Ultrasonic Sensor Parking System with Arduino

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I. Background

Today, the use of technology has a significant impact on people's daily lives, from the smallest to the most advanced technology. Several electronic devices are being developed to assist humans in their daily operations, ranging from entertainment equipment to tools that can replace human tasks.

Technology is advancing rapidly, and various electronic devices have been created with their respective functions. Many of these devices operate on similar systems. One of the most important components of any electronic device is a sensor, which can detect events or situations in its surroundings, such as sound sensors, fire sensors, and distance sensors.

The sensor chosen by our group is the ultrasonic sensor. What is an ultrasonic sensor? It is a sensor that can detect the presence of objects around it without physical contact. This sensor is often used in cars. When parking, modern cars typically have a sensor that beeps when the car is about to hit a wall—that is an ultrasonic sensor.

II. Working Principle

An ultrasonic sensor functions by converting physical quantities (sound) into electrical quantities and vice versa. The working principle of this sensor is based on the reflection of sound waves, which can be used to interpret the existence (distance) of an object at a certain frequency.

The ultrasonic sensor has two important pins: "TRIG" and "ECHO." The TRIG (Trigger) pin is used to generate ultrasonic signals, while the ECHO (Receiver/Indicator) pin detects the reflected ultrasonic signals.

III. Tools and Materials

1. Arduino Uno R3
2. Ultrasonic Distance Sensor
3. LCD 16X2(I2C)
4. Piezo
5. LED (Red,Yellow,White)
6. 3 kΩ resistor
7. Breadboard

IV. Datasheet sensor

Ultrasonic Ranging Module HC - SR04

Product features:

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:
(1) Using IO trigger for at least 10us high level signal,
(2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
(3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.
Test distance = (high level time×velocity of sound (340M/S) / 2,

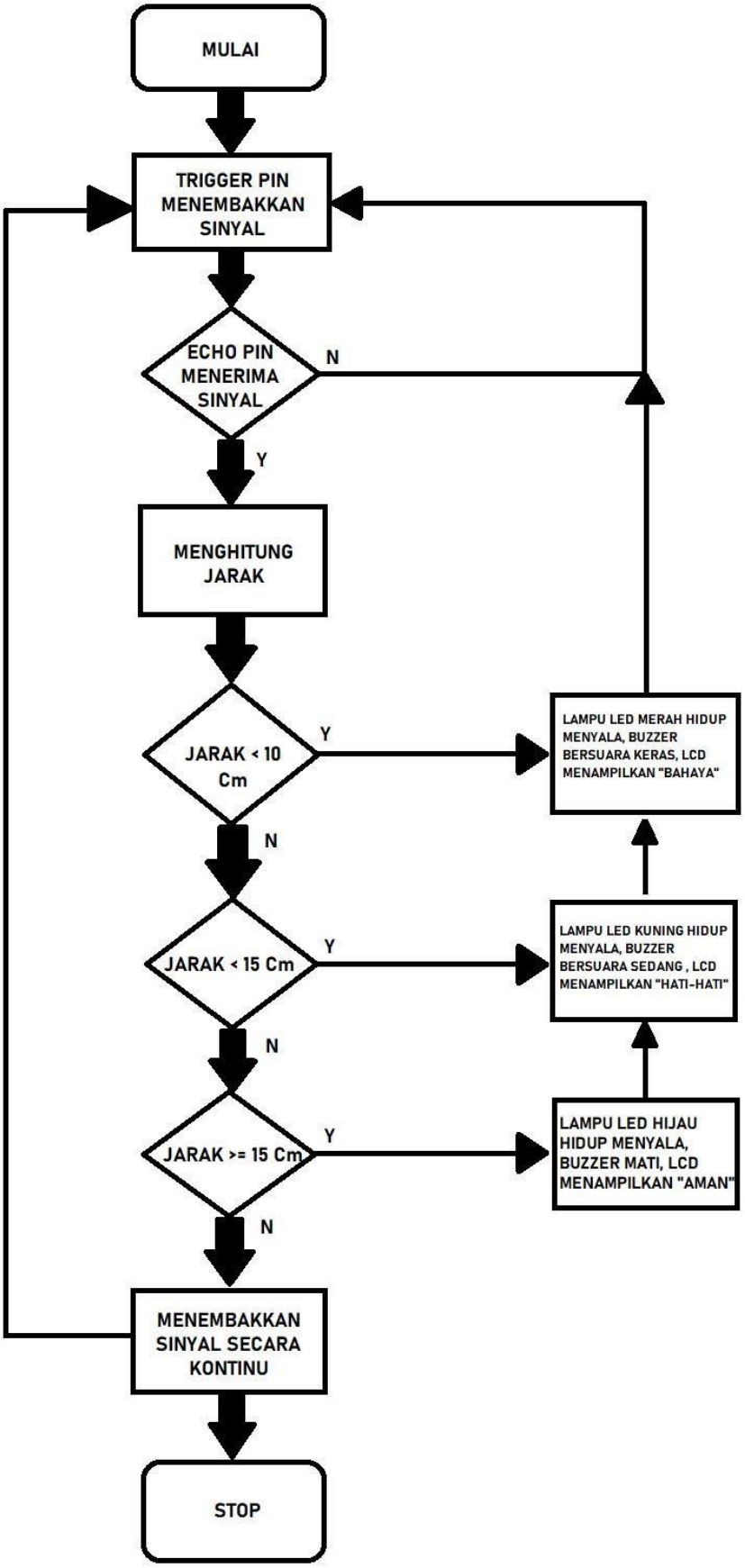
Wire connecting direct as following:

- 5V Supply
- Trigger Pulse Input
- Echo Pulse Output
- 0V Ground

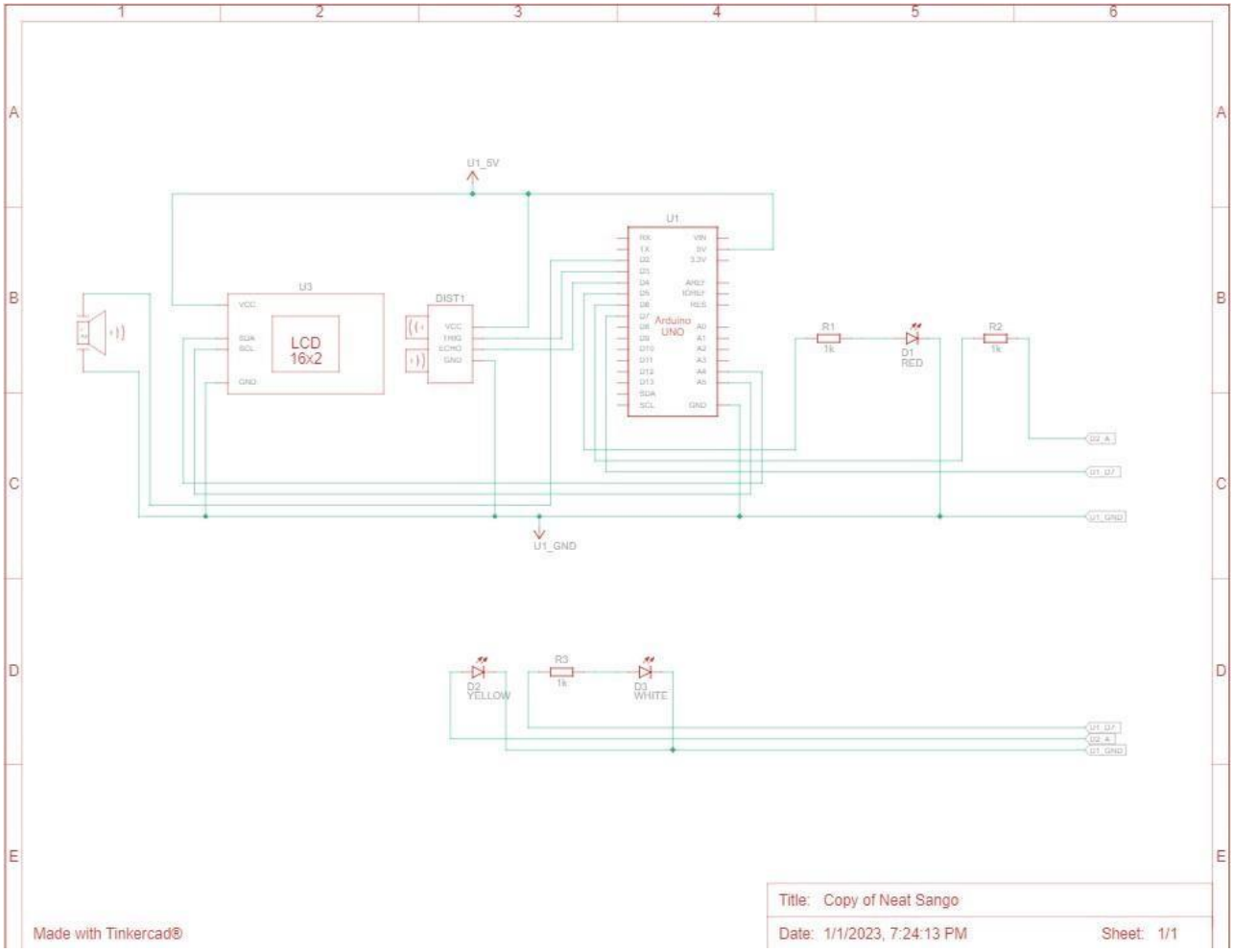
Electric Parameter

Working Voltage	**DC 5 V**
Working Current	**15mA**
Working Frequency	**40Hz**
Max Range	**4m**
Min Range	**2cm**
MeasuringAngle	**15 degree**
Trigger Input Signal	**10uS TTL pulse**
Echo Output Signal	**Input TTL lever signal and the range in proportion**
Dimension	**45*20*15mm**

