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# Gas Detection Using ESP32 and Fire Alarm Project Report

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# **UNITED INTERNATIONAL UNIVERSITY**

**Department of Electrical and Electronic Engineering**

## **Project Report**

**Gas Detection Using ESP32 and Fire Alarm**

**Course Code: EEE3107**

**Course Title: Electrical Properties of Materials**

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## 1. Introduction

The "Gas Detection Using ESP32 and Fire Alarm" project aims to create a comprehensive system for detecting harmful gases and potential fire hazards in indoor environments. By utilizing the capabilities of the ESP32 microcontroller and various gas sensors, the project enhances safety measures and environmental awareness.

### Objectives

- Develop a gas detection and fire alarm system using cost-effective components.
- Provide real-time monitoring and alerts for different types of harmful gases.
- Create an integrated system that combines gas sensors, fire detection, and alarm mechanisms.
- Raise awareness about gas leaks and fire hazards to enhance safety measures.

### Scope of the Project

The project scope encompasses the design, development, and implementation of a gas detection and fire alarm system. The system employs ESP32 microcontroller along with MQ-2, MQ-3, and MQ-135 gas sensors, as well as a fire sensor and a buzzer for alarm notification.

## 2. Project Overview

### System Architecture

The gas detection and fire alarm system consist of sensor modules, an ESP32 microcontroller, and an alarm mechanism. Gas sensors monitor the air for various harmful gases, while the fire sensor detects temperature changes associated with fire. The ESP32 processes data from the sensors and triggers the alarm if dangerous levels are detected.

### Components Used

1. ESP32 Microcontroller
2. MQ-2 Gas Sensor: Detects LPG, propane, and hydrogen gases.
3. MQ-3 Gas Sensor: Detects alcohol vapor.
4. MQ-135 Gas Sensor: Detects air quality including ammonia, benzene, and CO2.
5. Fire Sensor: Detects rapid temperature changes associated with fire.
6. Buzzer: Generates audible alarm alerts.

## 3. Technical Details

### ESP32 Microcontroller

The ESP32 serves as the central processing unit of the system. Its Wi-Fi capabilities enable remote monitoring and alerts. The microcontroller reads data from the gas and fire sensors, processes the information, and controls the alarm mechanism.

### Gas Detection Sensor

MQ-2: Detects flammable gases.

MQ-3: Detects alcohol vapor.

MQ-135: Detects various air pollutants.

### Types of Gases Detected

MQ-2: LPG, propane, hydrogen.

MQ-3: Alcohol vapor.

MQ-135: Ammonia, benzene, CO<sub>2</sub>.

### Fire Alarm System

The fire sensor monitors temperature changes and triggers the alarm if a sudden temperature increase is detected. The system responds to both gas leaks and potential fire hazards.

## 4. Implementation

### Hardware Setup

The gas sensors and fire sensor are connected to the ESP32 microcontroller through GPIO pins. The buzzer is also connected to the microcontroller. The system is powered using a suitable power supply.

