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
Kampus Pasir Gudang

ORGANIZED BY:

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A-ST050: FIRE AND SMOKE ALERT FOR ENHANCED SAFETY AND FAMILY ENVIRONMENT FUMISAFE

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ABSTRACT

The FUMISAFE (Fire and Smoke Alert for Enhanced Safety and Family Environment) project introduces an innovative solution to improve fire safety in residential spaces. Traditional fire alarm systems primarily rely on detecting smoke, which often delays response times in scenarios where flames appear first. FUMISAFE leverages advanced infrared flame sensors, smoke detectors, and IoT technology to provide quicker and more accurate identification of fire hazards. With IoT integration, the system offers real-time updates directly to the user's mobile phone, ensuring immediate awareness and response. Furthermore, the system is solar powered, making it environmentally friendly and independent of grid electricity, ensuring continuous functionality even during power outages. FUMISAFE combines essential components, including an LCD display for on-site notifications, a buzzer and LED indicators for local alerts, and a microcontroller that processes data for comprehensive monitoring. Its affordability, reliability, and eco-friendly design make it a practical choice for modern households. Beyond safeguarding lives and properties, FUMISAFE is aligned with the United Nations Sustainable Development Goal (SDG) 11: Sustainable Cities and Communities by enhancing safety and promoting the adoption of sustainable technology. Its strong commercialization potential makes it a scalable and adaptable solution for smart home applications.

Keywords: Fire Safety, IoT Integration, Solar Powered System, Flame Smoke Detection

1. Product Description

The FUMISAFE system integrates multiple sensors with an Arduino Uno microcontroller to provide a comprehensive fire and smoke detection solution as shown in **Figure 1** . It operates by continuously monitoring environmental conditions using a combination of a smoke sensor, a flame sensor, and a temperature sensor. The smoke sensor detects the presence of harmful gases or smoke, while the flame sensor identifies unique light signatures emitted by flames. The temperature sensor monitors the ambient temperature to detect potential fire-related anomalies.

When a hazard is detected, the Arduino processes the data and activates multiple outputs:

i. A buzzer emits a loud alarm to alert individuals in the vicinity.

ii. An LED indicator lights up as a visual alert.
iii. An LCD screen displays real-time information, such as temperature readings and the detection of smoke or fire.

Additionally, the system includes IoT capabilities for remote monitoring. Notifications are sent to the user's mobile phone, ensuring they are alerted even when away from home a depicts in **Figure 2**. The system is also solar-powered, enabling energy-efficient operation and reliability during power outages. This setup provides a cost-effective, real-time, and ecofriendly solution for fire and smoke detection in residential environments.

2. Schematic and Block Diagram

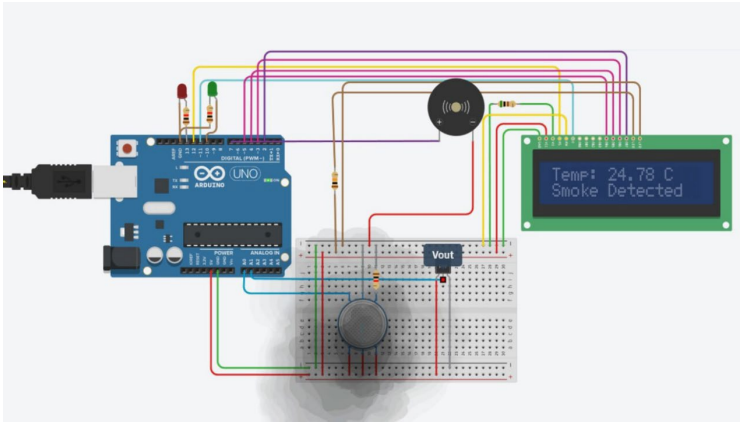

Figure 1. FUMISAFE System Circuit Simulation Diagram: Integration of Sensors and Arduino for Real-Time Fire and Smoke Detection with LCD Display Alerts

