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Fire and Smoke Detection System with Alarm using Arduino

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ABSTRACT

The main aim of this project is to develop a system that detects electrical short circuits and LPG gas leaks to reduce fire accidents this research explains a fire and smoke detection system made using an embedded system.

The Arduino Uno works like the brain of the system and controls all the parts. It also includes an MQ2 sensor to detect smoke, a piezo buzzer to make a warning sound, and a 16×2 LCD display to show alert messages, Breadboard and Jumper wires.

Keywords : Embedded System, Fire, Smoke, Arduino Uno, Buzzer

INTRODUCTION

Fire is a chemical reaction called combustion that produces heat, light, and harmful gases. Some of the Causes that occur in Houses are Cooking equipment which includes Gas stoves and LPG cylinders. Electrical equipment such as low- capacity wire, short circuits due to poor connection, and many more.

Software/hardware use:

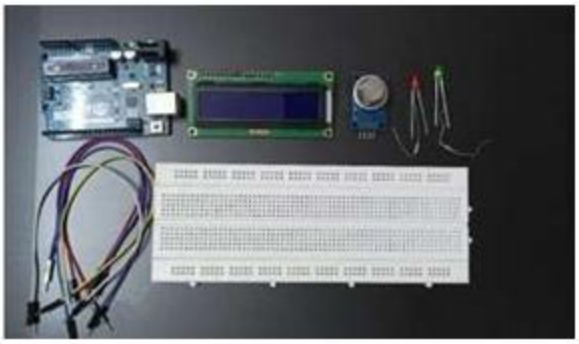
- Arduino Uno MQ-2
- Smoke and Gas Sensor
- Flame Sensor Module
- Arduino IDE
- C/C++ Programming
- Serial Monitor for testing

LITERATURE REVIEW

This Project is implemented by referring to various research papers mainly IEEE 2020, 2021, Science direct 2022, Elsevier –2020 which helped to optimize the basic idea about smoke and fire detection in an Embedded system.

Design: Design of whole project includes

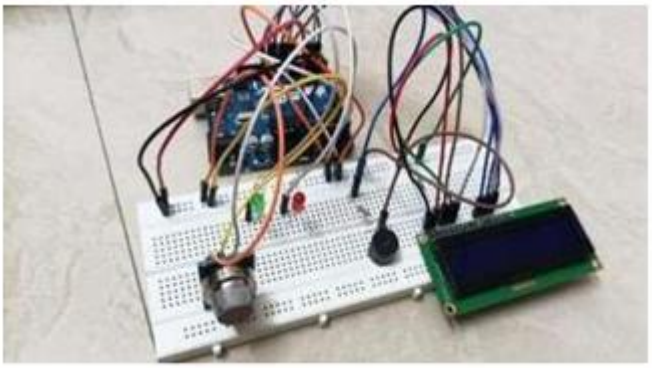
Arduino Uno, MQ2 Sensor, 16*2 LCD Display, Breadboard, 2 LED (red and green), Jumper cables, Resistors 220ohm and 1kohm.the image below will give more clarity about the component has been used in the project .



METHODOLOGY

His project is about a Fire and Smoke Detection System.
When smoke is produced inside a house, the MQ2 sensor detects the smoke in the air. The sensor can sense smoke and harmful gases.

After detecting smoke, it sends a signal to the Arduino. Then the system gives an alert, like turning on a buzzer or showing a warning message on the display. an an Analog input value, and this is run by an Arduino program so the Output will be in digital form that is the red LED will be On, when smoke is detected, the piezo buzzer will make a loud sound to warn people. At the same time, the 16×2 LCD display will show the message “ALERT!!” on the screen.

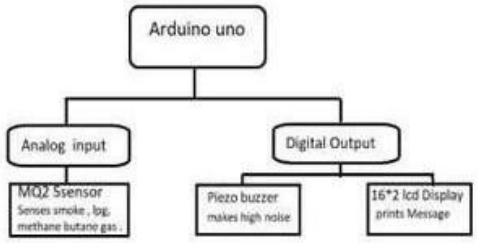


The MQ2 this output is connected to the A4 pin of the Arduino. The A4 pin reads the analog value from the sensor. Piezo buzzer, 16*2 LCD, 2 LED (red and green) colour are Output devices connected to digital pins Arduino Uno board

BLOCK DIAGRAM

System component:
Arduino uno: Arduino Uno is a small devicethat lets you control things like lights and sensors with code. You plug it into your computer, write some simple code, and it can do cool things like blink LEDs or read temperature. It is easy to use and very good for beginners who want to learn coding and electronics.

MQ-2 Smoke and Gas Sensor:
The MQ-2 Smoke and Gas Sensor detects smoke and gases like LPG and methane .It is easy to use and very good for beginners who want to learn coding and electronics.