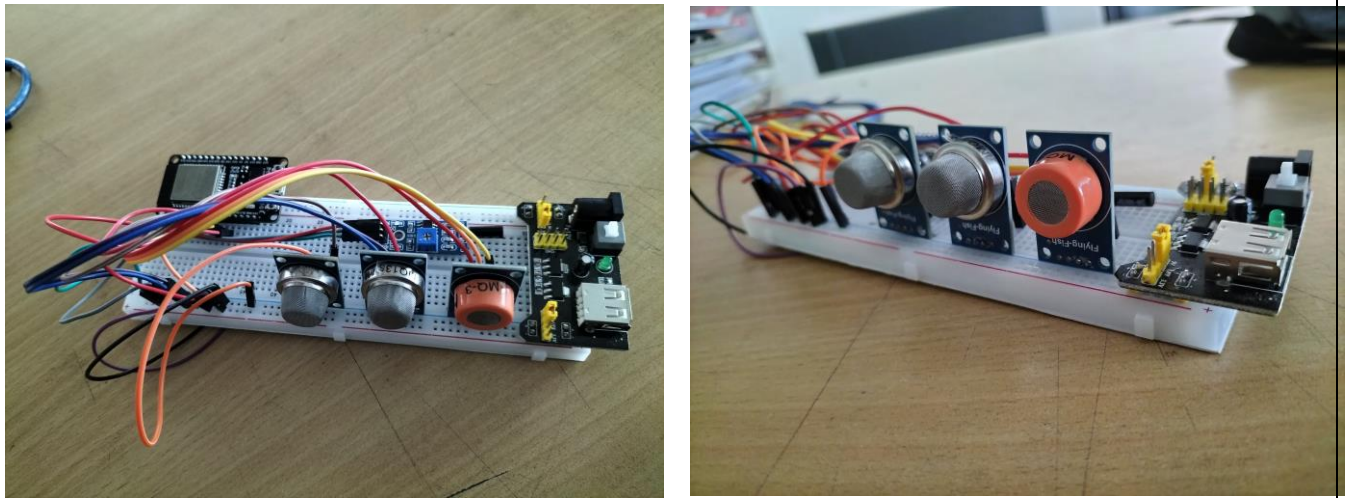


Fig. 1 Hardware implementation of our project

### Wiring Diagrams

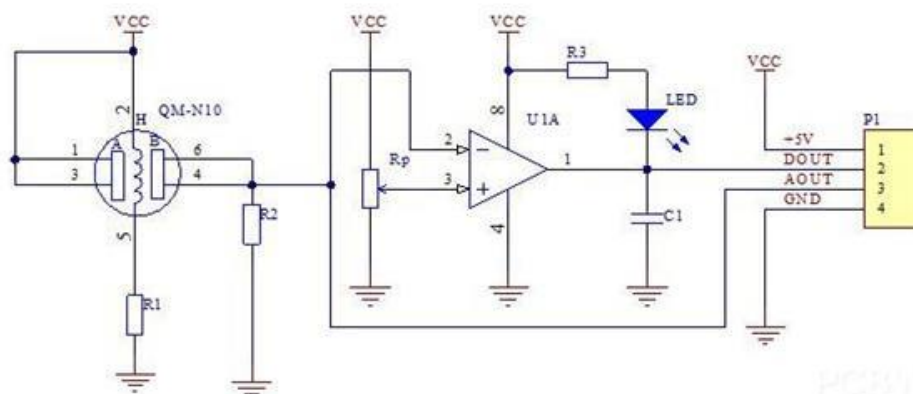


Fig. 2 Wiring Diagrams of the sensors

## 5. Results

### Demonstration of Gas Detection

Upon exposure to target gases, the respective gas sensors provide analog signals to the ESP32. The microcontroller processes these signals and determines the presence and concentration of the gases.

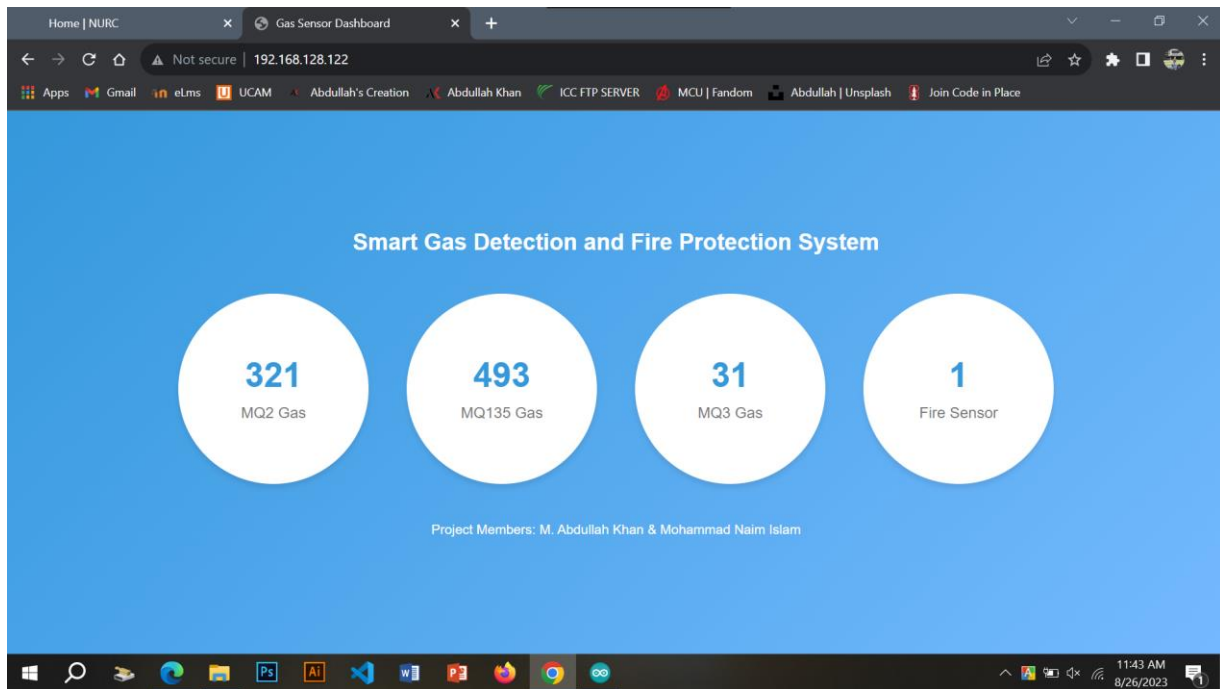


Fig. 3 Web dashboard of our project

### Activation of Fire Alarm

The fire sensor monitors temperature changes. When a rapid temperature increase is detected, the ESP32 triggers the alarm mechanism, activating the buzzer to alert users of potential fire hazards.

## 6. Discussion

### Solutions and Workarounds

Challenges encountered during the project include sensor calibration and interference between gas sensors. These issues were addressed through careful calibration procedures and sensor placement.

### Future Improvements

Future iterations of the system could include SMS or email alerts for remote monitoring, integration with home automation systems, and enhanced accuracy through advanced sensor calibration.

## 7. Social and Environmental Impact

### Importance of Gas Detection

Gas leaks pose serious health and safety risks. This project helps prevent gas-related accidents by providing timely alerts.

### Enhancing Safety Measures & Environmental Responsibility

The system promotes environmental responsibility by raising awareness about air quality and gas leaks, thus contributing to a safer and healthier environment.

## 8. Conclusion

The "Gas Detection Using ESP32 and Fire Alarm" project successfully created a comprehensive system for detecting harmful gases and potential fire hazards. The integration of ESP32, gas sensors, and a fire sensor forms a cohesive system that enhances safety measures and environmental awareness.

### **Summary of Achievements**

- Developed an integrated gas detection and fire alarm system.
- Utilized ESP32 for data processing and alarm triggering.
- Demonstrated successful gas detection and fire alarm activation.
- Significance of the Project
- The project contributes to improved safety standards and environmental consciousness by providing real-time gas detection and fire hazard alerts in indoor environments.