. It is specifically important to monitor the activity in these zones because elderly

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 11 Issue 44 (September 2026) PP. 101-114
people are at high risk of falling during bed transitions at night and utilising the toilet due to their low balance, limited mobility, and low-visibility factors. The long period of inactivity here can be a sign of a fall or an emergency that may need immediate medical care. Furthermore, by constantly monitoring occupancy presence and periods of inactivity, the system will allow early alert to abnormal cases. This combined system guarantees environmental risk monitoring, as well as activity-based risk evaluation, boosting the overall safety of the residence and facilitating living on its own by the elderly residents.

(a) The Hazard Detection Setup in the Kitchen Area

(b) The Ultrasonic Sensor Placement in the Bedding Area

(c) The Ultrasonic Sensor Placement in the Toilet Area

Figure 5 (a) Hazard Detection Setup in the Kitchen Area; (b) Ultrasonic Sensor Placement for Bedding Activity Monitoring; and (c) Ultrasonic Sensor Placement for Toilet Activity Monitoring.

Result and Discussion

System Latency Performance

To evaluate real-time responsiveness, system latency was measured as the time difference between hazard detection and the receipt of the Telegram alert notification on a mobile device. The latency measurement was conducted under controlled Wi-Fi conditions by triggering gas and flame detection scenarios multiple times. The detection timestamp was recorded from the ESP32 serial output, while the alert reception time was recorded upon Telegram message

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 11 Issue 44 (September 2026) PP. 101-114
display. The mean latency was around 1.97 seconds, which implied the ability to provide a notification almost in real-time, as observed in Table 2. The delay seen was mainly due to the network transmission and processing of cloud messaging. The response time is deemed to be acceptable in residential safety applications, in which a quick response by the caregiver is paramount in the event of fire or gas spillage. This observation is consistent with previous studies on IoT application architectures, which reported that cloud-based IoT systems often experience communication delays due to network transmission and cloud processing overhead. Nevertheless, cloud platforms remain suitable for residential monitoring applications where scalable remote access and reliable notification services are required (Dauda et al., 2024).

Table 2: Summarises the Measured Delay Across Five Experimental Trials

Trial	Detection Time (s)	Telegram Received (s)	Delay (s)
1	12.50	14.10	1.6
2	25.30	27.00	1.7
3	38.90	41.20	2.3
4	52.10	54.00	1.9
5	65.75	68.10	2.35

Network Scaling & Bandwidth Constraints

For a real word application, the experiences of increasing or decreasing in delay due to network scaling and bandwidth constraints. This factor may cause in achieving average latency of 1.97 seconds during the experimental trials of the developed system. Multiple home IoT devices competing for local Wi-Fi bandwidth, packet queuing, or third-party server load and API rate limits (such as Blynk and Telegram cloud servers) can influence end-to-end transmission times. It is suggested to configures the ESP32 firmware using lightweight payload formatting, local alert caching, and exponential backoff retry logic during periods of temporary network degradation for preventing latency spikes. These practical considerations are consistent with the literature, which highlights that cloud-centric IoT deployments may experience increased latency and bandwidth consumption as the number of connected devices grows (Dauda et al., 2024). Hybrid approaches incorporating edge processing have therefore been recommended to reduce unnecessary network traffic while maintaining real-time responsiveness.

Activity Tracking and Anomaly Detection

In addition to fire safety concerns, the system incorporates a simple activity monitoring feature to track high-risk daily routines, particularly bedding time and toilet usage, by using an ultrasonic sensor. Such activities are deemed important, and excessively long or unusual time spent might be a serious health risk or an emergency.

In the process of prototyping, the ultrasonic sensor was programmed to observe occupancy in a specified range of detection within its capability of about 5 cm, allowing the sensing to focus on the target subject and the object around it. In case of a presence detection, a timing mechanism was started by the millis () function in the ESP32 firmware to monitor the occupancy duration constantly. The signal was set to time out when the person was out of the area of detection. The system monitored the presence length to determine abnormal inactivity

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 11 Issue 44 (September 2026) PP. 101-114
in case of bedding. Six to eight hours is the usual range in which the threshold can be adjusted according to personal sleeping habits in real-life practice. To simulate long occupancy, the threshold was brought down to 10 seconds for experimental purposes. The system was able to produce an abnormal activity alert, and this signal was relayed to the caregiver interface when this time was surpassed, using the IoT platform.

