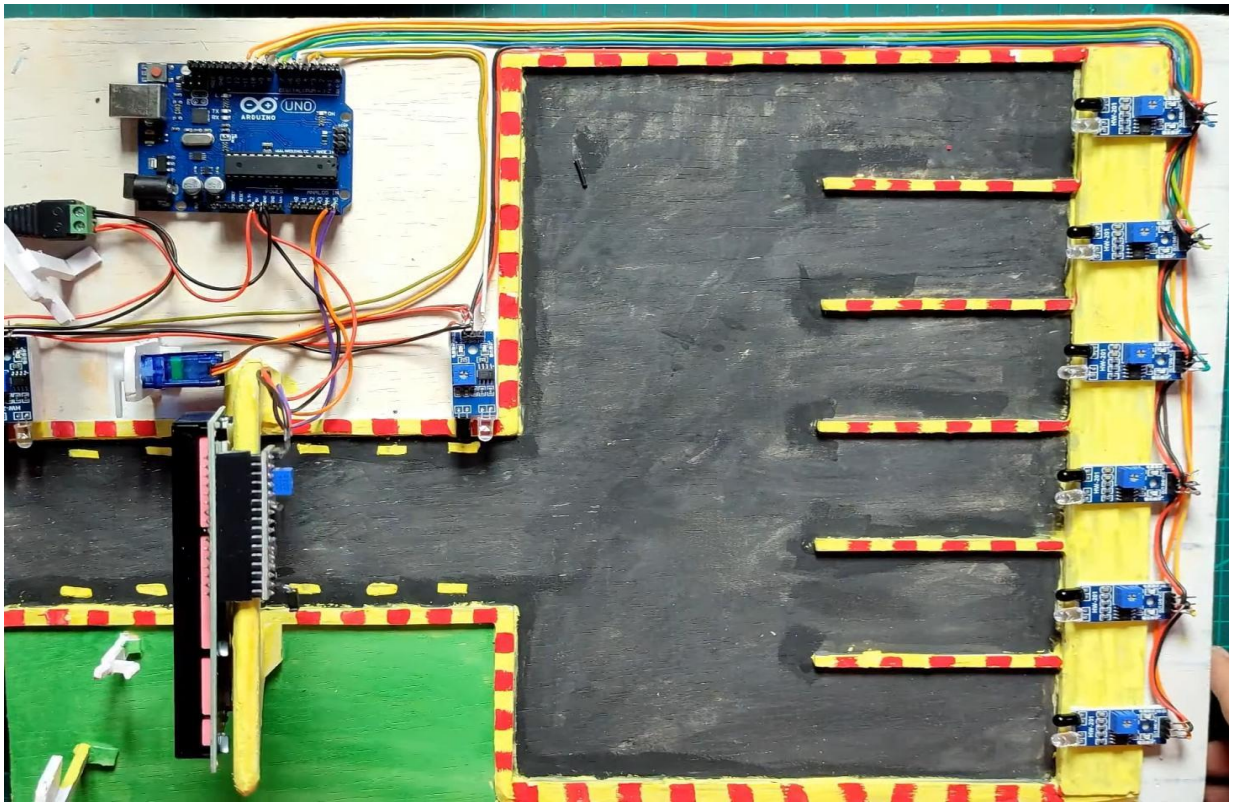
PHASE – 4

DEVELOPMENT PART - 2

Smart Parking System Using IOT



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Introduction :