V. Flowchart

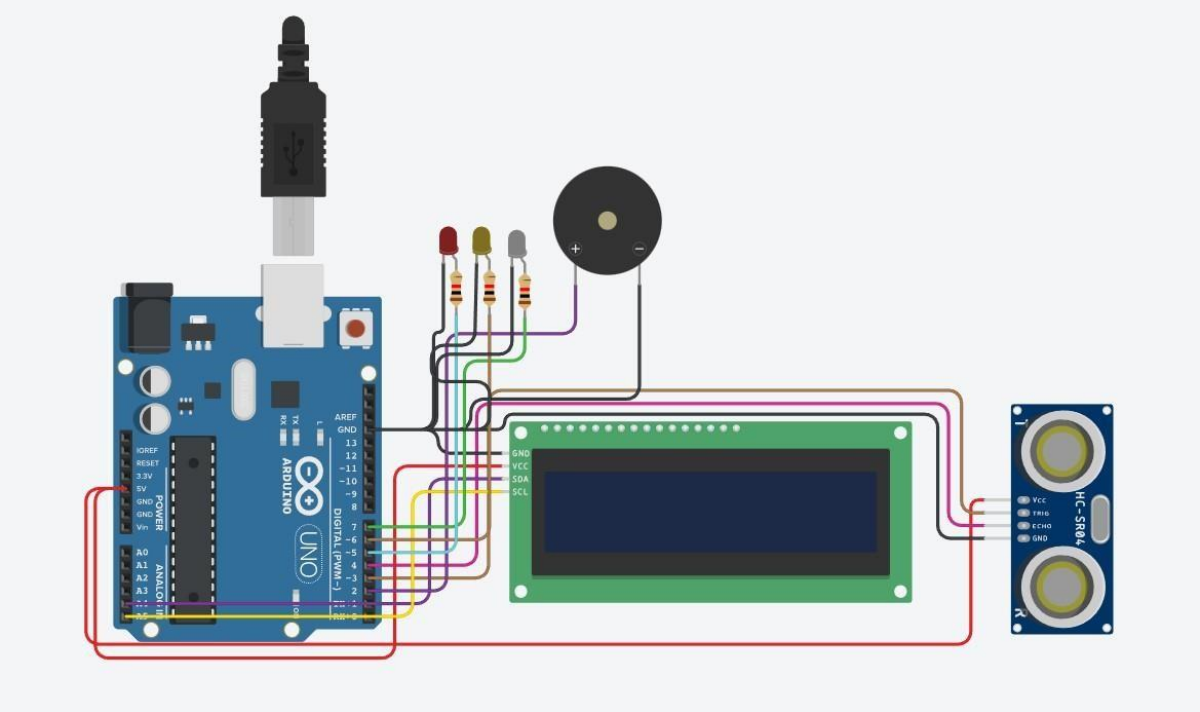

MULAI
TRIGGER PIN MENEMBAKKAN SINYAL
ECHO PIN MENERIMA SINYAL
N
Y
MENGHITUNG JARAK
JARAK < 10 Cm
Y
LAMPU LED MERAH HIDUP MENYALA, BUZZER BERSUARA KERAS, LCD MENAMPILKAN "BAHAYA"
N
JARAK < 15 Cm
Y
LAMPU LED KUNING HIDUP MENYALA, BUZZER BERSUARA SEDANG , LCD MENAMPILKAN "HATI-HATI"
N
JARAK >= 15 Cm
Y
LAMPU LED HIJAU HIDUP MENYALA, BUZZER MATI, LCD MENAMPILKAN "AMAN"
N
MENEMBAKKAN SINYAL SECARA KONTINU
STOP