The same was used in terms of toilet activity monitoring. The ultrasonic sensor was programmed strategically in order to get a presence in the toilet area, and the duration occupied was recorded by the same timing system. In a real-life situation, the threshold may be set based on some normal use pattern, say 30-40 minutes. In experimental testing, testing with a low threshold of 10 seconds was employed, and the system was capable of detecting abnormal prolonged occupancy and sending alert notifications efficiently. These findings indicate that the suggested system can offer easy, but effective, monitoring of activities, allowing the early identification of abnormal behaviours in critical daily activities without involving wearable gadgets or human intervention.

The performance of the system in terms of differentiating between normal and abnormal activity situations is 111ategorizi in Table 3 according to the length of occupancy. The findings indicate that the suggested system could be efficient in 111ategorizing user behaviour by establishing a comparison between designated thresholds and the detected duration. In both bedding and toilet monitoring, there was no alert enabled under normal circumstances, and abnormal long occupancy was able to issue alert notifications. Despite the experimental validation with a lower threshold of 10 seconds, the logic of the system can be adapted to real-life conditions, where thresholds can be changed to reflect real-life routines of a person (sleep and toilet use, 6-8 hours and 30-40 minutes, respectively).

Table 3: The Summarisation of Normal and Abnormal Observation Scenario

Scenario	Experimental Duration setup	Actual Duration setup	System Response
Bedtime occupancy (normal)	< 10 seconds	<6-8 hours	No alerts
Bedtime occupancy (abnormal)	>10 seconds	>6-8 hours	Alert triggered
Toilet usage (normal)	< 10 seconds	<30 minutes	No alerts
Toilet usage (abnormal)	>10 seconds	>30 minutes	Alert triggered

These results show that a simple ultrasonic sensor can be used to conduct time-based monitoring to reliably detect abnormal behaviour without the need to have any wearable devices or the active participation of the users. The method is especially applicable to older patients, since it will reduce the cognitive load and provide continuous and non-invasive care. Combined with environmental hazard detection, the system can improve overall situational awareness in the residential setting, allowing for faster behavioural and other safety-based risks.

Conclusion

The paper outlined the design and prototype development of a human-friendly IoT fire detection and activity tracking system to increase the safety of the elderly residing on their

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 11 Issue 44 (September 2026) PP. 101-114
own. The proposed system combines multi-sensory environmental hazard detection, such as gas, flame, temperature and humidity protection, with occupancy-based activity monitoring that is performed with the help of ultrasonic sensing. The main component is an ESP32 microcontroller, which allows processing data in real time, creating local alerts, and communicating over the Blynk and Telegram services remotely.

A scaled residential system proved through experimental validation that the system can be reliably used to detect fire-related hazards and to identify the presence of abnormal activity patterns in important regions of the premises (bedding and toilet spaces). Close attention should be paid to these high-risk areas since the elderly are likely to get involved in accidents such as falling at night or wasting a long time in the bathroom. The system offers early warning and helps caregivers to intervene in time by integrating environmental sensing with time-based activity analysis. The proposed system offers a simple, affordable, and easy-to-operate solution that would enhance the safety of the elderly and allow living a normal life.

Acknowledgements:	The authors would like to express their sincere gratitude to Universiti Teknologi MARA Johor Branch, Pasir Gudang Campus for providing the necessary resources and support throughout the course of this research. Special appreciation is extended to colleagues and peers who contributed valuable insights and constructive feedback, which greatly enhanced the quality of this paper.
Funding Statement:	No Funding

Conflict of Interest Statement:	The authors declare that there is no conflict of interest regarding the publication of this paper. All authors have contributed to this work and approved the final version of the manuscript for submission to the Journal of Information System and Technology Management (JISTM)
Ethics Statement:	This study did not involve any human participants, animals, or sensitive data requiring ethical approval. The authors confirm that the research was conducted in accordance with accepted academic integrity and ethical publishing standards.
Author Contribution Statement:	All authors contributed significantly to the development of this manuscript. Noor Hafizah Khairul Anuar was responsible for the conceptualization, methodology, and overall supervision of the study. Nor Diyana Md Sin handled data collection and hardware testing. Suhaili Beeran Kutty conducted data analysis, and interpretation of results. Norhalida Othman and Nur Amalina Muhamad contributed to the literature review, drafting, and critical revision and final editing of the manuscript. All authors read and approved the final version of the manuscript prior to submission.