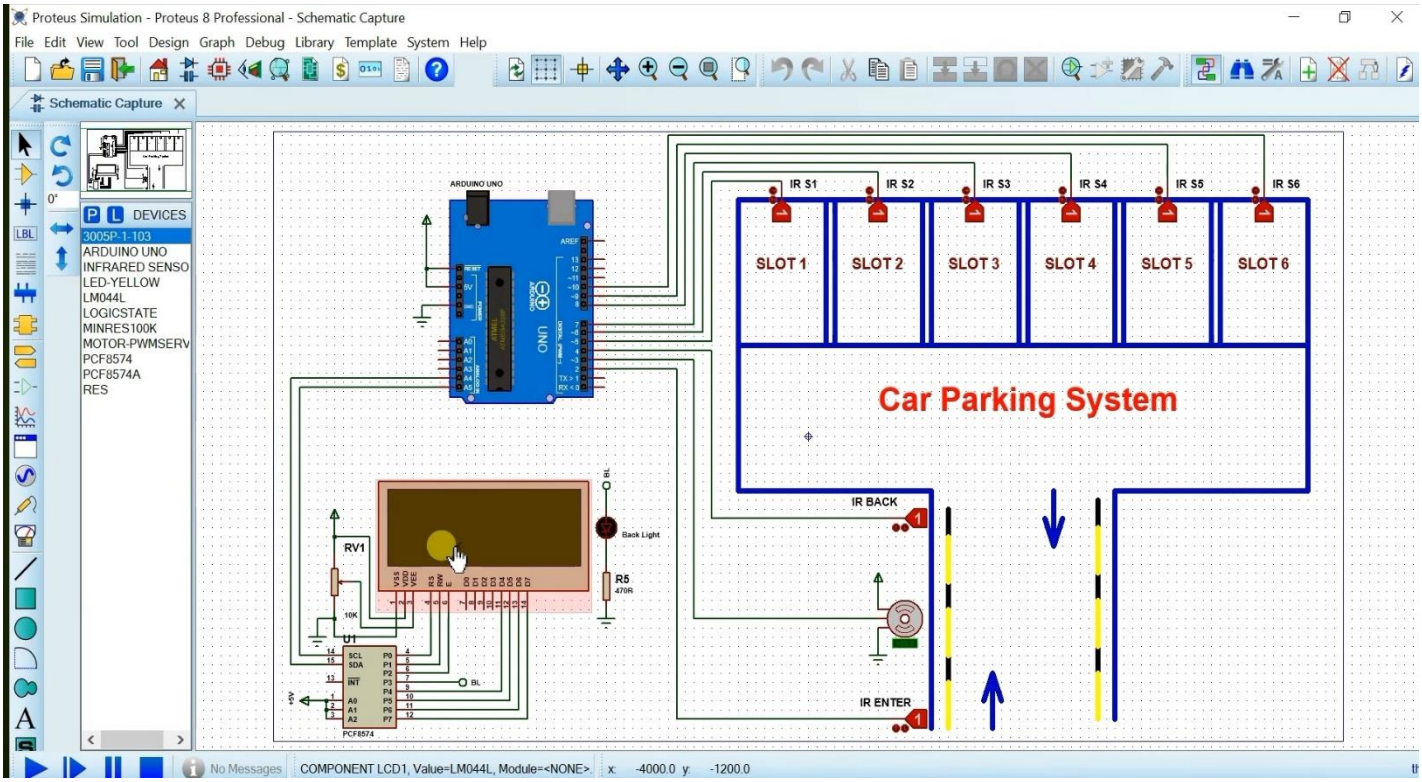
In the ever changing world of technology, automation has come to be an element of our daily life. An important common use of automation is in parking systems. Car parking systems are not only handy, but they also play an important role in managing limited parking places. In this blog article, we will look at a project that focuses on developing a **“Car Parking System”** with Arduino.

Components Required :

- Arduino UNO
- 20×4 LCD Display
- I2C Module for the LCD
- Two IR Sensors (for entrance and exit)
- Mini Servo Motor SG-90 (for barrier control)
- Six IR Sensors (for individual parking slots)
- Power source (220V)
- Power Adapter (5V, 2A)

Proteus Simulation :

Proteus is a sophisticated electronics simulation program that allows you to simulate design and test circuits before putting them into practice. This simulation serves as the foundation for the whole parking system, allowing you to see how the various components will interact.

