E-PROCEEDINGS

INTERNATIONAL TINKER INNOVATION & ENTREPRENEURSHIP CHALLENGE (i-TIEC 2025)

"Fostering a Culture of Innovation and Entrepreneurial Excellence"

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PTDI, UiTM Cawangan Johor
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A-ST090: IOT-BASED FIRE AND GAS ALARM FOR ENHANCED PROTECTION

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ABSTRACT

This technical report documents the design and simulation of an Internet of Things (IoT)-Based Fire and Gas Alarm for Enhanced Protection for Efficient Emergency Response utilizing ESP32-based sensors and connect to mobile phone. The system incorporates a Fire Sensor, DHT11 Temperature Sensor, and a MQ2 Gas sensor, complemented by a Liquid Crystal Display (LCD) for real-time data visualization. The inclusion of a Wi-Fi module enhances the system's capabilities, transforming it into an Internet of Things (IoT) device capable of receiving notification about the alarm system. Additionally, a fire alarm has been integrated as one of the systems to detect only fire and temperature. Leveraging Tinkercad's simulation platform, the ESP32 microcontroller processes data from these sensors to monitor and manage critical parameters in the house. Responsive components, including LEDs for visual alerts and a buzzer for connecting the sensor, enhance the system's functionality. The Arduino code incorporates intelligent decision-making, dynamically controlling them, activating LEDs and buzzer based on predefined temperature, fire, and gas sensor conditions, and interfacing with the Wi-Fi module for connectivity to the user's phone. The LCD displays various information screens to alert people on what danger they are facing off. This IoT-Integrated Next-Gen Fire and Gas Alarm System serves as a versatile and scalable solution to automated censoring the conditions of surrounding area than can lead to a fire issue with the added capability of IoT connectivity for efficient emergency response.

Keywords: Fire Sensor, Gas Sensor, and Temperature Sensor, Wi-Fi module, Internet of Things (IoT), Arduino-based Sensor, and LCD Display

1. Product Description

The IoT-Based Fire and Gas Alarm is an advanced safety system designed to detect fire and gas hazards quickly and accurately. It uses sensors to monitor temperature, gas levels, and flames, ensuring constant protection of the surroundings. The system is powered by an ESP32 microcontroller, which processes the data and displays important information on an LCD screen. Additionally, it includes an automatic fan that activates when high gas levels are detected, helping to ventilate the area and reduce potential dangers. A Telegram bot sends instant alerts to users' smartphones, enabling them to stay informed and take timely action, even remotely. This system is designed to identify unusual patterns that indicate danger, helping reduce false alarms and improving reliability. Its flexible design makes it easy to set up in homes, offices, or factories and allows it to integrate with existing safety setups. With real-time monitoring, automatic responses, and simple operation, this IoT-based alarm

system supports users in protecting lives and property, offering a smarter way to ensure safety. **Figure 1** illustrates the operational flow of the IoT-Based Fire and Gas Alarm system, where sensors monitor for gas, fire, or high temperature (above 70°C) to activate alerts via buzzer, LED, LCD, and a mobile app for real-time notifications. **Figure 2** show the Comparison of Actual and Predicted Gas Sensor Value Patterns Using Regression Model.

