Course Code: CSE-368

Course Title: Microprocessor and Interfacing Lab

Group No. : 18

Project Title: Fatal Gas Detector

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Date of Submission: 10/07/2024

Project Title: Fatal gas detection and alerting system using Arduino Uno

Abstract:

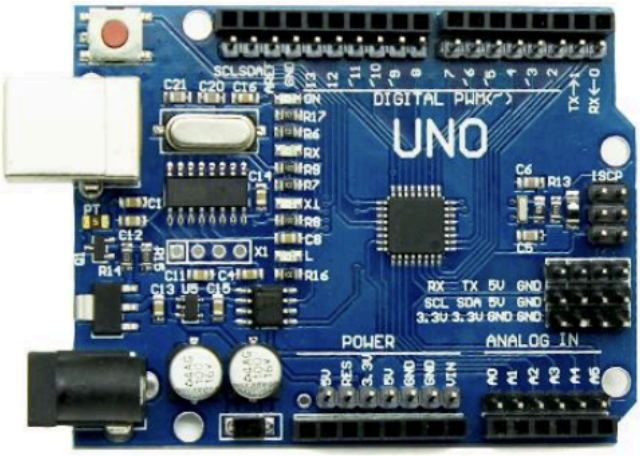
The Fatal Gas Detector is a microprocessor-based project designed to be alarmed. This project utilizes a microcontroller to detect hazardous gasses and to alarm the people.

Introduction:

Hazardous gasses, such as carbon monoxide (CO), hydrogen sulfide (H2S), and ammonia (NH3), LPG, pose serious health risks in industrial, residential, and commercial settings. The lack of efficient and integrated gas detection systems increases the likelihood of accidents and fatalities. Traditional gas detection methods often lack real-time monitoring and alarm functionality, leaving individuals vulnerable to exposure.

Hardware Description:

Arduino UNO: Microcontroller Arduino UNO is employed as shown in figure below. The central unit of the system is Arduino board, where all the components are interfaced externally on the board and programmed as per their functionality to work in synchronization.

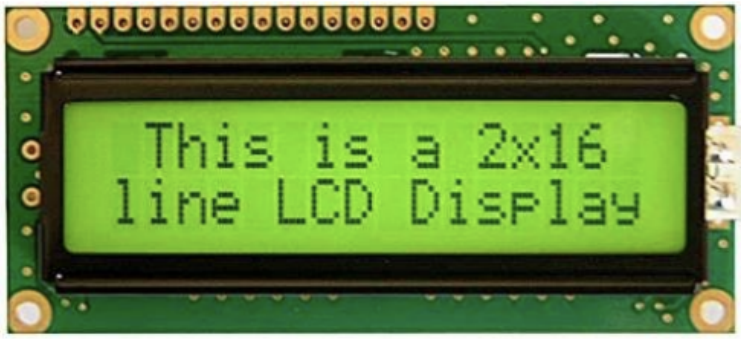


It's an electronic prototyping platform/ board supported Atmega-328 which is of 8-bit, 16 Mhz. During this serial communication is enabled and has 14 digital input /output pins

(out of which 6 are PWM) and 6 analog input pins. It operates at 5v. every pin contains a specific function to control.

Buzzer: Buzzer is used to alarm the beep sound to indicate and warn the danger to the people working around. The buzzer is the output of the system. The sound of the buzzer is beep-beep, which indicates the danger.

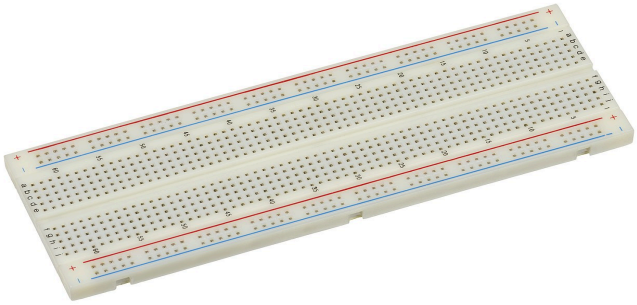
LCD: LCD is employed for displaying the message indicating that" gas detected at zone" into the display, which is initially coded in program to display the danger.



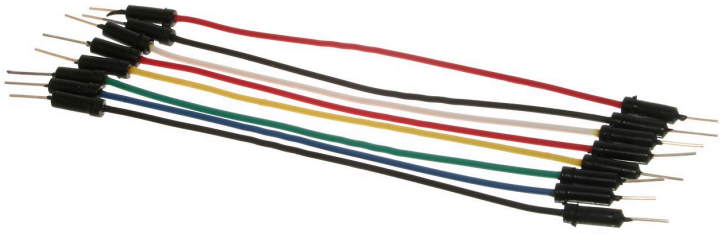
MQ-6 gas sensor: MQ-6 gas sensor has high sensitivity to butane, propane, methane and can detect methane and propane at the same time. It also can detect kinds of flammable gasses, especially LPG(Propane). It is a kind of low–cost sensor for many applications.