References

Anjum, F., Gani, R., Isty, M. N., Ali, M. S., & Hasan, M. (2024). IoT-Based Smart Home Automation System: Ensuring Safety for the Elderly. *Proceedings - 2nd International Conference on Advancement in Computation and Computer Technologies, InCACCT 2024*, 214–219. https://doi.org/10.1109/InCACCT61598.2024.10551092

Byun, N. (2019). Fire safety in planning of elderly residential facilities: a case study from Korea. *Journal of Asian Architecture and Building Engineering*, *18*(6), 617–626. https://doi.org/10.1080/13467581.2019.1696807

Dauda, A., Flauzac, O., & Nolot, F. (2024). A Survey on IoT Application Architectures. In *Sensors* (Vol. 24, Number 16). Multidisciplinary Digital Publishing Institute (MDPI). https://doi.org/10.3390/s24165320

David Chung Hu, B., Fahmi, H., Yuhao, L., Kiong, C. C., & Harun, A. (2018). Internet of Things (IOT) Monitoring System for Elderly. *2018 International Conference on Intelligent and Advanced System (ICIAS)*, 1–6. https://doi.org/10.1109/ICIAS.2018.8540567

Dev V. Savla, Soham Parekh, Ankit R. Gupta, Devansh Agarwal, & Narendra M. Shekokar. (2020, October 7). ResQ - Smart Safety Band. *Proceedings of the 4th International Conference on LoT in Social, Mobile, Analytics and Cloud (ISMAC 2020)*.

Karemaker, M., ten Hoor, G. A., Hagen, R. R., van Schie, C. H. M., Boersma, K., & Ruiter, R. A. C. (2021). Elderly about home fire safety: A qualitative study into home fire safety knowledge and behaviour. *Fire Safety Journal*, *124*. https://doi.org/10.1016/j.firesaf.2021.103391

Khokher, B., Dhivya, M., Swetha, D., Anila, D., Naik, A. G., & Shwetha, S. (2023). IoT-based Intelligent Modeling of Security Monitoring System for Human Safety. *2023 International Conference on Computer Communication and Informatics, ICCCI 2023*. https://doi.org/10.1109/ICCCI56745.2023.10128230Kotronis, C., Politi, E., Routis, I., Nikolaidu, M., & Dimitrakopoulos, G. (2018). Remote Elderly Monitoring Systems on a Human-centric Perspective. *Mediterranean Conference on Information Systems (MCIS)*. https://aisel.aisnet.org/mcis2018/7

Nunoo, D., & Eze, J. (2024). England: General Population Health Landscape. *2024 International Conference on Decision Aid Sciences and Applications (DASA)*, 1–7. https://doi.org/10.1109/DASA63652.2024.10836589

Qun Jin, Bo Wu, Shoji Nishimura, & Atsushi Ogihara. (2016). Ubi-Liven: A Human-Centric Safe and Secure Framework of Ubiquitous Living Environments for the Elderly. *2016 International Conference on Advanced Cloud and Big Data*. https://doi.org/DOI10.1109/CBD.2016.50

Rubesh Kumar, T., Attar, H., Sankar, R., Sivakumar, J., Dinesh, M., & Sahare, S. B. (2025). Cost-Efficient Self-Controlled Automated Home Management System in the IoT Context. *Proceedings - 1st International Conference on Frontier Technologies and Solutions, ICFTS 2025*. https://doi.org/10.1109/ICFTS62006.2025.11032050

Sin, A. K., Ahmad, A., Zaman, H. B., & Sulaiman, R. (2014). A wearable device for the elderly: A case study in Malaysia. *Proceedings of the 6th International Conference on Information Technology and Multimedia*, 318–323. https://doi.org/10.1109/ICIMU.2014.7066652

Suntiamorntut, W., Charoenpanyasak, S., & Ruksachum, J. (2011). An elderly assisted living system with wireless sensor networks. *2011 4th Joint IFIP Wireless and Mobile Networking Conference (WMNC 2011)*, 1–6. https://doi.org/10.1109/WMNC.2011.6097215

Tun, S. Y. Y., Madanian, S., & Mirza, F. (2021). Internet of things (IoT) applications for elderly care: a reflective review. *Aging Clinical and Experimental Research*, *33*(4), 855–867. https://doi.org/10.1007/s40520-020-01545-9

Wu, Z., & Deng, D. (2011). Risk management on social security in China from the perspective of aging population. *Proceeding of the International Conference on E-Education, Entertainment and e-Management*, 107–109. https://doi.org/10.1109/ICeEEM.2011.6137855

Yang, C.-F., & Sun, C.-S. (2016). Discussing the Influence of Aging on Taiwan's Design Industry. *2016 IEEE Symposium on Service-Oriented System Engineering (SOSE)*, 289–292. https://doi.org/10.1109/SOSE.2016.21