

Components Required

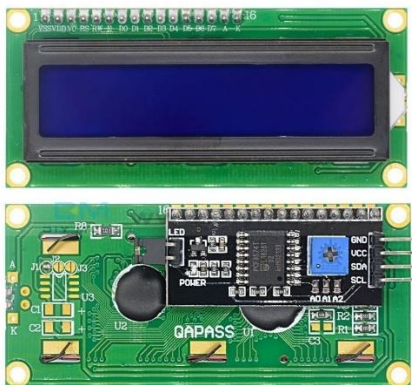
1. Arduino Uno

- **Description:** The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button.
- **Purpose:** The Arduino Uno is the brain of the project, controlling all the other components and executing the logic defined in the code.



2. LiquidCrystal_I2C (16x2) LCD

- **Description:** The LiquidCrystal_I2C is a 16x2 character display module that uses the I2C protocol to communicate with the Arduino, which significantly reduces the number of pins required for connection.
- **Purpose:** The LCD is used to display messages and the number of available parking slots to the users. It provides a user-friendly interface for monitoring the parking system status.



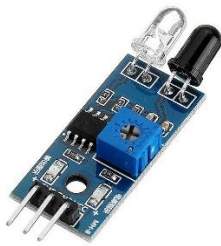
3. Servo Motor

- **Description:** A servo motor is a rotary actuator that allows for precise control of angular position. It consists of a motor coupled to a sensor for position feedback.
- **Purpose:** The servo motor is used to control the barrier at the parking entrance and exit. It opens and closes the barrier based on the signals received from the IR sensors and the availability of parking slots.



4. IR Sensors

- **Description:** Infrared (IR) sensors are electronic devices that emit and/or detect infrared radiation to sense objects in their surroundings. In this project, two IR sensors are used.
- **Purpose:** The IR sensors detect the presence of vehicles at the entrance and exit of the parking area. When a vehicle is detected, the corresponding sensor sends a signal to the Arduino to either decrement or increment the count of available slots and to control the barrier.



5. Jumper Wires

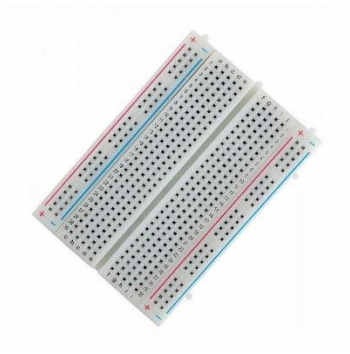
- **Description:** Jumper wires are short electrical wires with solid tips at each end, used for connecting components on a breadboard or other prototyping platforms.
- **Purpose:** Jumper wires are used to establish electrical connections between the Arduino, sensors, servo motor, and the LCD module.



6. Breadboard

- **Description:** A breadboard is a construction base for prototyping electronics. It allows for the easy insertion and removal of electronic components and wires without soldering.

- **Purpose:** The breadboard is used to connect and organize the components in the project in a non-permanent way, allowing for easy modifications and troubleshooting.



7. Power Supply

- **Description:** The power supply provides the necessary electrical power to the Arduino and other components. It can be a USB connection from a computer or an external power adapter.
- **Purpose:** To ensure the components receive a stable and sufficient voltage for proper operation.

Additional Notes

- **Arduino IDE:** This is the integrated development environment used for writing, compiling, and uploading the code to the Arduino board.
- **Libraries:** The project uses the LiquidCrystal_I2C library for controlling the LCD and the Servo library for controlling the servo motor.

Circuit Setup

The circuit setup involves connecting the Arduino with various components such as the LiquidCrystal_I2C LCD, servo motor, and IR sensors. Each component is connected to specific pins on the Arduino to ensure proper functionality and communication.

1. Arduino Uno

- **Power Supply:** Connect the Arduino to a power source (either through USB or an external power adapter).

2. LiquidCrystal_I2C (16x2) LCD

- **VCC:** Connect to the 5V pin on the Arduino.
- **GND:** Connect to the GND pin on the Arduino.
- **SDA:** Connect to the A4 pin on the Arduino.
- **SCL:** Connect to the A5 pin on the Arduino.

