PROJECT REPORT

I. Introduction

A **Gas Detector Sensor Module** is an electronic device used to detect the presence of harmful or combustible gases like LPG, methane, and carbon monoxide in the air. It helps prevent gas-related hazards by providing early warnings. These modules are commonly used in safety systems and IoT applications.

II. Objectives

1. To detect the presence of hazardous gases such as LPG, methane, or carbon monoxide in the environment.

2. To provide real-time alerts to prevent gas-related accidents and ensure safety.

3. To develop a low-cost, efficient, and reliable gas monitoring system using sensor modules.

III. Components Used

Component	Quantity	Description
STM32F407VGTX Board	1	Cortex-M4 based microcontroller board
MQ-135 sensor	1	Used to detect the gas
LED	1	Acts as a visual alert

III.

Resistor (330Ω)	1	Used with LED to limit current
Breadboard & Jumper Wires	5	For circuit connections
USB Cable	1	For programming and powering the board

IV. Working Principle

Gas detector sensor modules (like the MQ series) work on the principle of **change in resistance** of a **semiconducting material** when exposed to certain gases. The sensor contains a **heating element** and a **sensing layer (usually tin dioxide – SnO_2)**. In clean air, the sensor's resistance is stable. When target gas molecules (like LPG or CO) come into contact with the sensing layer, a **chemical reaction** occurs, altering the resistance. This change is converted into an electrical signal, which is then read by a microcontroller to detect the gas concentration.

V. Circuit Connections

HC-SR04 to STM32F407:

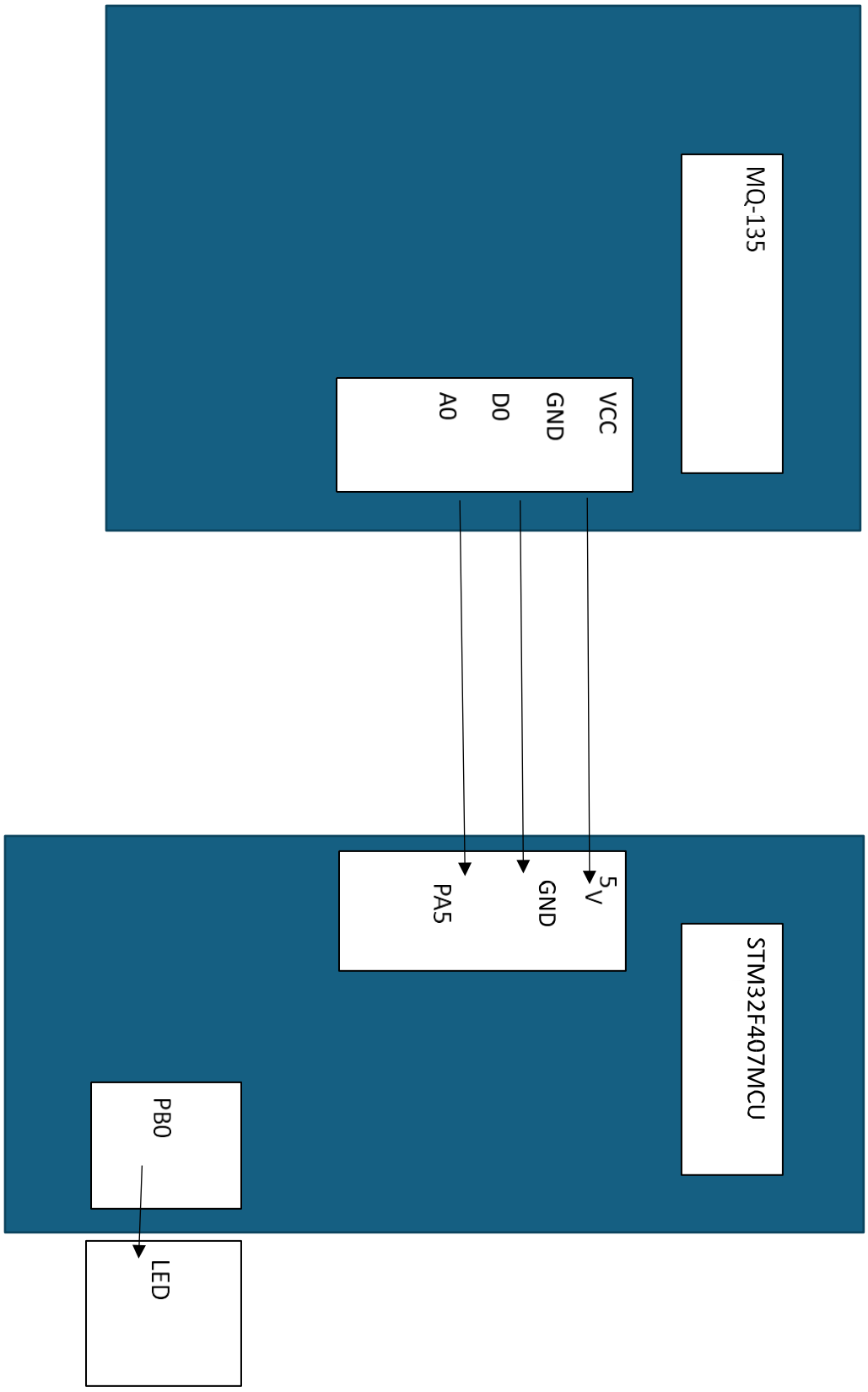
Sensor Pin	STM32 Pin
VCC	5V
GND	GND
AO	PA0
DO	Not used