2. Method Flow Chart and Product Model

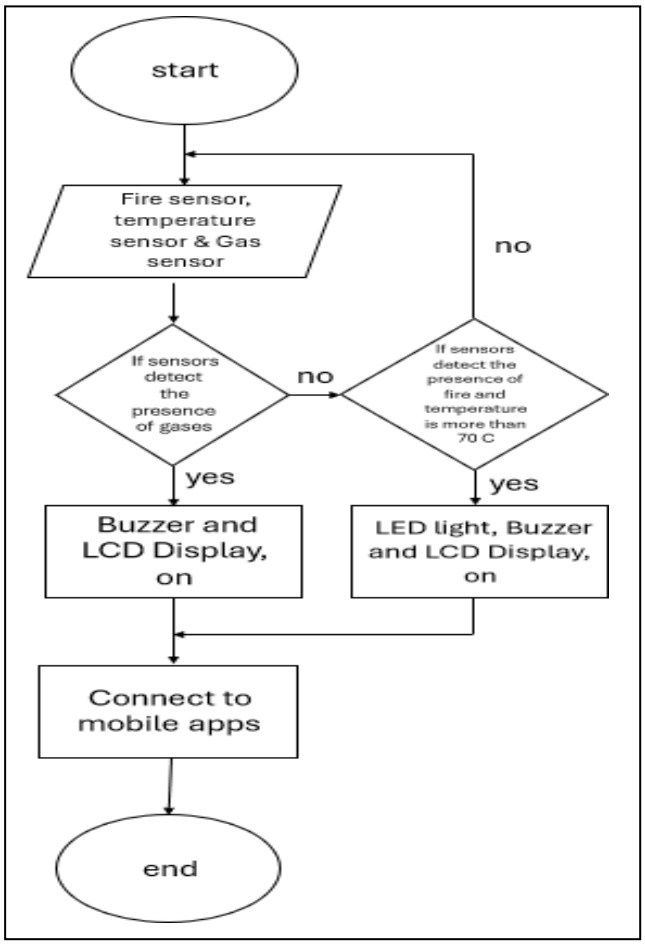

Figure 1. Model Flowchart

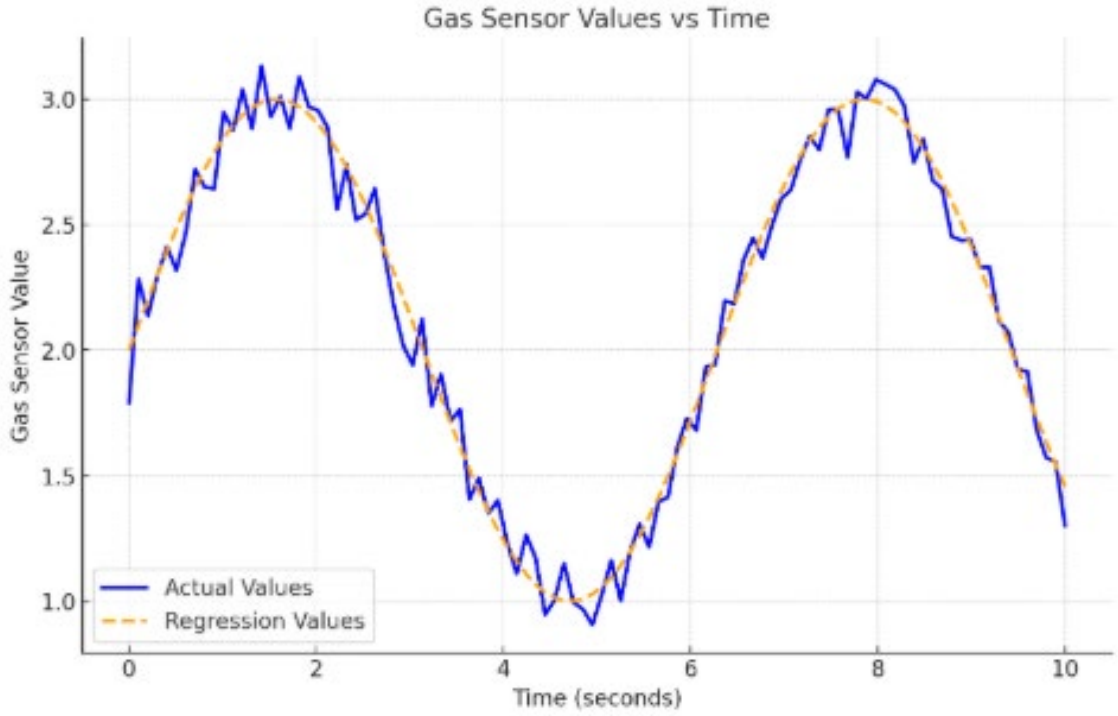

Figure 2. Comparison of Actual and Predicted Gas Sensor Value Patterns Using Regression Model

