DEPARTMENT OF
ELECTRONICS AND COMMUNICATION ENGINEERING
College of Engineering and Technology
SRM Institute of Science and Technology

MINI PROJECT REPORT

ODD Semester, 2023-2024

Lab code & Sub Name	:	18EC0108J-Embedded System Design using Arduino
Year & Semester	:	III year- V semester
Project Title	:	Smart Parking Assistant: Arduino Ultrasonic Sensor and LED-Based System
Lab Supervisor	:	**Dr.V. Padmajothi** AP/ECE
Team Members	:	1.Nitanshi Bhardwaj (Reg.No:RA2111047010005) 2.Krishna Gupta (Reg.No:RA2111047010041)

Particulars	**Max. Marks**	**Marks Obtained**
		Name:
		Register No :
Program and Execution	20	
Demo verification &viva	15	
Project Report	05	
Total	**40**	

Date :

Staff Name :

Signature :

SMART PARKING ASSISTANT: ARDUINO ULTRASONIC SENSOR AND LED-BASED SYSTEM

OBJECTIVE:

The "Smart Parking Assistant: Arduino Ultrasonic Sensor and LED-Based System" project is undertaken with the primary objectives of creating a technologically advanced parking aid system that solves common parking-related challenges. Parking in tight spaces can be a daunting task, often leading to vehicle damage or collisions with obstacles. To address this issue, the project aims to deliver a comprehensive solution. The heart of the system lies in the ultrasonic sensor, a device known for its accuracy in measuring distances. By accurately assessing the proximity of obstacles, the system empowers drivers with real-time information crucial for safe and precise parking.

The project also focuses on delivering multi-stage visual feedback to users. This is achieved through LEDs with different colors, each representing a distinct proximity level. Red LEDs signal that an obstacle is dangerously close, urging the driver to halt or adjust their position. Yellow LEDs indicate a moderate distance, providing a cautionary signal, while green LEDs assure the driver that the parking space is clear. This multi-color LED feedback system is designed to make parking more intuitive and safer. Additionally, the project emphasizes user-friendliness, aiming to create an intuitive and easy-to-operate system. The provided real-time distance data on a digital display allows users to track changes in distance as they approach an obstacle, providing valuable situational awareness during the parking process. Users can readily customize and fine-tune the system to suit their specific needs, including adjusting the distance thresholds that trigger LED and auditory alerts.

Thus, the "Smart Parking Assistant: Arduino Ultrasonic Sensor and LED-Based System" project endeavors to address the challenges associated with parking in tight spaces by providing accurate, real-time, and user-friendly feedback to enhance safety and precision. By combining ultrasonic distance sensing, multi-color LEDs, an audible alert system, and a digital display, the system aims to revolutionize the parking experience and minimize the risk of accidents and vehicle damage, making parking both safer and more convenient for drivers.

ABSTRACT:

The "Smart Parking Assistant: Arduino Ultrasonic Sensor and LED-Based System" project introduces an innovative solution to the challenges of parking in tight spaces. This project focuses on the development of a parking assistance system using an ultrasonic sensor and LED indicators. The ultrasonic sensor accurately measures distances between the sensor and nearby obstacles, providing real-time visual feedback through a multi-color LED indicator system. Red LEDs indicate close proximity, yellow LEDs signify moderate distances, and green LEDs ensure a safe clearance. The system is designed to enhance parking safety, precision, and user-friendliness, ultimately reducing the risk of accidents and vehicle damage in constrained parking environments.

The significance of this project lies in its potential to make parking more intuitive and secure. By combining precise distance measurement with multi-stage visual feedback, it empowers drivers with essential information for parking in tight spaces where visibility is limited. The project's user-friendly design allows for customization to meet the specific needs of different users, making it a versatile solution for various types of vehicles.

In conclusion, the project's main outcomes are a fully functional parking assistance system that provides accurate distance measurement and multi-color LED-based real-time feedback. This system has the potential to enhance the safety and precision of parking, making it a valuable tool for drivers navigating challenging parking scenarios.