3. Servo Motor

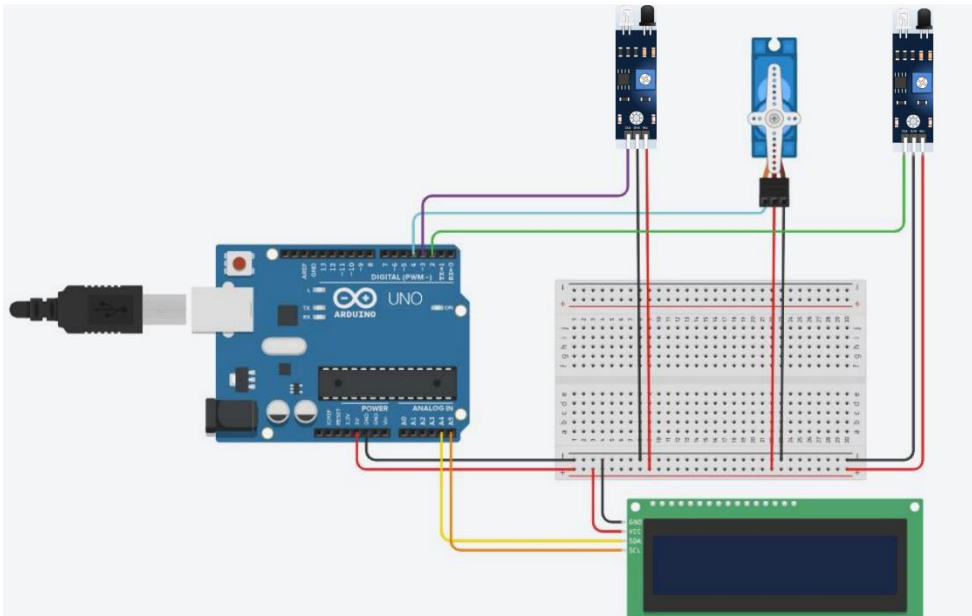
- **Signal Pin:** Connect to digital pin 4 on the Arduino.
- **Power (VCC):** Connect to the 5V pin on the Arduino.
- **Ground (GND):** Connect to the GND pin on the Arduino.

4. IR Sensors

- **IR1:**
 - **VCC:** Connect to the 5V pin on the Arduino.
 - **GND:** Connect to the GND pin on the Arduino.
 - **OUT:** Connect to digital pin 2 on the Arduino.
- **IR2:**
 - **VCC:** Connect to the 5V pin on the Arduino.
 - **GND:** Connect to the GND pin on the Arduino.
 - **OUT:** Connect to digital pin 3 on the Arduino.

5. Jumper Wires and Breadboard

- Use jumper wires to connect the components to the Arduino and to each other as needed. The breadboard can help organize and simplify these connections, especially for power (VCC) and ground (GND) lines, by creating common rails.



Code

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

LiquidCrystal_I2C lcd(0x27, 16, 2);
Servo myservo;

int IR1 = 2;
int IR2 = 3;
int Slot = 4; // Total number of parking slots
int flag1 = 0;
int flag2 = 0;

void setup() {
  Serial.begin(9600);
  lcd.init(); // Initialize the LCD
  lcd.backlight(); // Open the backlight

  pinMode(IR1, INPUT);
  pinMode(IR2, INPUT);

  myservo.attach(4);
  myservo.write(100);

  lcd.setCursor(0, 0);
  lcd.print("  ARDUINO  ");
  lcd.setCursor(0, 1);
  lcd.print(" PARKING SYSTEM ");
}
```

```

delay(2000);
lcd.clear();
}

void loop(){
  if (digitalRead(IR1) == LOW && flag1 == 0) {
    if (Slot > 0) {
      flag1 = 1;
      if (flag2 == 0) {
        myservo.write(0);
        Slot = Slot - 1;
      }
    } else {
      lcd.setCursor(0, 0);
      lcd.print("  SORRY :(  ");
      lcd.setCursor(0, 1);
      lcd.print(" Parking Full ");
      delay(3000);
      lcd.clear();
    }
  }

  if (digitalRead(IR2) == LOW && flag2 == 0) {
    flag2 = 1;
    if (flag1 == 0) {
      myservo.write(0);
      Slot = Slot + 1;
    }
  }

  if (flag1 == 1 && flag2 == 1) {
    delay(1000);
    myservo.write(100);
    flag1 = 0;
    flag2 = 0;
  }

  lcd.setCursor(0, 0);
  lcd.print("  WELCOME!  ");
  lcd.setCursor(0, 1);
  lcd.print("Slot Left: ");
  lcd.print(Slot);
}

```


Working Principle

1. **Initialization:** The system initializes the LCD, sets up the IR sensors as inputs, and attaches the servo motor.
2. **Entry Detection:** When a car approaches the entrance, IR1 sensor detects its presence. If there are available slots, the barrier (servo motor) opens, and the slot count decreases by one.
3. **Exit Detection:** When a car approaches the exit, IR2 sensor detects its presence. The barrier opens, and the slot count increases by one.
4. **Display:** The LCD continuously displays a welcome message and the number of available slots.
5. **Parking Full:** If there are no available slots, the system displays a "Parking Full" message on the LCD.