VI. Simulation Results in Tinkercad

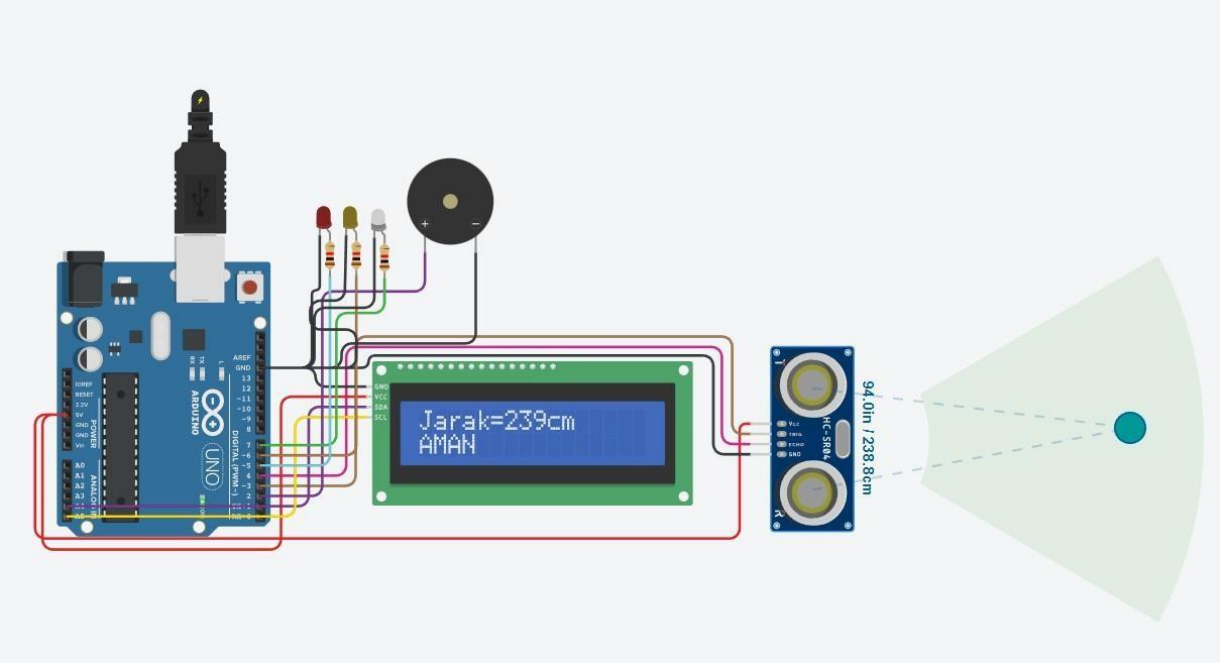


Name	Quantity	Component
U1	1	Arduino Uno R3
DIST1	1	Ultrasonic Distance Sensor
U3	1	PCF8574-based, 39 LCD 16 x 2 (I2C)
PIEZO1	1	Piezo
D1	1	Red LED
D2	1	Yellow LED
D3	1	White LED
R1 R2 R3	3	1 kΩ Resistor