Flame sensor module
A flame sensor module is used to detect fire or flames.
It works by sensing infrared light produced by a flame.
It is commonly used with Arduino for fire alarm systems.
The sensor helps improve safety by detecting fire early.

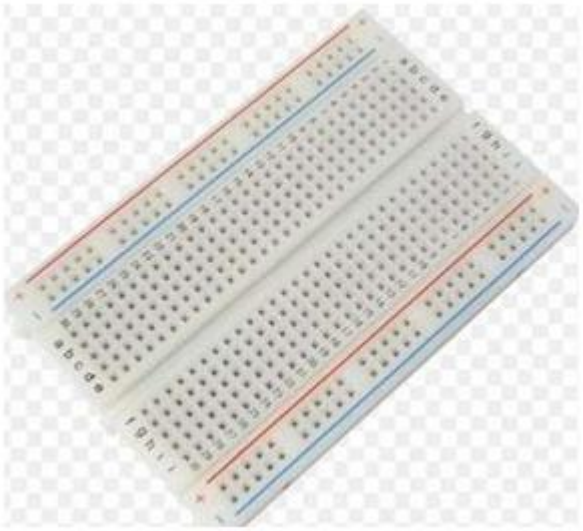
Piezoelectric Buzzer:
A piezoelectric buzzer is a small device that produces sound when electricity is applied. It is used to give alerts or alarms in electronic projects. The buzzer is commonly used with Arduino. It is simple, low cost, and useful for warning signals.

Connection wire:
Jumper wires are used to connect electronic parts together.
They help send power and signals between components.
Jumper wires are commonly used with Arduino and breadboards.
They are easy to use and make building circuits simple.

LEDs
LED (Light Emitting Diode) is a small light that turns on when electricity passes through it. It is used in electronic projects to show signals or indicators.

Bread board
A breadboard is a tool used to build and test electronic circuits without soldering. You can plug in components like LEDs,

sensors, and wires easily. It is reusable and works well with Arduino projects. Breadboards make experimenting with circuits simple and safe**.**



and gas sensor, flame sensor, piezo buzzer, LEDs, and Arduino Uno, the system can reliably detect smoke, gas leaks, and flames in real time.

The system is flexible and scalable, meaning it can be calibrated for rooms of different sizes and adapted for various applications such as homes, classrooms, or small offices. It's simple design allows for easy installation and modification, making it suitable for educational purposes, where students can learn about electronics and safety systems.

Compared to commercial fire alarm systems, this project is affordable, open-source, and customizable, providing a practical solution for areas where high-cost systems are not feasible. Overall, the project proves that effective fire safety systems can be built with basic electronic components, promoting awareness and safety in small-scale settings.

RESULT

- The microcontroller-based fire and smoke alarm successfully detects smoke and flames in the room.
- The MQ-2 sensor detected smoke and gas leaks effectively.
- The flame sensor accurately detected fire sources within a small range.
- The piezo buzzer and LED indicators activated immediately when smoke or flame was detected.
- The system is low-cost, easy to install, and can be calibrated for different room sizes.
- Overall, the project demonstrates a working, simple, and flexible fire and smoke alarm system suitable for small-scale and educational use.

CONCLUSION

The project successfully demonstrates a low- cost, microcontroller-based fire and smoke alarm system that is both functional and easy to use. Using components like the MQ-2 smoke

REFERENCE

[1]. Arduino Official Website. "Arduino Uno." https://www.arduino.cc/en/Guid e/ArduinoUno
[2]. Winsen Electronics. "MQ-2 Gas Sensor Datasheet." 2018. https://www.winsen-sensor.com
[3]. Random Nerd Tutorials. "Arduino Flame Sensor Module Guide." 2020. https://randomnerdtutorials.co m/arduino-flame-sensor/
[4]. Electronics Hub. "Piezo Buzzer Working and Applications." 2019. https://www.electronicshub.org/piezo-buzzer/
[5]. Spark Fun Electronics. "Breadboards and Jumper Wires Tutorial." 2020. https://learn.sparkfun.com/tutor ials/breadboard

[6]. International Journal of Engineering Research and Applications. “Microcontroller- Based Fire Alarm System.” Vol. 9, Issue 3, 2019.
[7]. Maker Pro. “How to Build a Smoke Detector Using Arduino.” 2021. https://maker.pro/arduino/proje cts/arduino-smoke-detector
[8]. Instructables. “Arduino Gas and Fire Detection System.” 2020. https://www.instructables.com/ Arduino-Gas-and-Fire- Detection-System/
[9]. Tutorials Point. “Introduction to Microcontrollers.” 2021. https://www.tutorialspoint.com/ microcontroller/index.htm
[10]. Electronics Tutorials. “LED Basics and Applications.” 2019. https://www.electronics- tutorials.ws/diode/diode_6.html