American International University- Bangladesh (AIUB)
Faculty of Engineering (EEE)

Course Name:	Microprocessor and Embedded Systems	**Course Code:**	EEE 4103
Semester:	Fall 2022-202322-23	**Section:**	F
Project Title:	Smart Gas Detection System		

Sl.	ID		Name	Marks		
				Demo and Viva [20]	Report [30]	Total [50]
1	19-39918-1		Rahman , Mahbubur			
2	19-39944-1		Alam , Sumona			
3	19-39948-1		Jaber , Md. Abdullah Al			
4	19-39890-1		Rahman , Saiydur			
5	19-39783-1		Tushar , Mahmud Hossain			
6	19-39721-1		Rafi , Ashraful Huda			
7	19-39882-1		Rafi , Kafi Anan			
8	20-42195-1		Leo , Nafinur			

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Course Project Report Outline (Microprocessor and Embedded Systems)

Total Report Marks: 30

1. **Download the template for report writing from the link:**
   https://www.ieee.org/content/dam/ieee-org/ieee/web/org/conferences/conference-template-a4.docx
   (Strictly follow the template)
2. **Abstract (at least 150 words but not more than 300 words) and Keywords (3-6 keywords separated by a comma)** **[2 mark]**

3. Introduction

3.1. Background of Study and Motivation	[2 mark]
3.2. Project Objectives	[1 mark]
3.3. A brief outline of the report	[1 mark]

4. Literature Review ***(At least 5 project-related published journal papers within the year 2018 to 2022)***
[5 mark]

5. Methodology and Modeling

5.1. Introduction	[1 mark]
5.2. Working principle of the proposed project	[1 mark]
5.2.1. Process of Work	[2 mark]
5.3. Description of the components	[1 mark]
5.4. Implementation	[2 mark]
5.5. Test/Experimental setup	[2 mark]

6. Cost analysis [1 mark]

7. Results and Discussion

7.1. Simulation/Numerical analysis	[2 mark]
7.2. Measured response/Experimental results	[2 mark]
7.3. Comparison between numerical and experimental results	[2 mark]
7.4. Limitations in the project	[1 mark]

8. Conclusion and future endeavors **[2 mark]**
9. References **[1 mark]**

Appendix (if any)

Rubric: Demonstration & Viva

Points	1	2	3	4	Total
Addressing complex engineering problem	The outcome of the project demonstrates a course project using microcontrollers, sensors, actuators, switches, display devices, etc. that can solve a complex engineering problem in the electrical and electronic engineering discipline through appropriate research.	The outcome of the project somewhat demonstrates a course project using microcontrollers, sensors, actuators, switches, display devices, etc., and also somewhat solves a complex engineering problem in the electrical and electronic engineering discipline through appropriate research.	The outcome of the project demonstrates a course project using microcontrollers, sensors, actuators, switches, display devices, etc. but cannot solve a complex engineering problem in the electrical and electronic engineering discipline through appropriate research.	The outcome of the project does not demonstrate a course project using microcontrollers, sensors, actuators, switches, display devices, etc. also cannot solve a complex engineering problem in the electrical and electronic engineering discipline through appropriate research.	4
Subject Knowledge	Student does not have grasp of information. Many statements are incorrect and unsupported.	Student is uncomfortable with information, leaves out important details and/or presents inaccurate information.	Student is at ease with topic and presents accurate information.	Student demonstrates full grasp of the topic, presenting complete and accurate information.	4
Explanations from Evidence	The student either has no conclusions or the conclusions are not related to the evidence provided in the presentation.	Conclusions are very poorly related to the evidence provided in the presentation.	The student uses some data, prior knowledge, research, and experience to draw conclusions but ignores other evidence introduced during the presentation.	The student uses all available data and his/her prior knowledge/research and experience to draw conclusions. If appropriate, student includes discussion of conflicting evidence.	4
Tables Graphs Graphics	Failed to explain graphics or graphics are unrelated to the subject and/or distract from the message.	Student partially explain tables/graphs, uses inappropriate graph type(s) or graphics conflict with conclusions.	Graphics illustrate evidence which supports the conclusion, appropriate graph type(s) used. Larger, smaller or simplified graphics would be clearer.	Appropriate graphics clearly present information which supports the conclusion and the student accurately explains the graphics during the presentation.	4
Questions	Student cannot answer questions about subject.	Student is able to answer only rudimentary questions, answers questions without explanation.	Student is at ease with answers to most questions, but fails to elaborate.	Student answers all class questions with explanations and elaboration.	4
				Total Points:	**20**