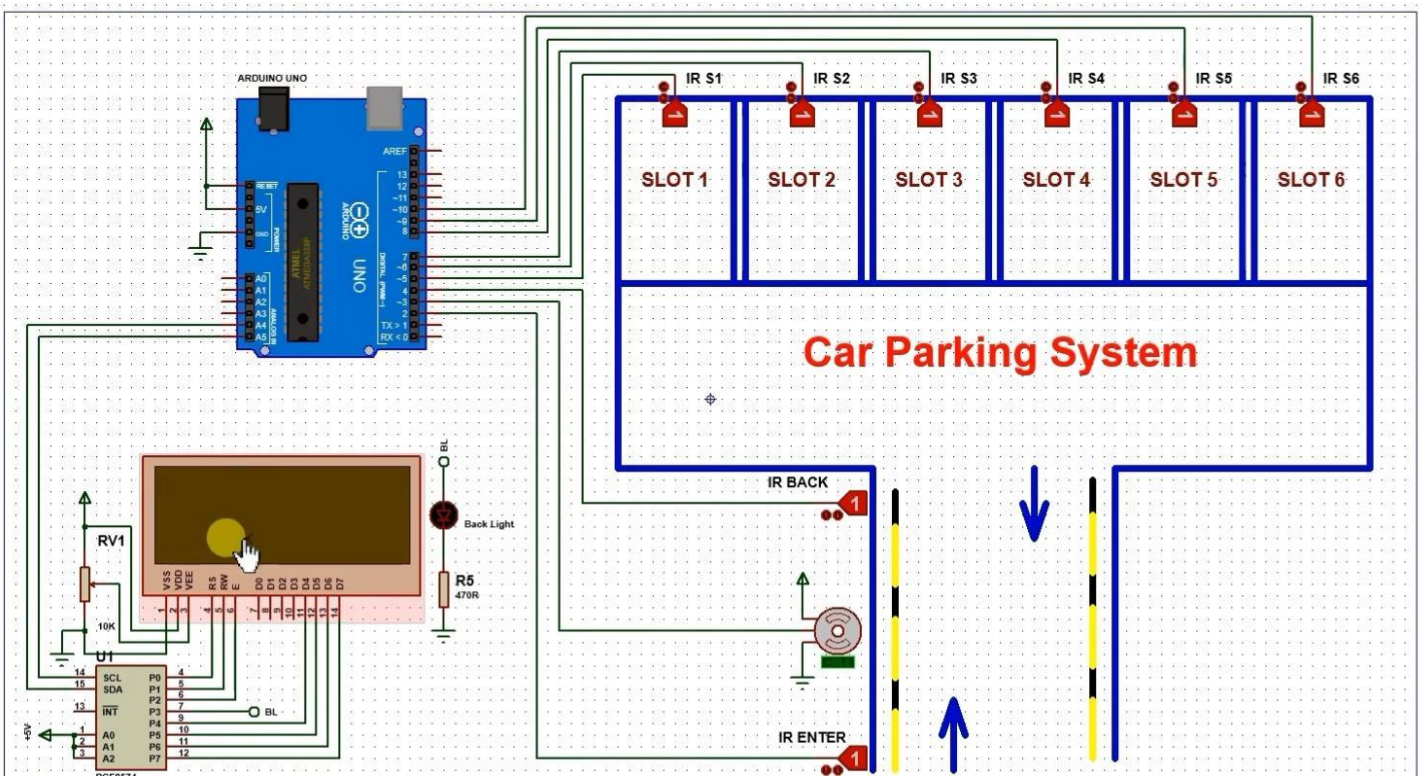


A sophisticated automobile parking system is shown in the Proteus simulation, replete with different electronic components and an Arduino microcontroller. The simulation starts with a demonstration of the essential hardware used, which include an Arduino Uno, a 20×4 LCD with an I2C module, two IR sensors, and a servo motor for barrier control. When a vehicle approaches the entry, the barrier opens, and when it passes the back sensor, it shuts. There are six spots in the parking lot, and each one has an IR (infrared) sensor to identify when a car is approaching.

The LCD shows the status of each slot; “fill” denotes a taken slot and “empty” denotes a vacant one. The connection between the sensors, barrier, and LCD is also demonstrated in the Proteus simulation, as is the dynamic updating of slot availability as automobiles arrive and depart.

It is a useful tool for testing and evaluating electronic components and code logic prior to real-world deployment, assuring the auto parking system's operation and durability.

Circuit Diagram :



1. **Power Supply:** The circuit starts with a 220-volt power source, which is then converted to 5 volts and 2 amperes using a power adapter. This 5-volt supply is used to power various components in the system.

2. **Arduino UNO:** An Arduino UNO board is the central controller of the system. It's responsible for processing data from sensors, controlling the servo motor, and displaying information on the LCD.

3. **I2C Module:** An I2C module is used to interface with the 20×4 LCD (Liquid Crystal Display). It simplifies the connection between the LCD and the Arduino.

4. **20×4 LCD:** The 20×4 LCD is used to display information about the parking slots. It can display messages such as the availability of parking slots and other system status.

5. IR Sensors: The system makes use of two infrared (IR) sensors. One sensor is at the front door, while the other one is in the back. These IR sensors detect the existence of a vehicle as it moves into or out of the parking area.

