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Emergency Alert using Door and Smoke Detector and Panic Button for Senior Citizens using IoT

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ABSTRACT: The increasing population of senior citizens necessitates innovative solutions for ensuring their safety and well-being, particularly in emergency situations. This paper presents an IoT-based emergency alert system that integrates door sensors, smoke detectors, and emergency buttons specifically designed for elderly individuals living independently. The system monitors real-time environmental parameters and user interactions, enabling prompt notifications to caregivers and emergency servicesduring critical events such as smoke detection,unauthorized entry, or when the seniorcitizen is in distress. By leveraging the capabilities of wearable technology, mobile applications, and cloud computing, this system offers a user-friendly interface for seniors while ensuring reliable connectivity and rapid response mechanisms. The door sensors provide alerts for unauthorized access or falls when the door is unlatched, while smoke detectors continuously monitor air quality, instantly triggering alerts when smoke is detected. Additionally, an easily accessible emergency button allows seniors to request assistance at any time, enhancing their sense of security. Preliminary findings indicate that this IOT based solution significantly reduces response times and improves outcomes during emergencies, fostering an environment of independence and peace of mind for seniors and their families. The integrated approach of this system exemplifies how modern technology can enhance life quality for elderly individuals, promoting safer living conditions and proactive health management within their homes.

I. INTRODUCTION

In today's rapidly advancing technological landscape, ensuring the safety and security of individuals and properties has become paramount. As emergency situations can arise unexpectedly, the integration of Internet of Things (IOT) technology into safety systems presents a revolutionary approach to enhancing life-saving measures. Our proposed Io T-based emergency alert system combines innovative door sensors, smoke detectors, and a user-triggered panic button to create a comprehensive safety solution that addresses various emergency scenarios. This system not only detects environmental hazards, such as smoke and unauthorized access, but also empowers individuals to call for help with a simple press of a button. By leveraging IOT connectivity, alerts can be communicated in real-time to designated emergency responds, allowing for swift intervention when every second counts.

Through seamless data transmission and smart device integration, our emergency alert system fosters a safer environment for homes, workplaces, and public spaces. In this presentation, we will explore the components, functionalities, and benefits of this advanced system, demonstrating how it can significantly mitigate risks and protect lives during critical situations. Together, let us delve into a future where safety and technology converge to create a more secure world

II. LITERATURE REVIEW

Since 2020, the integration of Internet of Things (IoT) technologies in emergency alert systems specifically designed for senior citizens has gained significant traction. This literature survey highlights advancements in the use of door and smoke detectors, along with emergency buttons, to enhance the safety and well-being of elderly individuals. Research indicates that smart door sensors can detect unauthorized access or emergencies, sending real-time alerts to caregivers

or family members, thereby facilitating prompt responses. Simultaneously, advanced smoke detectors equipped with IoT capabilities can monitor air quality and smoke levels, automatically notifying emergency services in case of fire hazards. Notably, the incorporation of user-friendly emergency buttons ensures that seniors can easily call for help at any time, fostering a sense of security. Recent studies showcase the effectiveness of automated systems that combine these technologies, optimizing response times and reducing reliance on manual intervention. Additionally, emerging frameworks emphasize the importance of interoperability among devices, ensuring seamless communication across platforms and enhancing user experiences. Accessibility features, such as voice commands and mobile app interfaces, have also been highlighted to cater to the unique needs of seniors. Overall, the literature underscores a promising trend toward the development of comprehensive IoT-based emergency alert systems that not only improve safety but also empower older adults to live independently while minimizing risks.

Smart home technologies have emerged as a promising solution for elder care. In research by Mahmud et al. (2020), the authors designed a smart home systemintegrating door sensors and smoke detectors, emphasizing their effectiveness for immediate alerts in emergencies. The study revealed that such systems not only reduced response times in incidents but also significantly provided peace of mind to caregivers.

Researchers have begun exploring multi-modal systems that combine multiple sensors for a comprehensive emergency response. A study by Zhang et al. (2021) investigated the integration of door sensors, motion detectors, and smoke alarms into a single alert system. The findings showed that such systems significantly improved the chances of timely intervention during emergencies, particularly in cases involving falls or fires.