Smart Gas Detection System

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***Abstract*— The number of accidents that occur in day-to-day life is immense. One of the biggest threats in the society is accidental gas leakage which can turn into a fire disaster. The technology of the world is also getting better day by day. As a result, the prevention measures to prevent such events around the world require continually improving such technologies. The topic of the study is settled on a gas detection problem. For this project, a gas detection module or sensor is used to detect high threshold of gas in a sizable area. It's observable just at its place of origin and its site of occurrence. Incorporating these two features, a cutting-edge gas detection system that was created in this project is called the "Smart Gas Detection System". It consists of a buzzer which will sound whenever the module detects a certain amount of gas pressure or density and LED indicator automated to indicate the current state. In addition to being not able to see gas one cannot measure gas pressure or density easily and an alert email will be sent if the gas is above risk point. For this task, an ESP32, MQ6 Gas/Smoke detector module, a buzzer, LED, an app called Blynk, and some basic programming knowledge is needed. This gear makes it simple to install a 'Gas Alert System' just about anywhere. It is possible for a Gas Detection System to function either as an independent device that generates a sound or commotion if it detects any form of irregular activity, or as an integral part of a much larger fire/smoke alarm system or some form of automated device that can send a signal to the proprietor or some form of automated device that can send a signal to the proprietor.**

Keywords— ESP32, Gas/Smoke Detector, Alert System.

V. INTRODUCTION

Safety is crucial to normal functioning. Every person has an inherent requirement for a sense of safety. Having confidence that one is roaming around a safe environment is must-haves for any resemblance of tranquility in daily life. But how can one achieve that feeling of safety in today's unsafe world, when accidents and other dangers are at an all-time high.

As a result, an increasing number of people are opting to install gas detection systems for themselves and their families. A gas detection alarm is a tool for keeping a building secure from gas, smoke or in turn fire. As a result, it can be used for anything from protecting low-value household items to protecting highly valuable company assets or factories from fire. When first developed, they were expensive options for ensuring safety. This type of gas detecting system is getting more reasonably priced because of cost reduction and rapid technology improvements.

With the help of the MQ6 Gas/Smoke sensor, we've developed a gas detection system using ESP32 and a buzzer. The core concept of the project is the development of a safety mechanism. A buzzer will sound whenever the air becomes heavy or too much condensed. An email will be sent if the safety point is breached and also a smart LED indicator to indicate the current state.

This project's scope is not limited to the confines of a single location; the use of gas detection system is to ensure safety from accidental gas leak or fire, to reduce as much property damage as possible and other such goods is already in widespread usage. The gas detection system can be used to protect many different types of buildings, including homes, offices, stores, and warehouses.

VI. LITERATURE REVIEW

This security apparatus dates to the early 1990s. They were historically large and notoriously difficult to keep tabs on in the event of an invasion. Technology has advanced greatly in recent years.

Considerably more than in the past. Burglar alarm systems that use lasers are another name for laser security systems. Laser and light-dependent resistors are employed in most modern security systems. Building and setting up this system is a breeze. Many other types of high-tech security systems, such as PIR-based systems, temperature-detecting systems, infrared systems, etc., are now available. This is the only system of its kind that has shown to be effective.