6. Mini Servo Motor: It is used to regulate the opening and closing of a barrier or gate that permits or prohibits entry to a parking lot. Based on the data gathered from the IR sensors, the motor is turned on.

7. Six Parking Slots: The system features six parking slots, each equipped with an individual IR sensor to detect the presence of a car in that slot. These sensors are crucial for monitoring which slots are occupied and which are vacant.

Explanation:

1. **Include Libraries:**
   - `Servo.h`: This library is used for controlling the servo motor.
   - `Wire.h`: Used for I2C communication with the LCD.
   - `LiquidCrystal_I2C.h`: This library simplifies controlling the 20×4 LCD screen using I2C communication.
2. **Servo Motor and IR Sensor Definitions:**
   - The code defines pins for the servo motor and IR sensors. For example, `ir_enter` is defined as pin 2 for the entrance sensor, and `ir_back` is defined as pin 4 for the back sensor.
3. **IR Sensor Variables:**
   - The state of each parking place is stored in the variables S1, S2, S3, S4, S5, and S6 (1 or 0).

- When an automobile is arriving or leaving, the variables flag1 and flag2 are utilized as flags to monitor this information.
- `slot` variable keeps track of the number of available parking slots.

4. **Setup Function:**
   - The `setup()` function initializes the serial communication, pin modes for IR sensors, and the servo motor.
   - It initializes the LCD and displays a welcome message for 2 seconds.
   - `Read_Sensor()` function is called to read the initial status of parking slots and calculate the number of available slots.
5. **Loop Function:**
   - The `loop()` function continuously runs the main logic of the system.
   - It calls `Read_Sensor()` to update the status of parking slots.
   - It displays the number of available slots and the status of each slot on the LCD.

- It checks the status of entrance and back IR sensors to determine if a car is entering or exiting.
- When a car enters, it checks if there are available slots and opens the barrier (servo motor) while decrementing the available slot count. If parking is full, it displays a “Parking Full” message.
- When a car exits, it opens the barrier and increments the available slot count.
- After a delay, the barrier is closed, and the flags are reset.

6. **Read_Sensor Funct**
   - The `Read_Sensor()` function is used to read the status of the IR sensors for all parking slots and update the corresponding variables `S1` to `S6`.

Arduino IDE Code :

```
#include <Servo.h> //includes the servo library
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 2, 1, 0, 4, 5, 6, 7, 3, POSITIVE);

Servo myservo;

#define ir_enter 2
#define ir_back  4

#define ir_car1 5
#define ir_car2 6
#define ir_car3 7
#define ir_car4 8
#define ir_car5 9
#define ir_car6 10

int S1=0, S2=0, S3=0, S4=0, S5=0, S6=0;
int flag1=0, flag2=0;
int slot = 6;

void setup(){
Serial.begin(9600);