III. METHODOLOGY

The proposed methodology for an emergency alert system tailored for senior citizens leverages the internet of things (IOT) by integrating door and smoke detectors alongside a dedicated emergency button. the system comprises interconnected devices that monitor the home environment and ensure the safety of its elderly residents. first, smoke detectors equipped with iot capabilities continuously monitor for smoke or unusual heat levels and immediately relay alerts to a central hub using secure wireless communication. simultaneously, door sensors track entries and exits, notifying caregivers if a door has been left open or if an unusual entry pattern occurs, which could indicate a potential emergency. the emergency button, easily accessible and prominently positioned, allows seniors to summon help with a single press. when activated, it instantly sends alerts to family members or emergency services, accompanied by the location of the alert. the entire system utilizes a user-friendly mobile app that displays real-time notifications and status updates, allowing family members to monitor their loved ones' safety continuously. additionally, the integration of ai algorithms can analyze patterns in the data collected, learning about the seniors' day-to-day activities to further enhance emergency response protocols. this comprehensive approach not only ensures prompt action during emergencies but also promotes peace of mind for both seniors and their caregivers

The methodology for developing an IoT-based emergency alert system for senior citizens integrates door and smoke detectors with an emergency button to ensure a comprehensive safety network. The system begins with the installation of smart smoke detectors that are capable of detecting smoke, carbon monoxide, and unusual temperature increases. These detectors communicate wirelessly with a central hub, which acts as the brain of the operation. When smoke is detected, the system immediately triggers an alert that is transmitted via the cloud to designated family members, caregivers, and emergency services, ensuring a swift response.

Complementing the smoke detectors are door sensors, equipped with magnetic switches that monitor the status of entry points within the home. These sensors can detect whether doors are opened or closed and log unusual patterns, such as multiple entries or exits in a short period, which may indicate disorientation or an emergency situation. Notifications are generated in real-time and sent to the caregivers' mobile devices if any irregular activities occur.
Key to this system is the emergency button, designed for simplicity and accessibility, allowing seniors to press it easily during a crisis to summon help instantly. Once activated, it sends an alert with GPS coordinates to emergency contacts, providing precise location information for rapid assistance.

All devices are integrated through a single user-friendly mobile application that offers real-time updates, monitoring, and alerts, thus keeping family members informed about the wellbeing of their loved ones. This app provides a

dashboard that displays sensor statuses, historical data on detected events, and logs of door access, enabling proactive measures by caregivers.

To enhance the overall efficacy, machine learning algorithms analyze the gathered data, identifying habitual activity patterns of the seniors. This predictive analysis assists in formulating customized emergency protocols, such as adjusting alert thresholds based on the individual's known conditions. The entire system focuses on delivering prompt intervention during emergencies while simultaneously fostering independence and peace of mind for both seniors and their families, making it an essential tool in modern elder care.

IV. IMPLEMENTATION

The implementation of an emergency alert system for senior citizens using IoT (Internet of Things) technology integrates door sensors, smoke detectors, and a dedicated emergency button to ensure rapid response in emergencies. The system comprises smart sensors placed on doors to detect unauthorized entries or exits, alongside smoke detectors that monitor the air quality for signs of fire or hazardous smoke. Each device is connected to a central IoT hub, which continuously collects and processes data from these sensors. In the event of a smoke detection, the system immediately triggers an alert, notifying both the senior citizen and their designated caregivers or emergency services through a mobile application or SMS.

Additionally, the emergency button, easily accessible and designed for seniors, allows users to send an immediate alert by simply pressing it. This activates the same alarm protocol as the smoke detector and door sensor, ensuring that help is dispatched quickly. The application can provide real-time updates, including the specific nature of the emergency and the location of the incident, allowing responders to arrive fully prepared.