INTRODUCTION:

The project addresses the application of parking assistance in scenarios where parking spaces are limited and require precise vehicle positioning. It aims to make the process of parking in tight spaces more manageable and secure by providing real-time feedback to the driver about the proximity of obstacles or other vehicles. This application is particularly relevant in urban environments, crowded parking lots, and scenarios where drivers need to navigate constrained spaces. The project's parking assistant system, utilizing an ultrasonic sensor and LED indicators, assists drivers in achieving accurate and safe parking by reducing the risk of collisions with obstacles and ensuring that vehicles are positioned with optimal clearance. This application is designed to enhance the overall parking experience, making it more accessible to drivers who encounter challenges related to limited parking space and visibility.

HARDWARE/SOFTWARE REQUIREMENTS:

Hardware Requirements:

1. Arduino Board: You will need an Arduino board, such as an Arduino Uno, for controlling the system.

2. Ultrasonic Sensor (HC-SR04): The ultrasonic sensor is used to measure distances and detect obstacles.

3. LEDs:You'll need at least three LEDs (red, yellow, and green) to provide visual feedback.
4. Resistors: Use resistors (around 220-470 ohms) for each LED to limit the current and prevent them from burning out.

5. Breadboard and Jumper Wires:These are essential for making connections between the components.

6. Power Supply: You can power the Arduino using a USB cable connected to a computer or a dedicated power supply.

Software Requirements:

1. Arduino IDE: You'll need the Arduino Integrated Development Environment (IDE) to write, upload, and run the code on your Arduino board. It can be downloaded from the Arduino website.

2. Arduino Libraries:Depending on the specific components you use, you may need to install relevant libraries. For the HC-SR04 ultrasonic sensor, you'll need the "NewPing" library, which simplifies working with ultrasonic sensors.

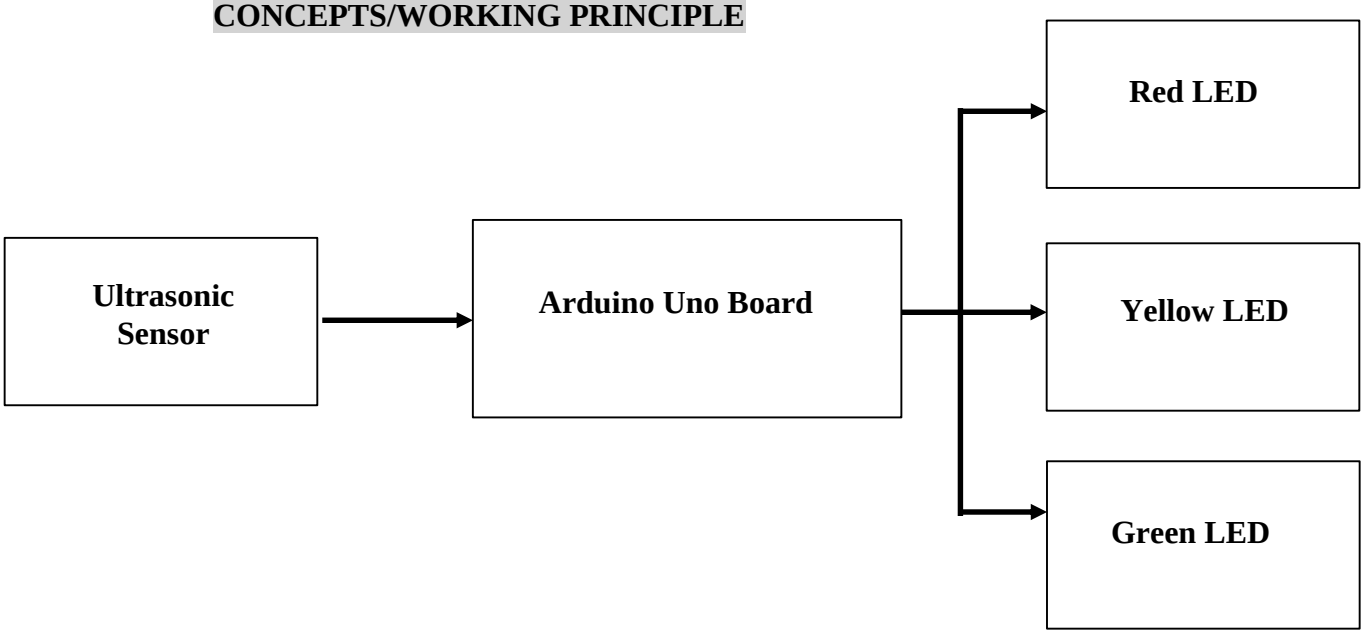
3. Device Drivers:Ensure that the necessary drivers for your Arduino board are installed on your computer, allowing it to communicate with the board through the USB connection.

