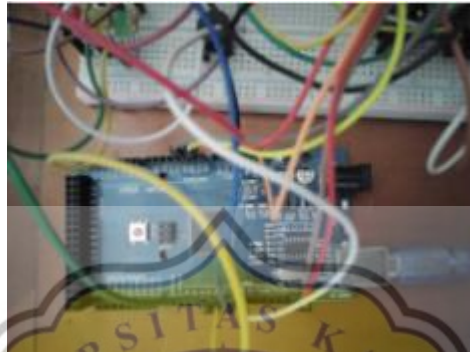# CHAPTER 4

## ANALYSIS AND DESIGN

### 4.1. Hardware



*Picture 1 Arduino AtMega 2560*

As a microcontroller, the Arduino ATMega 2560 executes all program code, including library code for calibrating each sensor, fuzzy algorithm library to identify the proper category based on human reasoning, and commands to the LED output, Buzzer, and 16x2 LCD for displaying notifications. There are 54 digital inputs/outputs, 15 PWM outputs, 16 analog inputs, and 4 UARTs on this board.
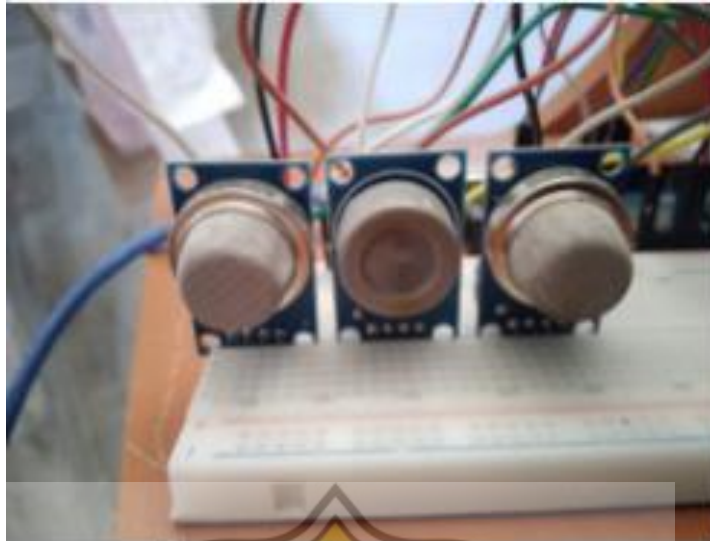
*Picture 2: Sensor Air Quality(MQ2, MQ7, MQ135)*

Several combustible gases, including methane, alcohol, propane, ibutane, hydrogen, and smoke, may be detected with the MQ-2 sensor. I utilized MQ-2 to detect the presence of methane/LPG gas in ppm units in this investigation. The MQ-7 sensor is identical to the MQ-2 sensor, which is capable of detecting methane, alcohol, hydrogen, and carbon dioxide gas. MQ-7 was utilized to detect the presence of carbon monoxide/CO gas in this investigation. Several gases may be detected with the MQ-135 sensor, including carbon dioxide, carbon monoxide, alcohol, acetone, toluene, and NH4. MQ-135 was utilized in this investigation to detect the presence of carbon dioxide/CO2 gas.
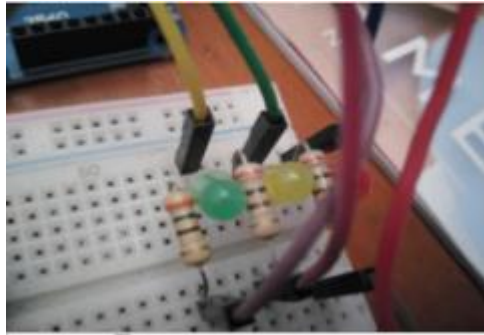
*Picture 3: LED(Green, Yellow, Red)*

As a notification output from the system, three different LED colors (green, yellow, and red). The color green denotes that the surrounding air is safe to breathe. The yellow tint signifies that the surrounding air includes gases that are hazardous to one's health but are still considered mild. The presence of gases that have a significant negative impact on health and are classified as hazardous is indicated by the red hue.


*Picture 4: Buzzer Active*

The active buzzer is utilized for sound notifications; it sounds when the LED turns red or when the air quality falls into a dangerous category.

*Picture 5: LCD 16x2*

The 16x2 LCD is utilized to display alerts of methane, carbon monoxide, and carbon dioxide levels, as well as the air quality categories of Good, Mid, and Bad.

**4.2.    Library Sensor Air Quality**
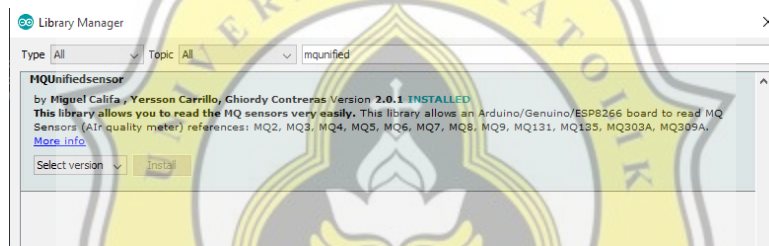

*Picture 6: Library MQUnifiedSensor*

The MQUnifiedSensor library is used to calibrate the MQ-2 (methane), MQ-7 (CO), and MQ-135 (CO2) sensors. This library, created by Miguel Califa, Yersson Carrillo, and Ghiordy Contreras, may be used on Arduino/Genuino/ESP8266. This library can calibrate MQ-2, MQ-3, MQ-4, MQ-5, MQ-6, MQ-7, MQ-8, MQ-9, MQ-131, MQ-135, MQ-303A, and MQ-309A.

## 4.3. Library LCD I2C
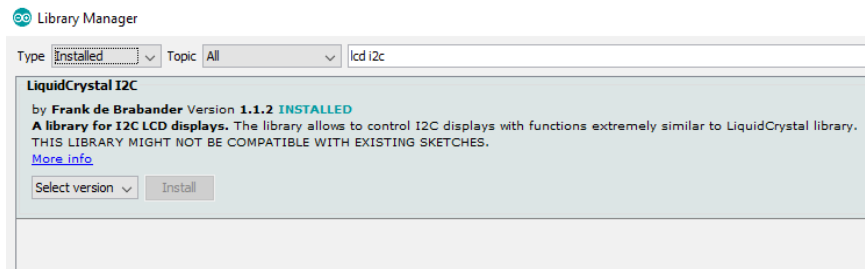


*Picture 7: Library LCD I2C*

The i2c module attempts to reduce the number of cords on the LCD and make it seem less complex. To make it easy to calibrate/adjust the LCD, we'll need an i2c module that uses the i2c LCD library.

## 4.4. Algorithm Fuzzy Logic Sugeno

The fuzzy algorithm is useful for processing input data and mapping it to output in such a way that the output results approach human-like reasoning. The incoming data will be fuzzified, after which it will be entered into the rule, with the minimum value being picked from each rule. The defuzzification procedure follows, with the defuzzification value being utilized to determine the fuzzy process' ultimate outcome.

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