LED Indicator Connections:

LED Pin	STM32 Pin
Anode(+)	PB0
Cathode(-)	GND

IV.

VI. Circuit Diagram



VII. Software Used

- **STM32CubeIDE** – for code writing, compiling, and programming
- **STM32CubeMX** – for peripheral configuration
- **HAL Libraries** – for easier low-level hardware control

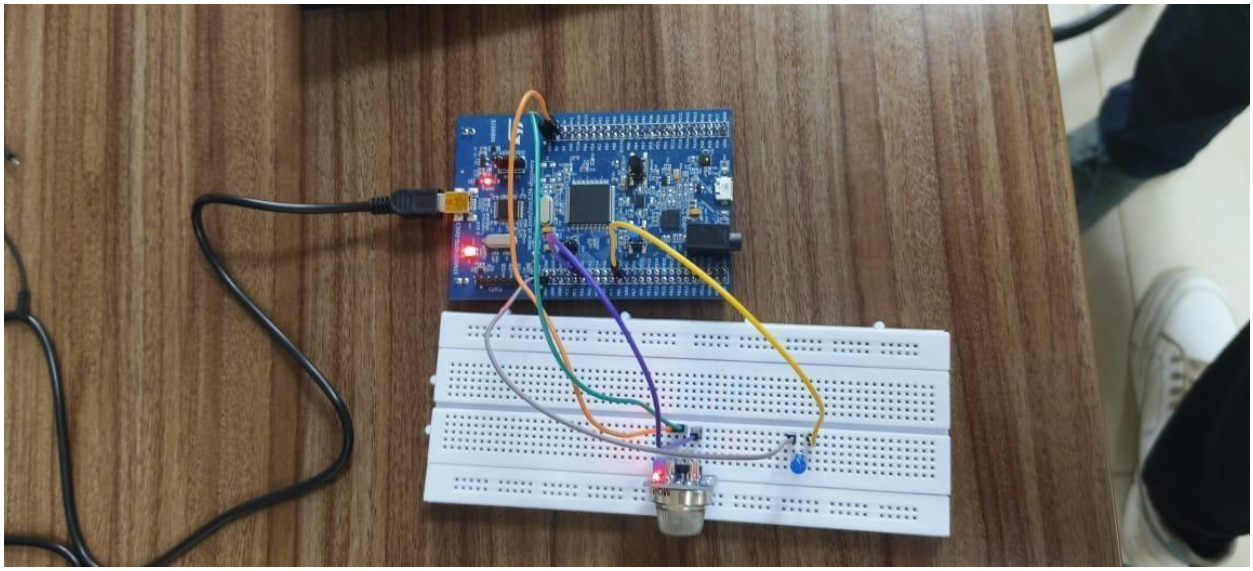
VIII. Code Overview

```
  uint32_t adc_value = 0;

float voltage = 0.0f; while

(1)

{

  HAL_ADC_Start(&hadc1);    if    (HAL_ADC_PollForConversion(&hadc1,

  HAL_MAX_DELAY) == HAL_OK)

  {

    adc_value = HAL_ADC_GetValue(&hadc1); voltage

    = ((float)adc_value / 4095.0f) * 3.3f;

    //  LED  Alert  if

    (voltage > 2.0f)

    {

      HAL_GPIO_WritePin(GPIOB, GPIO_PIN_0, GPIO_PIN_SET);  // LED ON
    }

    else
```

```
        {
            HAL_GPIO_WritePin(GPIOB, GPIO_PIN_0, GPIO_PIN_RESET); // LED OFF
        }
    }
    HAL_Delay(1000);
}
```

IX. Results

The Gas Detector Sensor Module successfully detected the presence of gases like LPG and methane in the environment. When the gas concentration exceeded a certain threshold, the sensor output triggered an alert signal, demonstrating its effectiveness in real-time gas monitoring and safety applications.



