UNIVERSITI TEKNOLOGI MARA

JOHOR INTERNATIONAL INNOVATION, INVENTION COMPETITION AND SYMPOSIUM 2024

PROCEEDINGS OF JOHOR INTERNATIONAL INNOVATION INVENTION COMPETITION AND SYMPOSIUM 2024 (JIIICaS 2024)

"Flourish and Nurturing Sustainable Innovation for a Prosperous Nation"

JOHOR INTERNATIONAL INNOVATION, INVENTION COMPETITION AND SYMPOSIUM

Editorial Board

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Preface

In the name of Allah, the Almighty who gives us the enlightenment, the truth, the knowledge and with regards to Prophet Muhammad (peace be upon him) for guiding us to the straight path. We thank to Allah for giving us guidance and strength to write this e-book.

This e-book compiles the extended abstracts that submitted to Johor International Innovation Invention Competition and Symposium 2024 (JIIICaS2024), where JIIICaS2024 is a virtual platform for all creative minds to share and present their invention and innovation. Each abstract gives a brief background on the innovation or project.

We hope that this e-book will help the readers to get to know the innovation done by the students and get some ideas to develop future innovation products.

Foreword Rector

Assalamualaikum warahmatullahi Wabarakatuh, Salam Sejahtera, Salam Malaysia MADANI and Salam UiTM Dihatiku.

In the name of Allah, the Most Gracious, the Most Merciful.

It is a great honor to welcome you to the Johor International Innovation, Invention, Competition, and Symposium 2024 (JIIICaS 2024). This event connects various disciplines, focusing on education and engaging educators, students, researchers, and innovators from all walks of life.

Innovation is not just about ideas; it demands perseverance, creativity, and determination to turn those ideas into reality. The remarkable projects showcased today highlight the dedication and spirit of all participants. Initiatives like this not only explore new technologies but also cultivate skills and leadership among our youth. At Universiti Teknologi MARA (UiTM) Johor Branch, we are fully committed to fostering a dynamic culture of innovation, promoting the commercialization of new products, and encouraging meaningful collaborations with industry and society.

As we celebrate this event, I would like to extend my heartfelt gratitude to all sponsors, judges, the College of Computing, Informatics and Mathematics, UiTM Pasir Gudang Campus as the event organizer, as well as to the researchers and participants for their hard work in making this event a success. Let us continue striving for innovation and excellence. May the ideas presented today inspire us and lay the groundwork for future achievements.

Thank you.

Associate Professor Dr. Saunah Zainon
Rector
Universiti Teknologi MARA (UiTM)
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(A-ST093) GASSHIELD: ADVANCED HOME GAS LEAK DETECTION SYSTEM

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ABSTRACT

Gas leaks in residential environments pose significant safety risks due to the odourless and colourless nature of natural gas and liquefied petroleum gas (LPG), commonly used for cooking and heating. Current detection methods often fail to promptly identify leaks, exposing occupants to potential explosions and health hazards. This study addresses this critical issue by developing and implementing an advanced home gas leak detection system. Utilizing advanced sensor technology, the system detects gas leaks near appliances and triggers immediate audible and visual alarms to alert occupants. An automatic gas shutoff feature halts the gas supply upon detection, reducing the risk of explosions. Additionally, a built-in ventilation fan disperses gas to prevent hazardous concentrations. Integration with a smartphone app provides real-time updates and alerts, empowering homeowners to take swift action remotely. Preliminary testing demonstrates the system's effectiveness in detecting and mitigating gas leaks, enhancing residential safety standards. The study contributes significantly by offering a comprehensive solution to mitigate the dangers associated with gas leaks, ensuring timely detection and intervention to safeguard families against hidden dangers in their homes. The proposed solution improves residential safety and provides safer living environment for homeowners and their families.

Keywords: Gas Leakage, Detection System, Advanced Sensor Technology, Home Safety, Smartphone Integration

1. INTRODUCTION

Our homes, even though offering shelters of comfort and relaxation, it can also have hidden dangers such as gas leaks. Natural gas and LPG, while essential for daily living, pose a hidden threat due to their odourless and colourless nature. Despite the addition of odorants by utility companies, leaks can still go unnoticed, leading to potentially catastrophic events such as fires, explosions, and carbon monoxide poisoning. Homeowners may be unaware of a leak or may not have enough time to respond effectively. To address this critical safety concern, this project aims to develop a smart gas leakage detection system that offers real-time detection, automatic mitigation, and remote mobile notifications, thereby enhancing home safety. Utilizing advanced electrochemical sensors placed near gas appliances, the system detects leaks and triggers a loud siren and flashing LED lights to alert occupants. It also automatically shuts off the gas supply via a solenoid valve and activates a ventilation fan to disperse the gas. Integrated with a smartphone app, the system offers real-time

updates and remote control, ensuring homeowners can manage gas leaks even when away. Designed for typical residential settings, this system enhances home safety and provides peace of mind by preventing potentially catastrophic incidents.

2. OBJECTIVE

The objectives of the project are to develop a real-time gas leak detection system for home use by utilizing the MQ-3 and MQ-5 gas sensors for accurate monitoring. It integrates automatic mitigation measures, such as a gas shutoff mechanism using a valve and servo motor, to prevent explosions and fires upon leak detection. Additionally, the project includes the implementation of a mobile application using Blynk software, enabling homeowners to receive remote notifications of gas leaks, ensuring timely response and enhanced home safety.

3. METHODOLOGY

This project implements a rapid prototyping methodology, which is ideal for developing innovative products. This iterative method prioritizes speed and adaptability, making it suitable for IoT-based device development. Figure 1 shows the steps of the prototyping model.