4. Operating System: The Arduino IDE is available for Windows, macOS, and Linux, so you can choose the version that matches your operating system.

5. USB Cable: If you are connecting the Arduino to your computer, you'll need a USB cable compatible with your Arduino board and computer.

6. Computer: A computer is required for writing and uploading code to the Arduino.

CONCEPTS/WORKING PRINCIPLE



The working principle of the "Smart Parking Assistant: Arduino Ultrasonic Sensor and LED-Based System" revolves around the accurate measurement of distances and real-time feedback to enhance parking safety and precision.

An ultrasonic sensor emits high-frequency sound waves, which travel outward until they encounter an obstacle. Upon collision with an object, the sound waves bounce back towards the sensor, and the sensor precisely measures the time it takes for this return journey. This time measurement is directly proportional to the distance between the sensor and the obstacle. An Arduino microcontroller processes this data, converting it into actionable information.

The programmed code interprets the distance data and activates the appropriate LED (red, yellow, or green) based on proximity levels, providing immediate visual feedback to the driver. Red LEDs signify close proximity, indicating the need for caution, yellow LEDs denote a moderate distance, serving as a warning signal, and green LEDs ensure a safe clearance for parking.

This real-time feedback empowers drivers to make informed decisions during the parking process, significantly reducing the risk of collisions and vehicle damage in tight parking scenarios.

APPROACH/METHODOLOGY/PROGRAMS:

The circuit design for the "Smart Parking Assistant" project involves the careful arrangement of components to ensure accurate distance measurement and effective LED feedback. The core components include the ultrasonic sensor, LEDs, resistors, and the Arduino board as explained before.

Code:

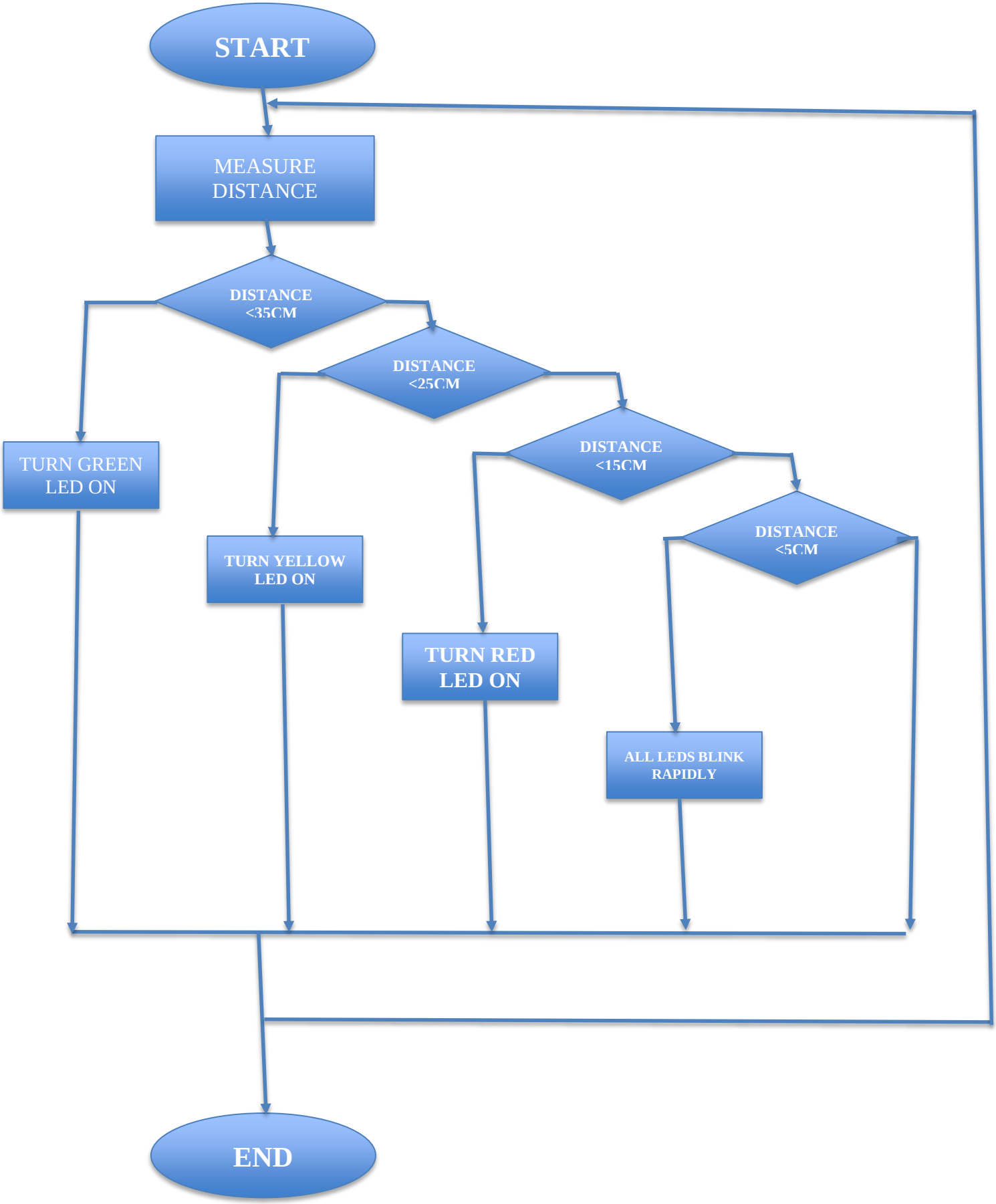
UltrasonicParkingSensor.ino

```
long cm = 0;
void setup()
{
Serial.begin(9600);
pinMode(2, OUTPUT);
pinMode(3, OUTPUT);
pinMode(4, OUTPUT);
}
void loop()
{
cm =readUltrasonicDistance(7, 6);
Serial.print(cm);
Serial.println("cm");

if (cm > 35) {
  digitalWrite(2, LOW);
  digitalWrite(3, LOW);
  digitalWrite(4, LOW);
}
if (cm <= 35 && cm > 25) {
  digitalWrite(4, HIGH);
  digitalWrite(3, LOW);
  digitalWrite(2, LOW);
}
if (cm <= 25 && cm > 15) {
  digitalWrite(4, LOW);
  digitalWrite(3, HIGH);
  digitalWrite(2, LOW);
}
if (cm <= 15 && cm > 5) {
  digitalWrite(2, HIGH);
  digitalWrite(3, LOW);
  digitalWrite(4, LOW);
}
```