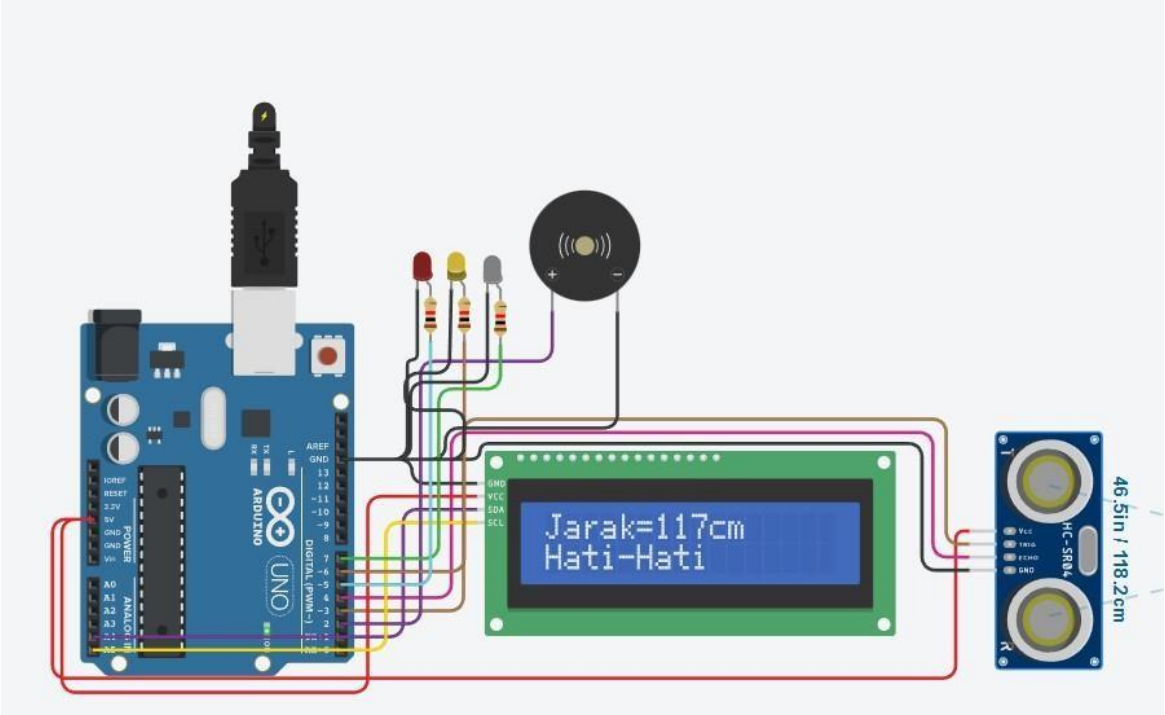
Off state



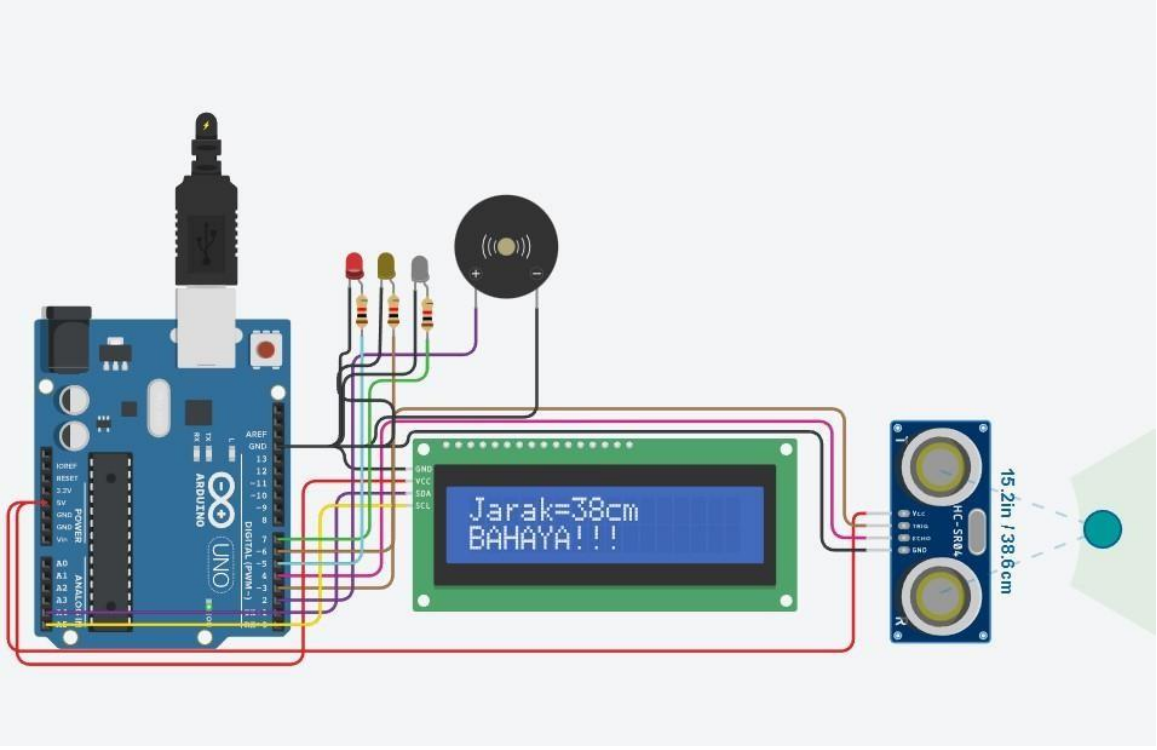
White LED, Safe Range



Yellow LED, Caution Range



Red LED, Danger !