```

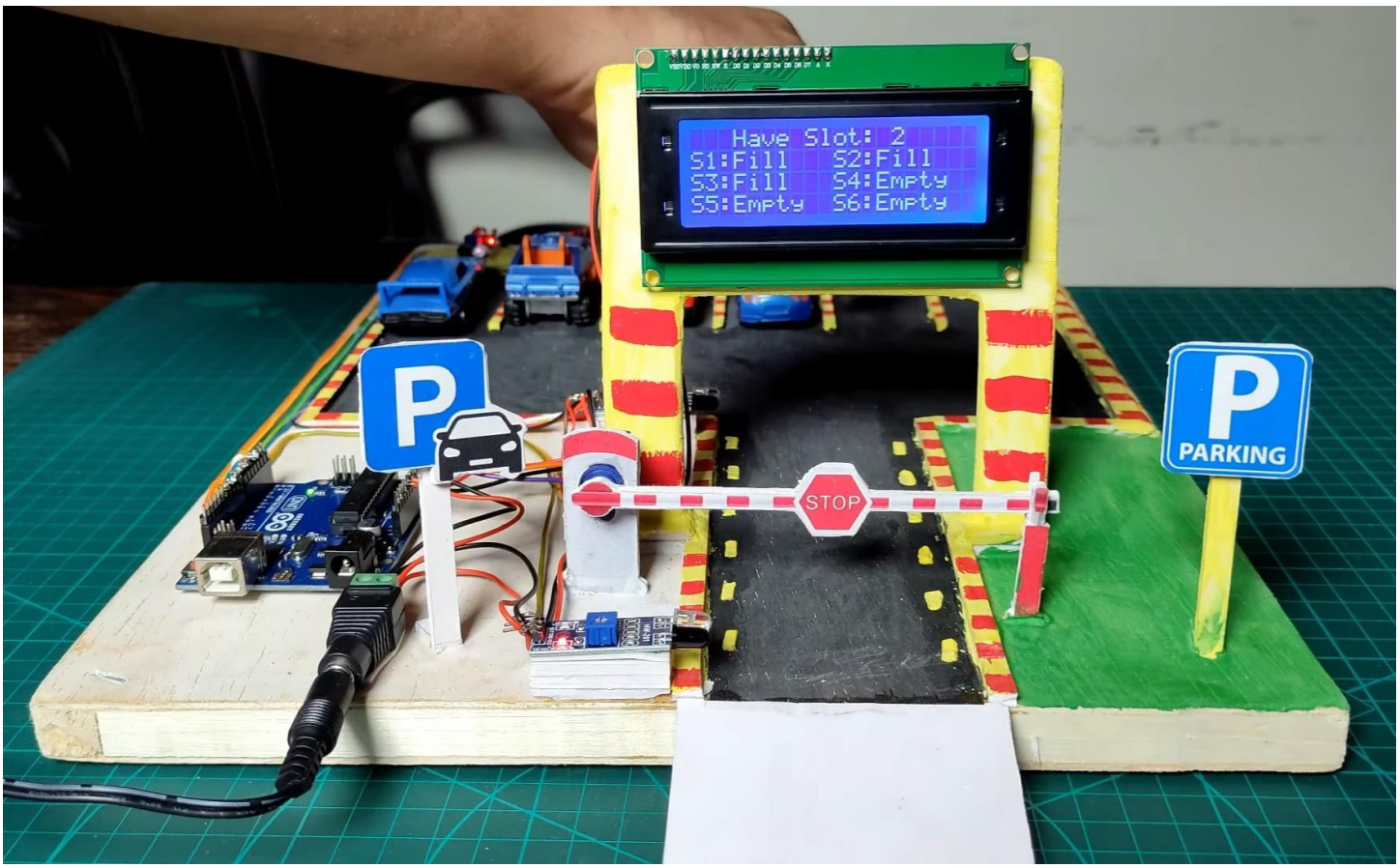
```
pinMode(ir_car1, INPUT);
pinMode(ir_car2, INPUT);
pinMode(ir_car3, INPUT);
pinMode(ir_car4, INPUT);
pinMode(ir_car5, INPUT);
pinMode(ir_car6, INPUT);

pinMode(ir_enter, INPUT);
pinMode(ir_back, INPUT);

myservo.attach(3);
myservo.write(90);

lcd.begin(20, 4);
lcd.setCursor (0,1);
lcd.print("    Car  parking  ");
lcd.setCursor (0,2);
lcd.print("       System     ");
delay (2000);
lcd.clear();

Read_Sensor();

int total = S1+S2+S3+S4+S5+S6;
slot = slot-total;
}

void loop(){

Read_Sensor();

lcd.setCursor (0,0);
```