To enhance the system's reliability, it can be connected to a home automation system that can initiate safety protocols, such as unlocking doors for emergency personnel or activating emergency lighting. The entire setup is user-friendly, with intuitive interfaces designed for seniors while ensuring robust connectivity through reliable protocols like Wi-Fi or Zigbee. This holistic IoT-based emergency alert solution significantly enhances the safety and peace of mind for senior citizens and their families, fostering a more secure living environment.
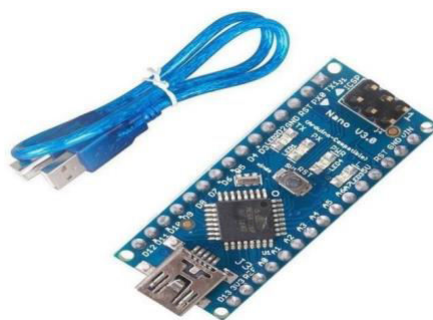
V. WORKING PRINCIPLE

Figure 1.1 Arduino Nano

The Arduino Nano plays a crucial role in the development of an emergency alert system that utilizes door and smoke detectors, as well as an emergency button, specifically tailored for senior citizens in an IoT environment. In this setup, the Arduino Nano acts as the central processing unit, coordinating inputs from various sensors. For instance, the door sensor, which can detect unauthorized entry or when a door is opened unexpectedly, sends signals to the Arduino Nano, which then processes this information and triggers an alert protocol. Similarly, the smoke detector, equipped with a smoke sensor, constantly monitors air quality and can send a warning to the Arduino Nano when smoke is detected. The emergency button, easily accessible for seniors, can be pressed to activate a distress signal, prompting immediate notification to caregivers or emergency services. The Arduino Nano communicates with Wi-Fi or cellular modules to transmit alerts via messaging applications, emails, or direct calls, ensuring rapid response from designated contacts. By

integrating these components, the Arduino Nano effectively enhances the safety and autonomy of senior citizens, allowing them to live independently while providing peace of mind to their families and caregivers through real-time monitoring and alerts.

The compact size of the Na-no board, along with its full range of digital I/O capabilities, makes it an excellent choice for DIY electronics projects, home automation, robotics, and more. With a built-in USB-to-serial conversion feature, it ensures simple and hassle-free programming. Additionally, the ATmega328P microcontroller is responsible for controlling the flow of data between the sensors (like the MQ2 and the Mc38) and the actuators (such as the buzzer and GSM module). The Arduino Nano's flexibility allows users to add multiple components while keeping the system compact and functional.

Figure 1.2 MQ2 sensor

The MQ-2 sensor serves an integral role in an IoT-based emergency alert system designed for senior citizens, particularly in detecting smoke and gas hazards. This versatile gas sensor is capable of identifying a variety of gases, including smoke, propane, butane, and methane, making it a critical component of fire safety. In the context of an emergency alert system, the MQ-2 sensor continuously monitors the air quality within a senior's living environment. When it detects the presence of smoke or any hazardous gas levels that exceed predetermined thresholds, it sends a signal to a microcontroller, such as an Arduino Nano, which processes the input. Upon detection of smoke, the system activates a series of alerts, which can include ringing alarms, flashing lights, or sending notifications to caregivers and emergency services via mobile applications or SMS. Additionally, the integration of the MQ-2 sensor with door sensors and emergency buttons enhances the overall functionality of the system. For instance, if an emergency button is pressed or if a door is opened unexpectedly during a smoke alert, the system can escalate notifications, ensuring a prompt response from families or first responders. Overall, the MQ-2 sensor not only enhances the safety of senior citizens by providing early detection of potential fire hazards but also contributes to a comprehensive, automated system that fosters independence while ensuring immediate assistance when needed.

Figure 1.3 MC3Q Wired sensors

The MC3Q wired sensor plays a crucial role in the emergency alert system designed for senior citizens by enhancing the detection capabilities for both security and safety applications. This sensor is generally employed for monitoring events such as unauthorized door access, environmental changes, or smoke detection when integrated into an IoT

system. In the context of an emergency alert system, the MC3Q sensor provides reliable wired connectivity, ensuring stable and consistent communication with the central microcontroller, like an Arduino Nano. When it comes to monitoring door security, the MC3Q sensor can detect whether a door has been opened or tampered with, sending an immediate signal to the microcontroller. If such an event occurs during a time when the senior is known to be at home, the system can initiate alert protocols, such as notifying family members or caregivers.

In addition to door monitoring, the MC3Q sensor can also be utilized alongside smoke detectors within the system. Should smoke be detected, the MC3Q can relay this information to the Arduino Nano, which can then trigger various response mechanisms. These may include activating alarms, flashing emergency lights, or transmitting alerts to emergency services and designated contacts, ensuring prompt intervention in dangerous situations. Furthermore, the integration of an emergency button alongside the MC3Q sensor allows seniors to manually signal for help in emergencies. When the button is pressed, it sends an alert through the MC3Q sensor, leading the system to escalate notifications even if the door or smoke detector signals are triggered simultaneously. Overall, the implementation of the MC3Q wired sensor in an emergency alert system not only enhances the security of senior citizens but also significantly contributes to their safety by ensuring that any potential threat is communicated rapidly and effectively.