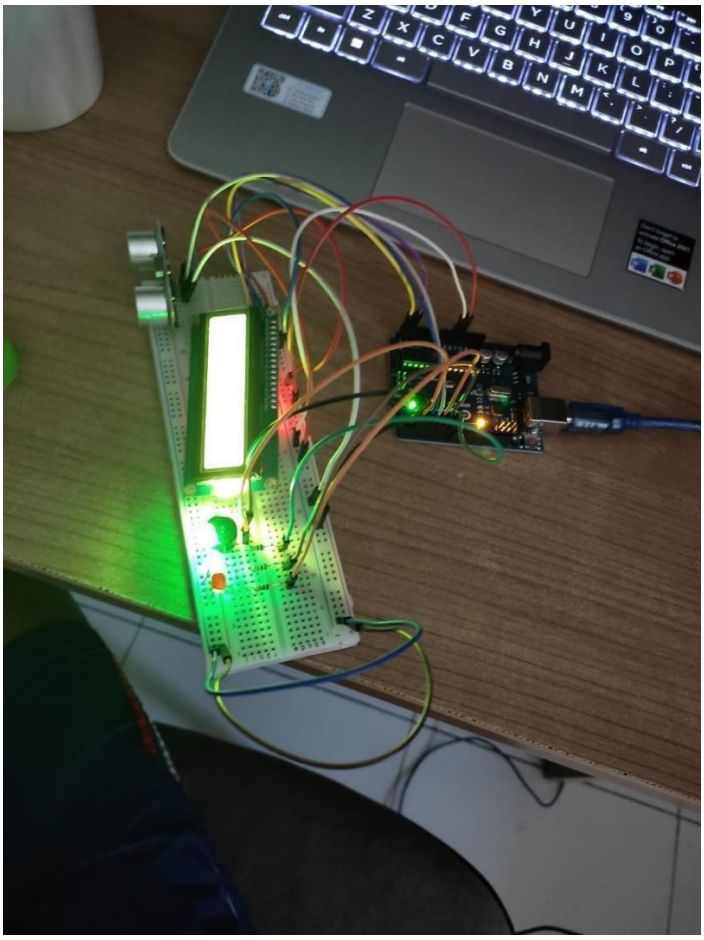


VII. Source Code Arduino

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27,16,2);

#define Buzzpin 2
#define Trigpin 3
#define Echopin 4
#define ledRed 5
#define ledYellow 6
#define ledWhite 7
 long
duration,cm,inches;
 void setup(){
pinMode(Buzzpin,OUTPUT);
pinMode(Trigpin,OUTPUT);
pinMode(Echopin,OUTPUT);
pinMode(ledRed,OUTPUT);
pinMode(ledWhite,OUTPUT);
pinMode(ledYellow,OUTPUT);
lcd.begin();     lcd.init();
lcd.backlight();
lcd.clear();     lcd.home();
    Serial.begin(19200);
}
void loop(){     lcd.setBacklight(1000);
digitalWrite(Trigpin,LOW);
delayMicroseconds(2);
digitalWrite(Trigpin,HIGH);
delayMicroseconds(10);
digitalWrite(Trigpin,LOW);     int
duration = pulseIn(Echopin,HIGH);
int distance = duration/58;
    int echopin = digitalRead(echopin);

    if(distance<50){
digitalWrite(ledRed,HIGH);
digitalWrite(ledYellow,LOW);
digitalWrite(ledWhite,LOW);
tone(Buzzpin,900,500);
lcd.setcursor(0,1);         lcd.print("Bahaya
!!!");
```

```
    }      else if(distance < 150){
digitalWrite(ledYellow,HIGH);
digitalWrite(ledWhite,LOW);
digitalWrite(ledRed,LOW);
tone(Buzzpin,LOW);
lcd.setcursor(0,1);
lcd.print("Hati-Hati!");
delay(10);
    }      if(distance>=150){
digitalWrite(ledRed,LOW);
digitalWrite(ledYellow,LOW);
digitalWrite(ledWhite,HIGH);
digitalWrite(Buzzpin,LOW);
lcd.setcursor(0,1);
lcd.print("Aman ");
    }
    delay(10);
     lcd.setCursor(0,0);
lcd.print("Jarak = ");
lcd.print("cm    ");
}
```

VIII. Final Result



Final Result Image

IX. Conclusion

Our group created an ultrasonic sensor system. The sensor we developed is commonly used in cars during parking. If an object is detected at a distance of >= 15 cm, the white light will turn on, and the LCD will display "Safe." If an object is within < 15 cm, the yellow light will turn on, and the LCD will display "Caution," with the buzzer sounding. If the object is within < 10 cm, the red light will turn on, the buzzer will sound more loudly, and the LCD will display "Danger."

The tools and materials we used can be seen in the images. We used an ultrasonic sensor to detect objects. The sensor emits ultrasonic waves, and if an object is detected in front of it, the sensor responds.

What's the difference between ultrasonic and PIR sensors? The difference is that an ultrasonic sensor can detect the precise location of the object because it uses ultrasonic waves.

We used **C++/CPP**, which is the programming language commonly used for Arduino. The "Safe," "Caution," and "Danger" distances, as well as the buzzer's sound, can be adjusted in the code.

X. Suggestions

We hope this paper can be used as a reference to enhance knowledge in this field. We also encourage further development based on this project.