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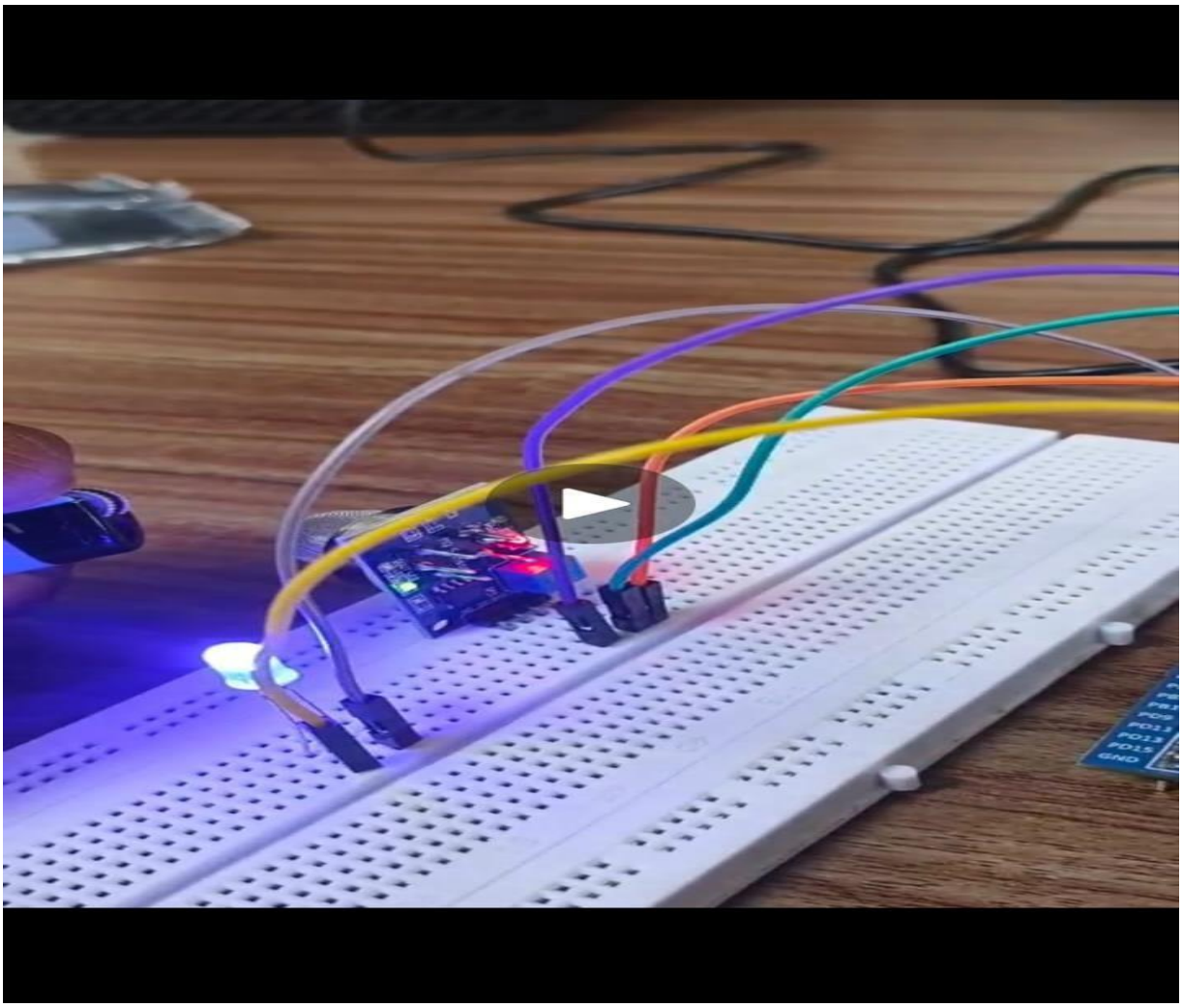

X. Conclusion

The Gas Detector Sensor Module proved to be an effective and reliable solution for detecting harmful gases in the environment. Its ability to provide timely alerts can help prevent accidents and ensure safety in homes, industries, and other sensitive areas. The module's simplicity, low cost, and compatibility with microcontrollers make it ideal for real-time gas monitoring systems.