The presence of an alarm security system in our homes, hospitals, schools, organizations, and industries has been proved to deter most offenders. Often, criminals target unprotected buildings rather than those with alarm systems. Since the beginning of time, humans have been working to perfect security alarm systems. People use various signals, shouts, and sounds to convey potentially dangerous information. In the early stages of some African societies, this was superseded using clapping hands and the use of signals to inform the community or broadcast a specific message. William.F. Channing created the first electronic fire and security alarm system. Mr. MosesG. Farmer, an electronics electrical engineer, came up with the design in the late 20th century. This alarm system, which was developed in Boston, Massachusetts, was the first of its kind in the United States. After Dr. William developed his alarm system, numerous different types of sophisticated fire and intruder protection alarm system technology emerged for homeowners to choose from. Malaysian scientists have created a home security system with many layers that uses a variety of sensor nodes as inputs and outputs based on the signals they receive. The sensor nodes include alarms, presence detection circuits, and cameras built in. The Chinese have devised a system that combines WSN and GSM. Whether it's a gas leak, fire, or theft, it may alert the owner immediately. Components of the hardware are:

Single-chip C5081F310, wireless receiving and transmitting CC1100, and the Simens TC35 GSM module.

VII. METHOLOGY AND MODELING

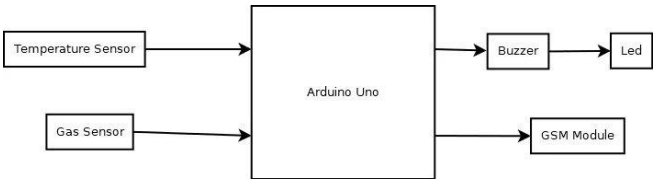


Fig 1: Block Diagram of System

In this paper, the outline is the theoretical foundations of sensor-based gas detection systems. This suggested block diagram includes components such as a MQ6 module, ESP32(Microcontroller) and a buzzer. Our alarm system is linked to a controller.

A gas detection module and ESP32 are the two mainstays of any gas detection security alert setup. The MQ6 is a highly sensitive module that can detect high density of gas in an environment. When the detection module senses high pressure or density in the environment; the circuit detects this variation and emits a warning signal; and finally, the buzzer begins sounding alert signals. This project operates on the notion of detection of gas/smoke. If the pressure/density of gas does not reduce for some reason, the alarm will go off until it is reduced.

When the MQ6 module senses gas going up certain threshold, it generates a voltage because of its pressure-sensitive nature. Alarms are set off when the detection module is broken and cannot understand the pressure, since the MQ6's voltage output will shift.

A. ESP32:

ESP32 is created by Espressif Systems with a series of SoC (System on a Chip) and modules which are low cost with low power consumption.

This new ESP32 is the successor to the well-known ESP8266(became very popular with its inbuilt Wi-Fi). ESP32 not only has Built in Wi-Fi but also has Bluetooth and Bluetooth Low Energy.

ESP32 chip ESP32-D0WDQ6 is based on a Tensilica Xtensa LX6 dual core microprocessor with an operating frequency of up to 240 MHz

The small ESP32 package has a high level of integrations such as:

1. Antenna switches
2. Balun to control RF
3. Power amplifier
4. Low noise reception amplifier
5. Filters and power management modules

On top of all that, it achieves very low power consumption through power saving features including clock synchronization and multiple modes of operation. The ESP32 chip's quiescent current is less than 5 μA which makes it the ideal tool for your battery powered projects or IoT applications.

Fig-1: ESP32

B. MQ6 Gas/Smoke Sensor:

The MQ6 gas sensor senses the gases methane. The MQ-6 gas sensor has a lower conductivity to clean the air as a gas sensing material. In the atmosphere we can find polluting gases, but the conductivity of gas sensor increases as the concentration of polluting gas increases. MQ-6 gas sensor can be implemented to detect the smoke, benzene, steam and other harmful gases. It has the potential to detect different harmful gases. It is with low cost and particularly suitable for Air quality monitoring applications.