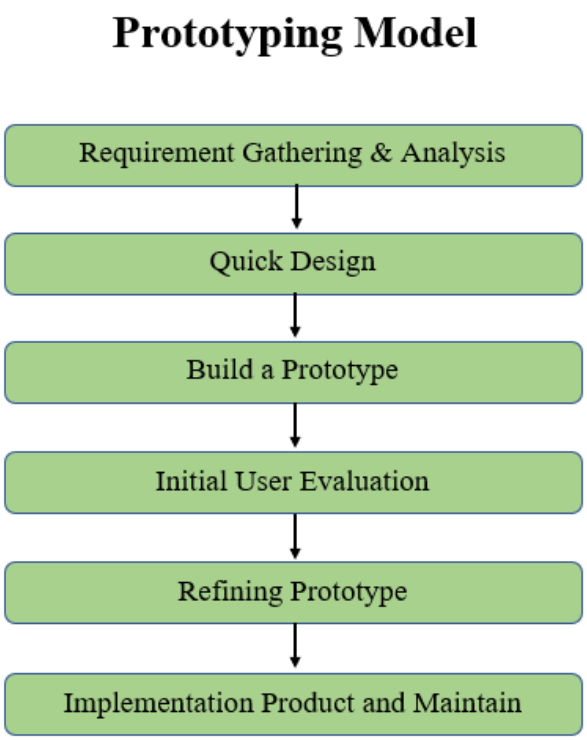

Figure 1: Prototyping model

4. IMPLEMENTATION

The implementation of the project is as illustrated in Figure 2. Several hardware components are used to develop a complete prototype such as Arduino UNO, ESP8266 ESP-01S, MQ-3 gas sensor, MQ-5 gas sensor, buzzer, fan, and servo motor. Software integration is essential to enable remote management of the device through mobile phones. Arduino IDE is used to program the microcontroller ESP32 which is connected to Blynk Apps.

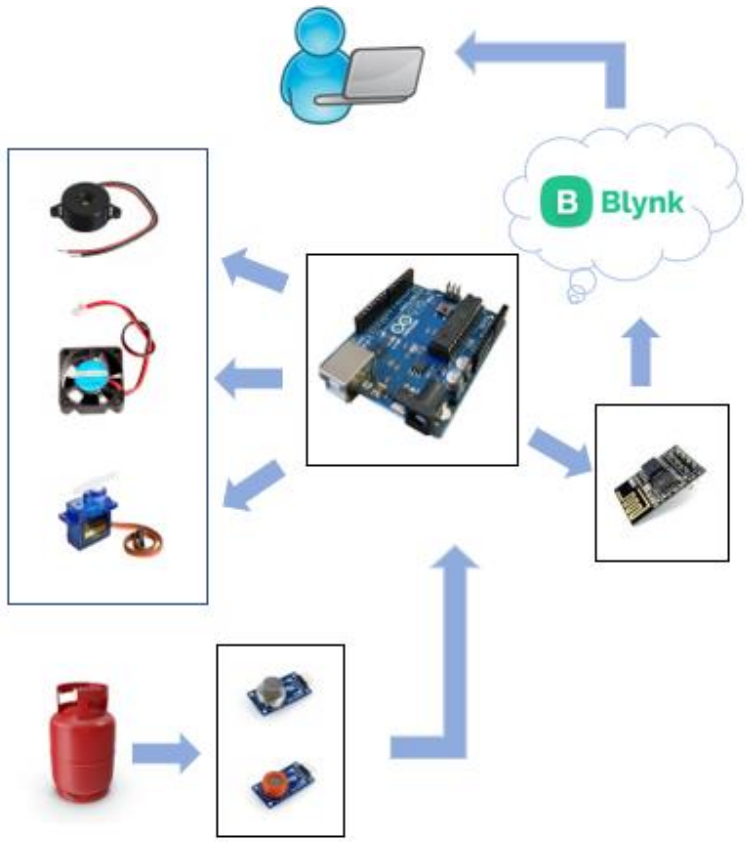

Figure 2: Overview of the system

5. RESULT

An overview of the key features of the project are as follows.

a) Automatic gas shutoff
Servo motor integration: The automated response mechanism of the system featured a servo motor for gas shutoff, which was triggered by the Arduino Uno when a gas leak was detected. This critical safety feature effectively stopped the gas flow, reducing the risk of explosions and further leaks, thereby enhancing the overall safety of the home.

b) Real-time alerts
Auditory and Visual Alarms: Upon detecting a gas leak, the system immediately triggers a loud siren to alert occupants, while flashing LED lights provide a visual warning, especially important for those who may be asleep or have hearing impairments.

c) Ventilation support
Automatic Ventilation Fan: To reduce the concentration of leaked gas, the system can activate a ventilation fan. This fan helps to disperse the gas, particularly in cases where the leak is minor, and immediate evacuation is not required.

d) Mobile connectivity
Smartphone Application: The system integrates with a dedicated smartphone app (Blynk), providing real-time status updates and alert notifications. The app allows homeowners to receive instant alerts about potential gas leaks, even when they are away from home. In some implementations, the app also allows remote control of the gas supply, adding an extra layer of safety.

e) Data Management
Data visualization: The system's data visualization capabilities through the Blynk app allowed for accurate data logging and real-time visualization on mobile dashboards, providing valuable insights into gas leak incidents and supporting continuous monitoring and decision-making processes.

6. CONCLUSION

In conclusion, proposed solution represents a significant advancement in home safety. By integrating state-of-the-art sensor technology, automation, and mobile connectivity, the system empowers homeowners to detect and mitigate gas leaks proactively, significantly reducing the risk of dangerous incidents. Potential enhancement to the system could involve integrating additional sensors, such as carbon monoxide detectors, to improve detection accuracy and expand safety monitoring capabilities.