UltrasonicParkingSensor.ino

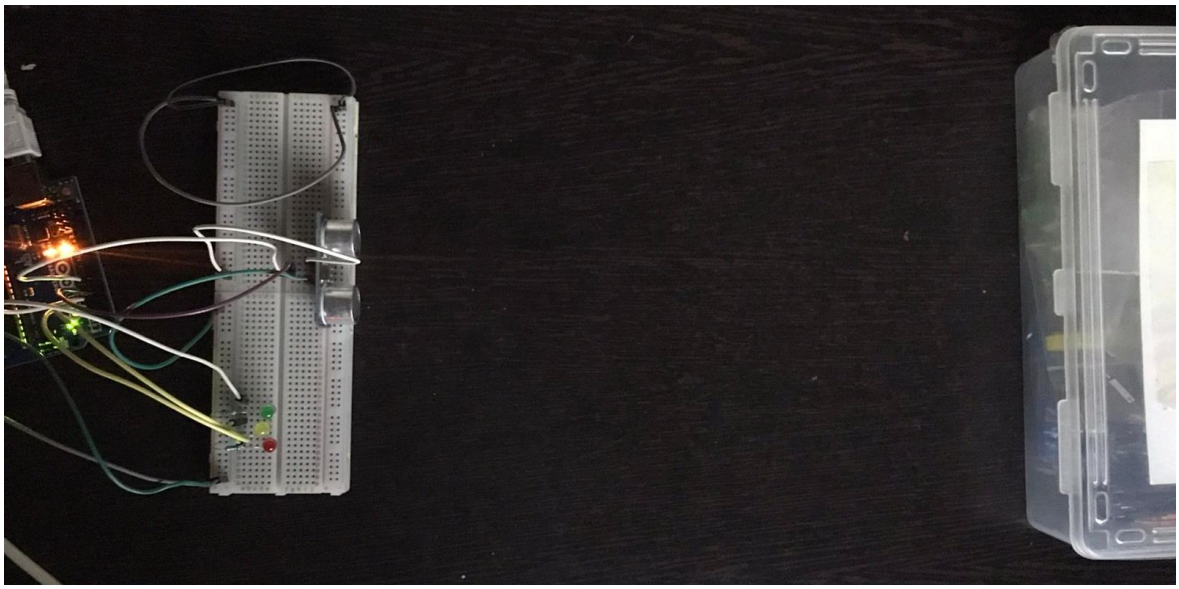
```
  digitalWrite(3, LOW);
  digitalWrite(4, LOW);
}
if (cm <= 5) {
  digitalWrite(2, HIGH);
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);

  delay(50);

  digitalWrite(2, LOW);
  digitalWrite(3, LOW);
  digitalWrite(4, LOW);

  delay(50);
  }

delay(100);
}

long readUltrasonicDistance(int triggerPin, int echoPin)
{
pinMode(triggerPin, OUTPUT);
digitalWrite(triggerPin, LOW);

delayMicroseconds(2);

digitalWrite(triggerPin, HIGH);

delayMicroseconds(10);

digitalWrite(triggerPin, LOW);

pinMode(echoPin, INPUT);
return (pulseIn(echoPin, HIGH)*0.01723);
}
```

FLOWCHART:


START
MEASURE DISTANCE
DISTANCE <35CM
DISTANCE <25CM
DISTANCE <15CM
DISTANCE <5CM
TURN GREEN LED ON
TURN YELLOW LED ON
TURN RED LED ON
ALL LEDS BLINK RAPIDLY
END