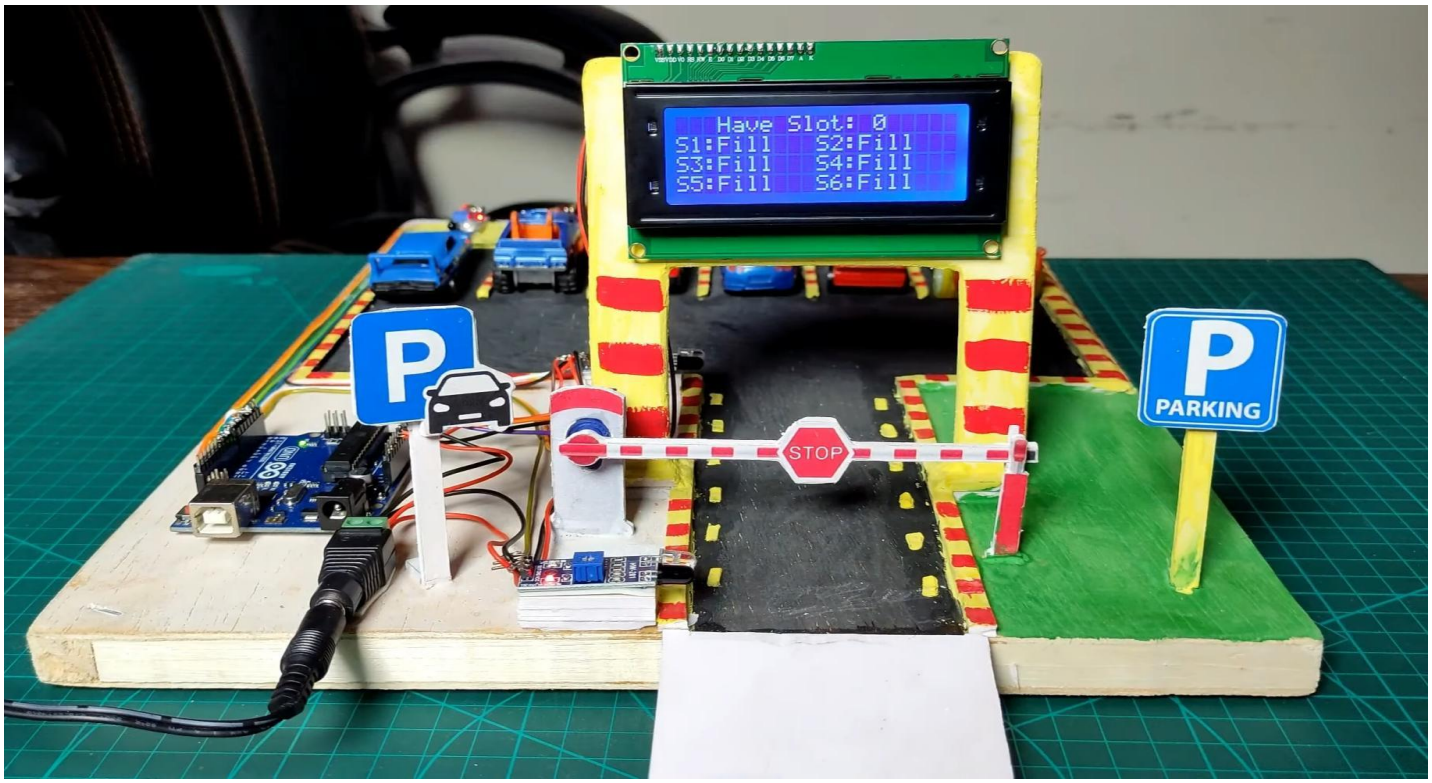
```
lcd.print("   Have Slot: ");
lcd.print(slot);
lcd.print("    ");

lcd.setCursor (0,1);
if(S1==1){lcd.print("S1:Fill ");}
     else{lcd.print("S1:Empty");}

lcd.setCursor (10,1);
if(S2==1){lcd.print("S2:Fill ");}
     else{lcd.print("S2:Empty");}

lcd.setCursor (0,2);
if(S3==1){lcd.print("S3:Fill ");}
     else{lcd.print("S3:Empty");}

lcd.setCursor (10,2);
if(S4==1){lcd.print("S4:Fill ");}
     else{lcd.print("S4:Empty");}

 lcd.setCursor (0,3);
if(S5==1){lcd.print("S5:Fill ");}
     else{lcd.print("S5:Empty");}

lcd.setCursor (10,3);
if(S6==1){lcd.print("S6:Fill ");}
     else{lcd.print("S6:Empty");}

if(digitalRead (ir_enter) == 0 && flag1==0){
if(slot>0){flag1=1;
if(flag2==0){myservo.write(180); slot = slot-1;}
}else{
```