LED: Lights up when gas is detected above the threshold level, providing a visual alert.

Breadboard: A breadboard is used for building temporary circuits. It is useful to designers because it allows components to be removed and replaced easily. It is useful to the person who wants to build a circuit to demonstrate its action, then to reuse the components in another circuit.



Jumper Wires: Jumper wires are electrical wires with connector pins at each end. They are used to connect two points in a circuit without soldering.



Software Requirements:

Arduino IDE: The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board. It can be downloaded from this link

Results and discussion:

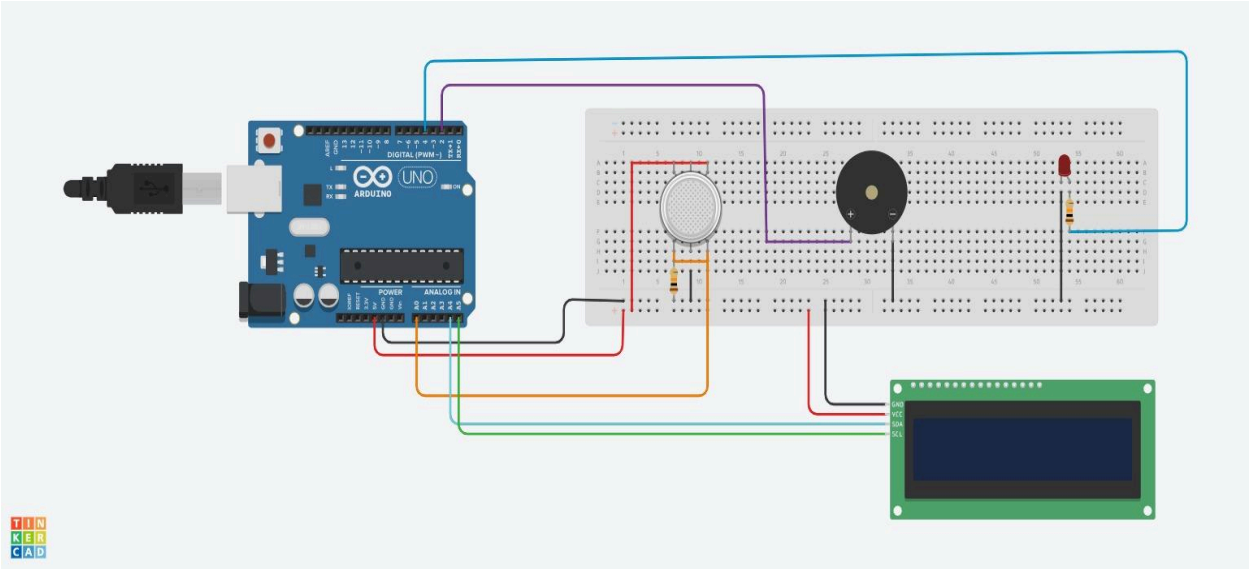


Fig.: Schematic Diagram

The figure above shows the schematic diagram of our project. This technique has been tested by leakage of gas in almost all sensors, MQ6 gas sensor sends the signal to the Arduino UNO after detecting the gas leakage. Arduino to other externally connected devices such as LCD, buzzer and LED send vigorous signals. In practice, results that are noticed by the people surrounding the area are displayed in the LCD and buzzer sound indicates the danger to the people by making a beep sound.

Connections:

Arduino to Breadboard

Power (5V and GND):

- The 5V pin of the Arduino is connected to the positive rail of the breadboard.
- The GND pin of the Arduino is connected to the negative rail of the breadboard.

Gas Sensor Connections

- VCC: Connected to the positive rail of the breadboard.
- GND: Connected to the negative rail of the breadboard.
- Signal (Data): The signal pin of the sensor is connected to A0 on the Arduino.

Buzzer Connections

- Positive (+): Connected to D2 digital pin on the Arduino.
- Negative (-): Connected to the negative rail of the breadboard.

LED Connections

- Anode (+): Connected to D4 digital pin on the Arduino through a current-limiting resistor.
- Cathode (-): Connected to the negative rail of the breadboard.

LCD Display Connections (I2C Interface)

- GND: Connected to the negative rail of the breadboard.
- VCC: Connected to the positive rail of the breadboard.
- SDA: Connected to A4 on the Arduino.
- SCL: Connected to A5 on the Arduino.