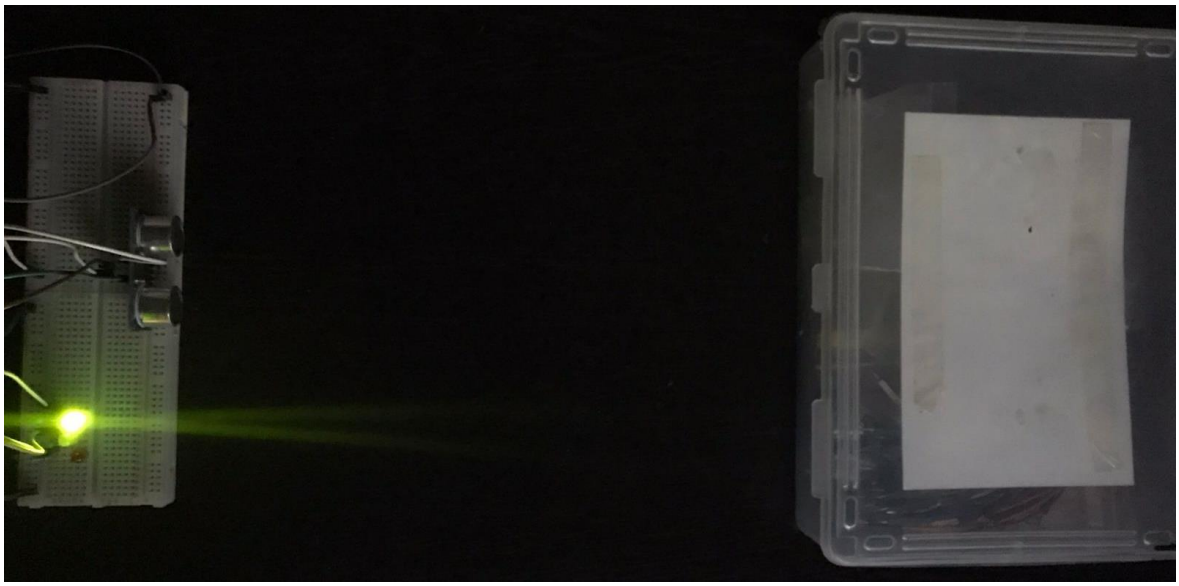
OUTPUT:

Case 1: When distance is **greater than 35cm**.



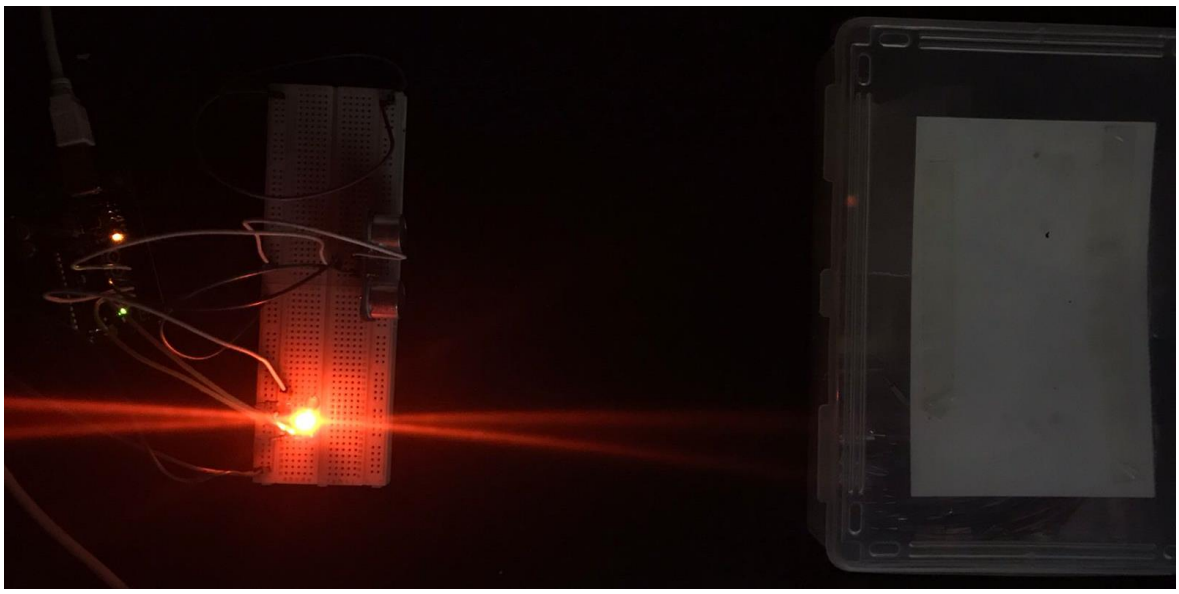
None of the LEDs are turned on, indicating that there is a huge distance between the car and the object.