3. Novelty and uniqueness

The novelty of this project lies in its application of The IoT-Based Fire and Gas Alarm system stands out for its integration of real-time monitoring, multi-sensor fusion, and IoT technology. By combining gas, temperature, and flame sensors, the system provides comprehensive hazard detection with reduced false alarms. A unique feature is the automatic ventilation mechanism, where a fan activates upon detecting high gas levels, minimizing the risk of dangerous gas buildup. The system also ensures users are alerted locally through an LCD, buzzer, and LED indicators, as well as remotely via a mobile application, enabling timely responses to potential hazards. Another key innovation is the system's anomaly detection capability, which identifies irregular patterns in sensor data to predict and mitigate risks before they escalate. This intelligent feature, paired with its scalable IoT-based design, allows seamless integration into existing safety setups for homes, offices, or industrial facilities. Overall, the system offers a smarter and more proactive approach to safeguarding lives and property, setting it apart from traditional fire and gas alarm systems.

4. Benefit to mankind

The IoT-Based Fire and Gas Alarm system provides important benefits by improving safety and preventing dangerous situations. It can quickly detect gas leaks, fires, and high temperatures, helping to avoid injuries, loss of life, and damage to property. The system sends alerts through mobile apps, allowing users to act quickly, even if they are not at the

location, which can save lives during emergencies. The system's automatic fan helps reduce gas buildup, lowering the risk of explosions or harm. Its simple design makes it easy to set up in homes, offices, and factories, ensuring more people can use it to stay safe. By offering better protection and faster responses to hazards, this system helps create safer living and working environments for everyone.

5. Innovation and Entrepreneurial Impact

The system is innovative because it combines modern IoT technology with sensors for gas, fire, and temperature, along with features like remote alerts and automatic ventilation. Unlike regular alarm systems, it offers smarter and faster responses to hazards. It's simple and flexible design makes it useful in homes, offices, and factories, making it suitable for a wide range of users. This system also has strong business potential. As more people and industries look for smart and reliable safety solutions, this product stands out as an affordable and effective option. Entrepreneurs can use this system to create businesses in the growing field of smart safety devices. It not only helps improve safety and save lives but also opens new opportunities in the smart technology market.

6. Potential commercialization

This IoT-Based Fire and Gas Alarm system has strong potential for commercialization due to its practical features and wide range of applications. Its ability to provide real-time monitoring, instant alerts, and automatic responses makes it an appealing safety solution for homes, offices, factories, and other environments. The system's affordability, ease of installation, and compatibility with existing infrastructures further increase its appeal to a broad audience. With the growing demand for smart and connected safety devices, this system can be marketed to individuals, businesses, and industries seeking reliable and innovative solutions for fire and gas hazard detection. Its unique combination of features, such as multi-sensor monitoring and IoT integration, positions it as a standout product in the market. Entrepreneurs and companies can commercialize this system by targeting smart home, industrial safety, and IoT device markets, tapping into the increasing need for smarter and safer living and working spaces.

7. Acknowledgment

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8. Authors' Biography

Muhammad Aiman Sulhan is a Diploma student in Electrical Engineering (Electronics) at UiTM, Johor, Pasir Gudang Campus. With two years of academic and practical experience, he is skilled in electrical equipment and PCB design. Passionate about innovative techniques, he aims to advance his knowledge and contribute to engineering and research.

Muhammad Afiq Hakimi Bin Rosli is a Student at the UiTM, specializing in electrical engineering that specifically leads to computer. With over 2 years of experience, he has pioneered methods for designing software prototypes for the model and coding in C++ for the model.

Nor Diyana Md Sin is a lecturer in the Faculty of Electrical Engineering of the Universiti Teknologi MARA (UiTM), Malaysia. She received her PhD in Electrical Engineering (Nanoelectronics) from the Universiti Teknologi MARA (UiTM), Malaysia in 2014. She earned her degree in in Electrical Engineering with honors from Universiti Teknologi MARA (UiTM). Her research interest are in the area of Digital system, Internet of Things, sensor, metal oxide semiconductors, nanotechnology and nanodevices.