Code:

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
// Initialize the library with the I2C address and LCD size
LiquidCrystal_I2C lcd(0x27, 16, 2);
int GAS_VAL = 0;
void setup() {
  pinMode(A0, INPUT);  // MQ-6 A0 Pin
  Serial.begin(9600);
  lcd.init();          // Initialize the LCD
  lcd.backlight();     // Turn on the backlight
  pinMode(2, OUTPUT);  // LED Red
  pinMode(4, OUTPUT);  // LED Green
  lcd.setCursor(0, 0);
  lcd.print("   GAS SENSOR  ");
}
void loop() {
  GAS_VAL = analogRead(A0);  // Read the analog value from the sensor
  Serial.println(GAS_VAL);
  if (GAS_VAL > 500) {
    digitalWrite(4, HIGH);  // Turn on Green LED
    digitalWrite(2, HIGH);  // Turn on Red LED
  } else {
    digitalWrite(4, LOW);  // Turn off Green LED
    digitalWrite(2, LOW);  // Turn off Red LED
  }
  // Display the detection status and gas value on the LCD
  lcd.setCursor(0, 1);
  if (GAS_VAL > 500) {
    lcd.print("LPG Detected: ");
    lcd.print(GAS_VAL);
  } else {
    lcd.print("LPG Not Detected  ");
  }
  delay(1000);  // Short delay before next reading
}
```

Code Description:

Libraries

- **Wire.h:** Allows communication with I2C devices.
- **LiquidCrystal_I2C.h:** Controls the LCD display via the I2C interface.

Initialization

- **LiquidCrystal_I2C lcd(0x27, 16, 2):** Initializes the LCD with I2C address 0x27 and sets it to a 16x2 character display. Global Variables int GAS_VAL = 0; Holds the gas sensor's analog value.

Setup Function

1. **pinMode(A0, INPUT):** Sets A0 as an input pin for the MQ-6 sensor.
2. **Serial.begin(9600):** Initializes serial communication at 9600 baud rate for debugging.
3. **lcd.init()** and **lcd.backlight():** Initialize the LCD and turn on its backlight.
4. **pinMode(2, OUTPUT)** and **pinMode(4, OUTPUT):** Set pins 2 and 4 as output for the LEDs.
5. **lcd.setCursor(0, 0)** and **lcd.print(" GAS SENSOR "):** Set the cursor to the first line and print "GAS SENSOR" on the LCD.

Loop Function

1. **GAS_VAL = analogRead(A0):** Read the analog value from the MQ-6 sensor.
2. **Serial.println(GAS_VAL):** Print the gas value to the serial monitor for debugging.
3. **if (GAS_VAL > 500):** Check if the gas value is greater than 500.
    - **digitalWrite(4, HIGH)** and **digitalWrite(2, HIGH)**: Turn on both LEDs if gas is detected.
    - **digitalWrite(4, LOW)** and **digitalWrite(2, LOW):** Turn off both LEDs if gas is not detected.
4. **lcd.setCursor(0, 1):** Set the cursor to the second line of the LCD.
5. **lcd.print("LPG Detected: ")** and **lcd.print(GAS_VAL):** Display "LPG Detected" and the gas value on the LCD if the gas is detected.
6. **lcd.print("LPG Not Detected "):** Display "LPG Not Detected" on the LCD if the gas is not detected.
7. **delay(1000):** Wait for 1 second before taking the next reading.

Github Link:

https://github.com/Walid-2020331024/FatalGasDetector

Steps of Making the Project from Scratch:

1. *Gather Components*: - Ensure all components are available, including the Arduino, gas sensor, buzzer, LED, and LCD display.
2. *Build the Circuit:* - Follow the wiring diagram to connect the components to the Arduino. Use a breadboard and jumper wires for easy connections.
3. *Write and Upload the Code:* - Write the code as provided and upload it to the Arduino using the Arduino IDE.
4. *Test and Calibrate:* - Place the gas sensor in an area where LPG gas might be present and test the system. Adjust the threshold value based on the specific environment and sensor calibration.
5. *Refine the Setup:* - Secure the components and ensure the buzzer, LED, and LCD display are easily noticeable for effective alerts.

Conclusion:

The Fatal Gas Detector project aims to address the critical need for advanced gas detection systems capable of detecting hazardous gasses and triggering alarms to alert individuals of potential dangers. By integrating cutting-edge sensor technology with microprocessor control, the proposed system offers a cost-effective and reliable solution for enhancing safety in various environments.