Case 2: When distance is **between 35cm and 25cm**.



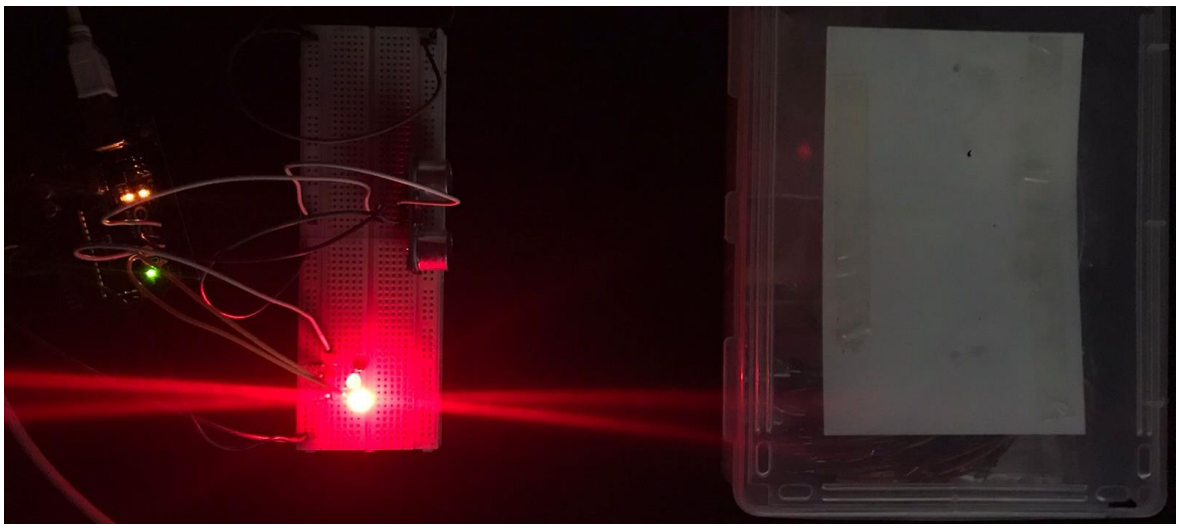
Green LED is turned on, indicating that there is still a good amount of distance between the car and the object.

Case 3: When distance is **between 25cm and 15cm**.



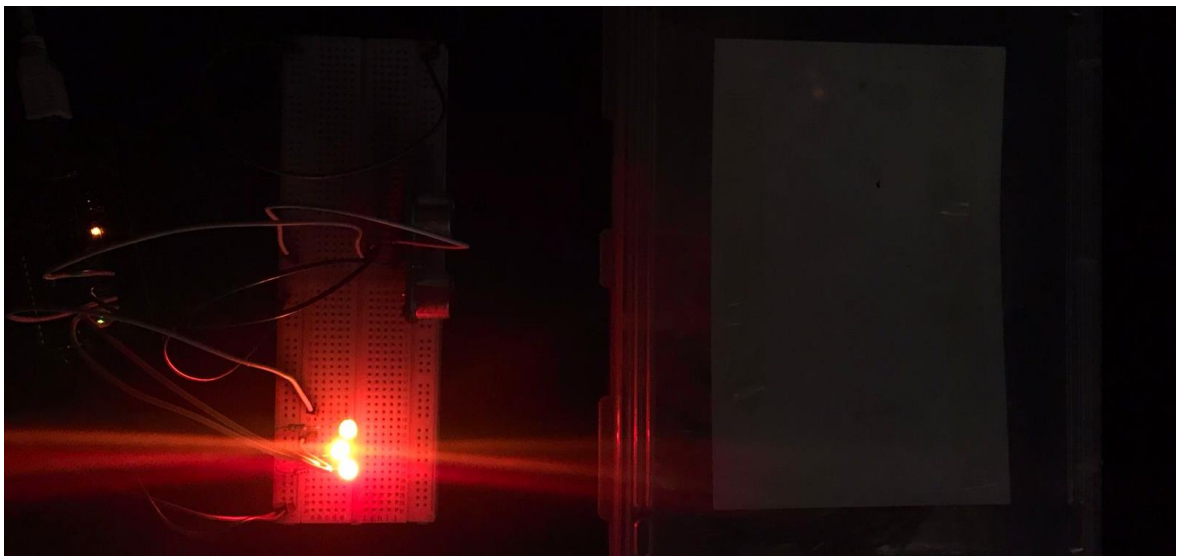
Yellow LED is turned on, indicating that there is not a lot of distance between the car and the object.