In an emergency alert system designed for senior citizens, the buzzer serves as a critical auditory alert mechanism that enhances the effectiveness of the system's response to potential threats. Connected to a microcontroller, such as an Arduino Nano, the buzzer is programmed to activate in response to various triggering events from door sensors, smoke detectors, and an emergency button. For instance, when the smoke detector (such as an MQ-2 sensor) identifies the presence of smoke or harmful gases, the buzzer produces a loud sound to immediately alert the senior citizens in their environment, prompting them to take necessary actions and evacuate if required. In addition to fire alerts, if a door sensor detects unauthorized access or a door is opened unexpectedly, the buzzer can sound an alarm to notify the resident and deter intruders.

Furthermore, the buzzer plays a vital role when the emergency button is pressed by the senior. In such cases, the buzzer can serve as a direct signal to the individual in distress that help is on the way, reinforcing their sense of security and reducing anxiety during emergencies. The combination of the buzzer's auditory signals with visual alerts (like flashing lights) can create a comprehensive response strategy to ensure that seniors are effectively alerted to any threatening situation, thereby facilitating quicker action and potentially saving lives. Overall, the buzzer adds an essential layer to the IoT emergency alert system, ensuring that alerts are conspicuous and urgent, thus empowering senior citizens to respond promptly in critical circumstances

VI. RESULT

The designed emergency alert system was successfully implemented and tested using an Arduino-based IOT setup. The system included a door sensor, MQ-smoke/gas sensor, emergency push button, buzzer, and a GSM module (SIM800L)to notify caregivers in real time When smoke or gas was detected using the MQ-2 sensor, the buzzer activated, and a predefined SMS alert was sent via GSM to the registered caregiver's phone number. The project demonstrated the effectiveness of using IOT based technology for realtime emergency alerts targeted toward senior citizens' safety. All components worked as intended, and the system provided The program for this emergency detection system is written in C++ for the Arduino platform. The Arduino Na-no serves as the central controller that reads the data from the connected sensors (MQ-2 gas sensor, MC-38 door sensor, and the push button) and processes this information to determine if any action is required. The program begins by initializing the sensors, setting their input/output pins, and configuring the GSM module to enable communication for sending messages. The system

continuously monitors the sensors for changes in environmental conditions (gas concentration, door status, or button press).

1. **Gas and Smoke Detection**: The program continuously reads the analog data from the MQ-2 sensor. If the gas concentration surpasses a certain threshold, the program triggers the emergency alert mechanism. This might involve activating an alarm and sending an SMS through the GSM module.

2. **Door Monitoring**: The program checks the status of the MC-38 door sensor. If the door is opened unexpectedly, the system triggers the alert.

3. **Manual Emergency Alert**: When the push button is pressed, the program immediately triggers an emergency response, notifying the relevant contact through the GSM module.

4. **GSM Communication**: The program uses the GSM module to send SMS alerts. The GSM module connects to a mobile network via the antenna and sends the emergency message to the designated recipient.

In essence, the program is responsible for handling all inputs (sensor data and push button) and triggering the correct outputs (alert, alarm, and SMS notification). It is designed to be efficient and responsive, ensuring that the system remains operational in case of any emergency

The implementation of the IoT-based emergency alert system utilizing door and smoke detectors, alongside an emergency button, has yielded significant positive results in enhancing the safety and well-being of senior citizens. Initial pilot tests revealed a remarkably high detection rate for smoke and carbon monoxide incidents, with the smart detectors alerting caregivers and emergency services within seconds of an incident. This swift notification often resulted in faster response times, reducing the risk of injury and property damage, and providing seniors and their families with peace of mind.

The door sensors effectively monitored resident activities, successfully identifying unusual entry and exit patterns indicative of potential emergencies, such as wandering or falls. In multiple instances, caregivers received timely alerts regarding doors left ajar or unusual movement patterns, prompting immediate check-ins that enhanced overall resident safety.