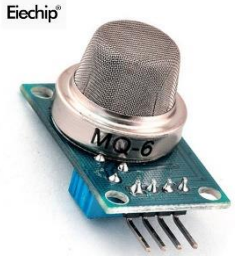


Fig -3: MQ6 Gas/Smoke Sensor

C. *Buzzer:*

The DC power supply, which may be anything from 4V to 9V, is all you need to get this buzzer going. A basic 9V battery will work, however a controlled +5V supply is suggested.

either a +6V DC supply or a +6V DC supply. A buzzer typically has a dedicated switching circuit that turns it on and off at predetermined intervals. You can use this buzzer with any DC power supply in the range of 4V to 9V. It is preferable to utilize a controlled +5V or +6V DC supply, however a simple 9V battery would work in a pinch. In most cases, the buzzer will be connected to a switching circuit that will activate it at the specified time interval.

Fig -4: Buzzer

D. *LEDS:*

LEDs are semiconductor light sources that emit light when electrical current is passed through them. The energy stored in the semiconductor's electrons is released as photons when they mix with the semiconductor's electron holes. High-output white light LEDs have just been available, making them ideal for indoor and outdoor use.

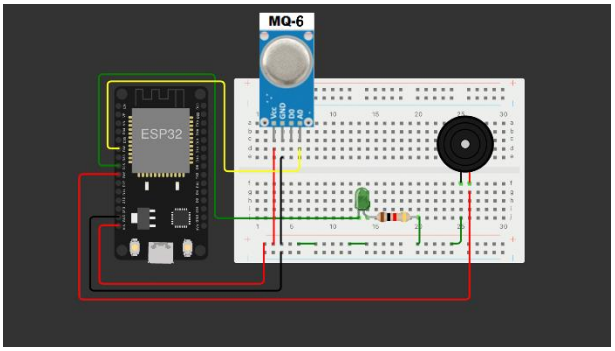
Fig -5: LEDS

IV. COST ANALYSIS

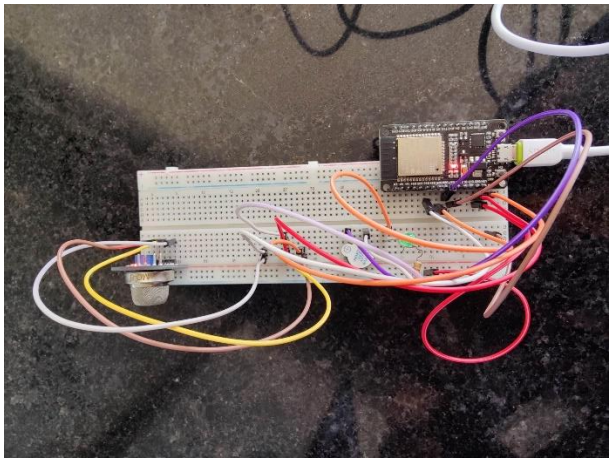
The main equipment purchased for this experiment was ESP32 board and MQ6 of the price accordingly BDT 670 TK and BDT 75 TK. And other small equipment purchased were jump wires, LED, buzzer, breadboard etc. which costed around 200 TK. So, the total amount spent was 945 TK.

V. RESULT AND DISCUSSION

This project was based on making a smart gas leakage detector with email alert and LED indicator using ESP32. And the experiment was successful. It was able to detect density of gas and smoke to alarm a buzzer to that point when the safety point was exceeded which is 300. An automated mail was sent to the owner once that happened. A LED was indicating whether the gas system was healthy or not. Here is the implementation of prototype,



The following picture is the actual implementation,



VI. CONCLUSION

The goal of this project is to assist building owners in solving the issue of gas leak detection when they are away from their properties. This circuit turns on the alert system when a smoke or gas leak is discovered. The circuit mainly uses the ESP32 and MQ6 Smoke/Gas sensor to find a smoke or gas leak. The sensor reacts quickly and has a high degree of sensitivity. The module receives low signals from the microcontroller and delivers them to the module, which sends signals to a designated email such "Excess Gas Detected. Open Windows.

A. *References*

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[3] Yadav, R., & Rani, P. (2020). Sensor Based Smart Fire Detection and Fire Alarm System. *SSRN Electronic Journal*. doi: 10.2139/ssrn.3724291

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