Case 4: When distance is **between 15cm and 5cm**.



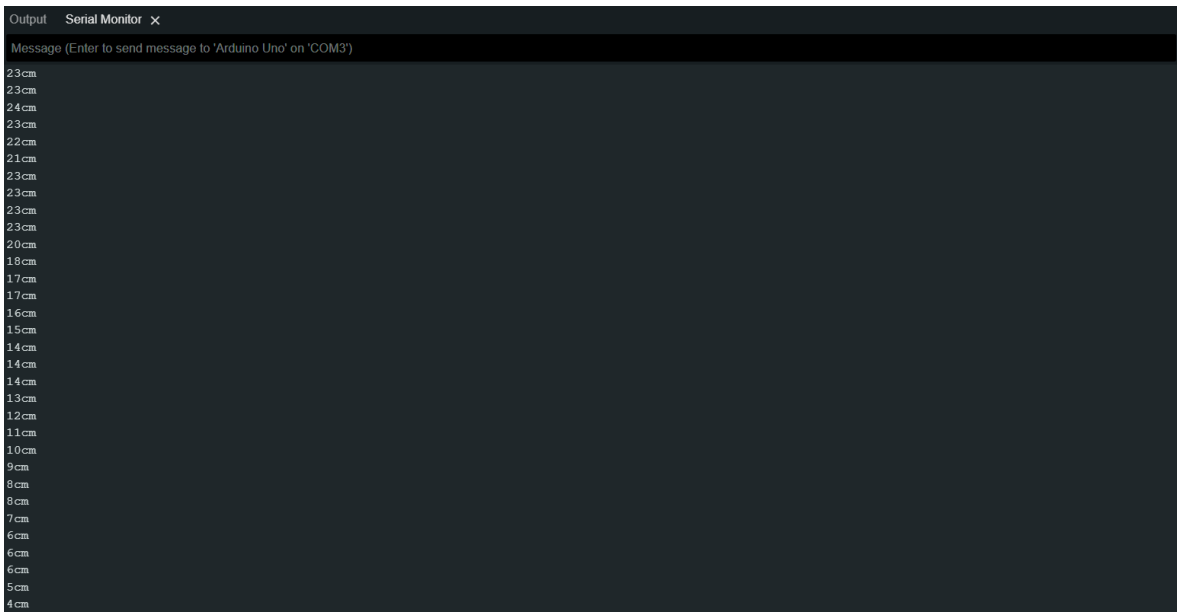
Red LED is turned on, indicating that there is very little distance between the car and the object, and thus the driver should stop reversing.

<u>Case 5:</u> When distance is **less than 5cm**.



All the LEDs start blinking rapidly, indicating that the car is about to collide with the object and hence the driver should stop immediately.

The **Serial Monitor** showing the different distances measured by the **Ultrasonic Sensor**:



CONCLUSIONS:

In conclusion, the "Smart Parking Assistant: Arduino Ultrasonic Sensor and LED-Based System" project has successfully developed a reliable and user-friendly solution for enhancing parking safety and precision in confined spaces.

The integration of an ultrasonic sensor and multi-color LED feedback system, coupled with a well-structured Arduino program, provides drivers with real-time proximity information, making it easier to gauge distances and park with confidence.

With the potential to reduce the risk of accidents and vehicle damage, this project represents a valuable tool for improving the overall parking experience and holds promise for practical application in urban and tight-space parking scenarios.

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