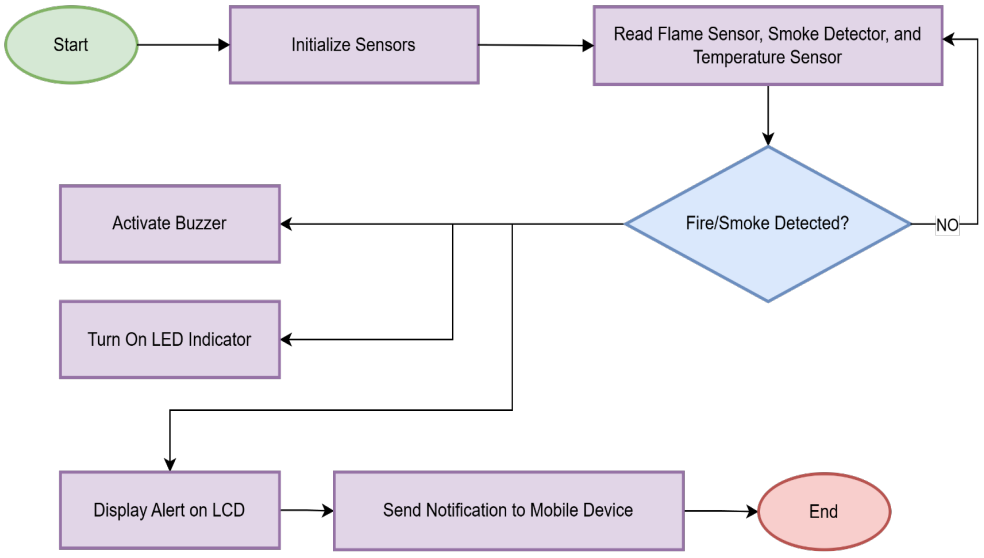

Figure 2. Flowchart of the FUMISAFE System: Real-Time Fire and Smoke Detection Process with Integrated Alerts and Notifications.

3. Novelty and uniqueness

The FUMISAFE system introduces a unique combination of advanced features for fire and smoke detection, setting it apart from conventional systems. Unlike standard smoke- based detectors, FUMISAFE employs a dual-sensor system that integrates flame and smoke detection with temperature monitoring to provide precise and rapid hazard identification. It also incorporates IoT technology, allowing real-time alerts to be sent directly to the user's mobile device, ensuring immediate awareness even when users are not at home. Furthermore, FUMISAFE is solar-powered, making it eco-friendly and operational during power outages, a feature rarely found in similar systems. The integration of an LCD display for on-site updates and local alarms via a buzzer and LED adds redundancy to the notification process. The system's scalability and compatibility with modern smart home environments underscore its innovative edge, making it a pioneering solution in residential fire safety.

4. Benefit to mankind

FUMISAFE significantly enhances residential fire safety by providing a faster, more reliable detection system that can save lives and reduce property damage. Its ability to send real-time notifications ensures users are promptly alerted, enabling quicker responses to emergencies. The solar-powered design supports energy efficiency, reducing reliance on non-renewable resources and ensuring functionality even during electrical outages. By minimizing fire-related casualties and economic losses, FUMISAFE contributes to public safety and peace of mind. Additionally, the system promotes sustainable living, aligning with environmental preservation efforts, and is affordable enough for widespread adoption, making advanced safety technology accessible to diverse communities.

5. Innovation and Entrepreneurial Impact

FUMISAFE exemplifies innovation by integrating IoT, renewable energy, and multi- sensor detection into a unified safety system, addressing critical societal concerns. Aligned with the Madani Economy, it supports (d) "Industries based on energy transition" through its use of renewable energy, (k) "Digital and technology-based industries" via IoT integration, and (o) "Empowering MSMEs" by offering an affordable, modular design that encourages entrepreneurial customization for diverse markets. FUMISAFE fosters a culture of innovation, problem-solving, and collaboration, bridging academia and industry. It inspires the development of market-driven, impactful technologies, promoting entrepreneurship by encouraging the commercialization of smart, socially impactful solutions.

6. Potential commercialization

FUMISAFE has strong commercialization potential due to its unique features, affordability, and relevance in the smart home market. Its eco-friendly, solar-powered design attracts green consumers, while IoT capabilities appeal to tech-savvy homeowners. Cost-effective for mass production, it suits diverse economic segments and can be marketed standalone or integrated into smart home systems. Partnerships with real estate developers, home automation firms, and safety distributors can boost adoption, making FUMISAFE a competitive fire safety solution.

7. Authors' Biography

Nur Adam Norazmi is a diploma student in Electrical Engineering at Universiti Teknologi MARA (UiTM), Pasir Gudang. Passionate about innovation and technology, he is actively developing his skills in integrating smart systems and renewable energy. His dedication to learning reflects his commitment to excelling in the field of engineering.

Aznilinda Zainuddin obtained both her bachelor's degree and master's degree in electrical engineering from Universiti Teknologi MARA (UiTM), Shah Alam, Malaysia. Her research activities are centered on engineering education, inventive problem-solving, and space weather. Currently, she is a senior lecturer at the Electrical Engineering Studies, UiTM Johor Branch, Pasir Gudang Campus and her current research focuses on the development of prediction models for geomagnetically induced current.

Munirah Onn is a PhD student at the Faculty of Chemical and Energy Engineering, Universiti Teknologi Malaysia (UTM), and a senior lecturer at UiTM, Pasir Gudang. She holds a science degree from UiTM and a master's in science from UTM. She received UiTM's Best Degree Student, Best Thesis Writing, and Vice- Chancellor Awards, as well as UTM's Best Master Programme Student award. She has 4 years of industrial experience as a Production Engineer, Research Officer, and Executive Chemist. Her research focuses on renewable and advanced materials.

Nur Faizal Kasri earned his bachelor's degree in electrical engineering with a focus on Mechatronics in 2011, followed by a Master's in 2014 and a Ph.D. in 2023, with research on Pulsed Electric Field Technology for Food Pasteurization. Now, as a senior lecturer at UTM, he actively engages in various research fields, specializing in Food Technology, Renewable Energy, and Inverter Design, making significant contributions to these innovative areas.