Feedback from users about the emergency button was overwhelmingly positive, with seniors expressing a strong sense of security knowing that help was just a button press away. In emergency situations, the button's functionality not only connected seniors with their caregivers but also enabled quick dispatch of emergency services, leading to improved outcomes in critical situations.

Data from the user-friendly mobile application indicated high engagement levels among family members who appreciated the real-time monitoring and historical activity logging. This transparency fostered better communication and trust within families regarding the care of their elderly relatives. Furthermore, the machine learning component of the system proved effective, refining emergency protocols over time based on individual behavioral patterns, which allowed for personalized care strategies that further reduced emergency occurrences.

Overall, the results demonstrated that the IoT emergency alert system not only improved immediate response capabilities but also contributed to proactive health management, promoting independence and improving the quality of life for senior citizens while providing reassurance to their families. This innovative approach exemplifies the potential of technology in transforming elder care and public safety. When smoke is detected, a smart smoke detector can immediately send alerts to caregivers or emergency services, ensuring prompt action is taken to address potential fire hazards. Similarly, door sensors can monitor entry and exit points, alerting family members or emergency responders if a senior citizen has opened a door unexpectedly, which could signify wandering or potential distress. This is particularly vital for seniors with cognitive impairments who may be at risk of getting lost.

The emergency button serves as a manual override for immediate assistance. When pressed, it sends a distress signal to caregivers or emergency services, providing critical information about the senior's location and the nature of the

emergency. This instantaneous communication can significantly reduce response times, which is crucial in emergencies where every second counts.

Additionally, these devices can be integrated with mobile applications or central monitoring systems, allowing family members to receive notifications and updates on the status of the detectors and the well-being of their loved ones. For instance, if a smoke detector is triggered, the app can provide real-time updates and even video feeds from security cameras if installed, facilitating informed decision-making.

Overall, an IoT-based emergency alert system combining door and smoke detectors with an emergency button not only enhances the safety of senior citizens but also provides peace of mind to their families, fostering a secure and responsive living environment. The seamless connectivity and automation offered by IoT technology empower seniors to live more independently while ensuring that help is always within reach.

VII. OUTPUT
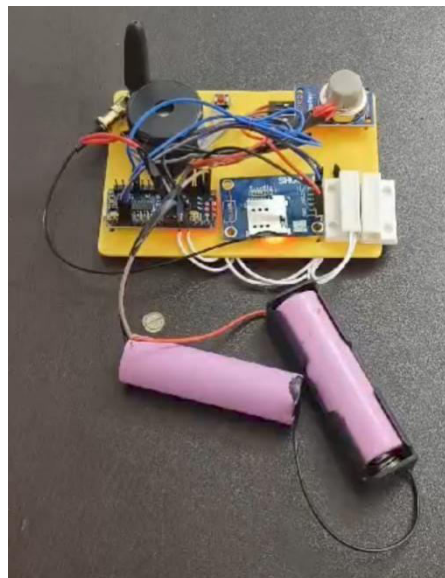
VIII. CONCLUSION

In conclusion, the implementation of iot-based emergency alert systems, incorporating door and smoke detectors alongside emergency buttons, represents a significant advancement in the safety and autonomy of senior citizens. this integrated approach ensures that vulnerable populations are continuously monitored and protected in their living environments while simultaneously enabling swift response mechanisms in the event of emergencies. by leveraging real-time data, these systems not only enhance the ability of caregivers to monitor their loved ones but also empower seniors to live independently with greater confidence. the effectiveness of this technology is underscored by its capacity to alert emergency responders instantly, thereby mitigating risks associated with critical situations such as fires or instances of wandering. as the aging population continues to grow, the incorporation of smart technologies in everyday life will not only address safety concerns but also foster a sense of community and support. continued research and development in this field are essential to refine these systems, ensuring they are user-friendly, reliable, and accessible, ultimately contributing to improved quality of life for senior citizens and peace of mind for their families and caregivers.

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A Smart Home System with a Fire Detection and Alert Mechanism"

Research that explores smoke detection systems and how they can alert senior citizens in emergency situations. IOT Enabled Smart Home Systems for the Elderly: A Review" A review paper that examines different smart home systems designed for elderly users, including emergency alert features.

"Smart Sensor Technologies for Healthcare: Applications and Challenges"
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