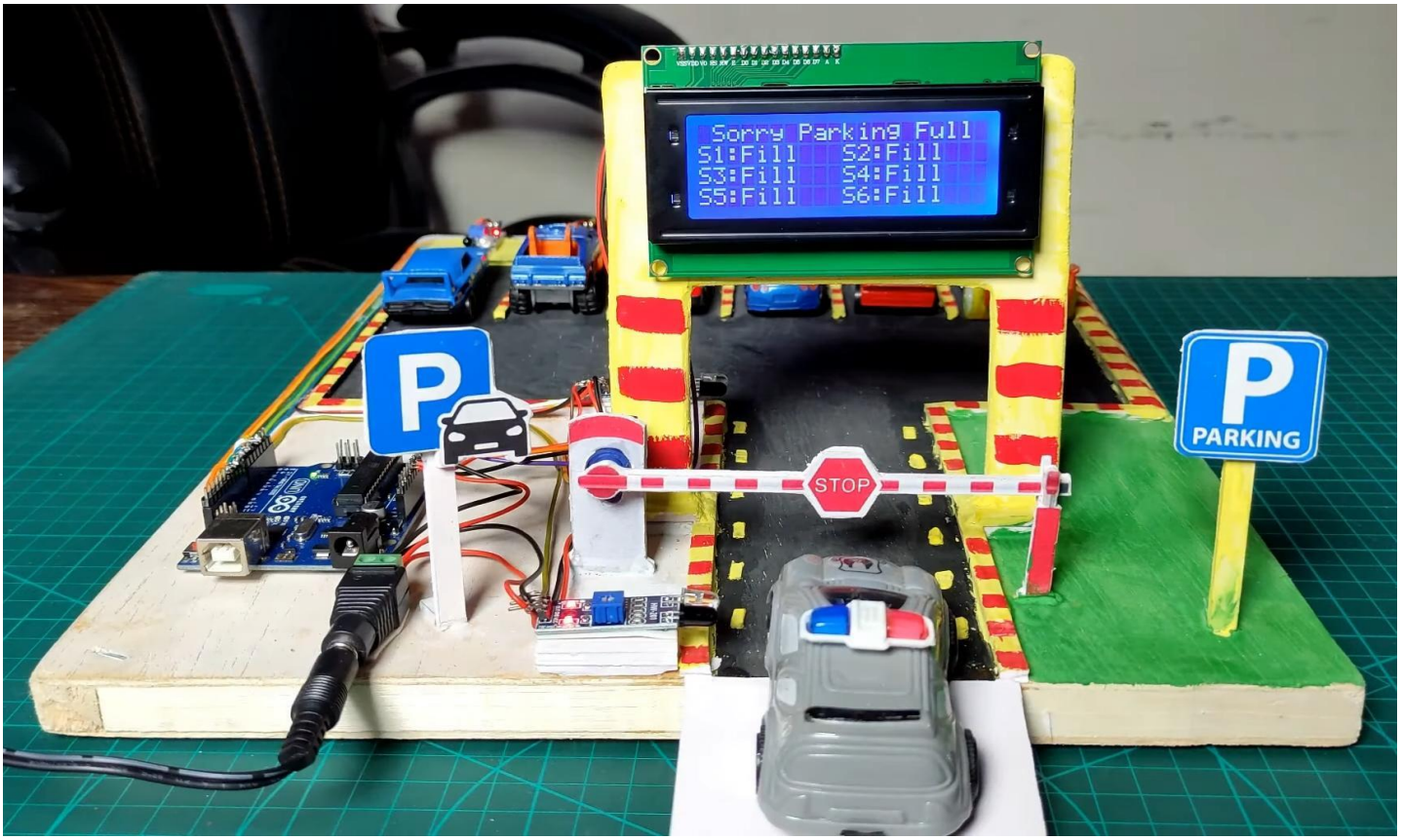
```
lcd.setCursor (0,0);
lcd.print(" Sorry Parking Full ");
delay(1500);
}
}

if(digitalRead (ir_back) == 0 && flag2==0){flag2=1;
if(flag1==0){myservo.write(180); slot = slot+1;}
}

if(flag1==1 && flag2==1){
delay (1000);
myservo.write(90);
flag1=0, flag2=0;
}

delay(1);
}

void Read_Sensor(){
S1=0, S2=0, S3=0, S4=0, S5=0, S6=0;

if(digitalRead(ir_car1) == 0){S1=1;}
if(digitalRead(ir_car2) == 0){S2=1;}
if(digitalRead(ir_car3) == 0){S3=1;}
if(digitalRead(ir_car4) == 0){S4=1;}
if(digitalRead(ir_car5) == 0){S5=1;}
if(digitalRead(ir_car6) == 0){S6=1;}
}
```

Output or Hardware Testing :

It’s time for hardware testing when you’ve finished the simulation, uploaded the code to your Arduino, and constructed the circuit according to the circuit design. This phase includes real-world testing to confirm that the auto parking system works properly. You’ll witness how the system reacts when a car enters, parks, and departs.




Have Slot: 0
S1:Fill S2:Fill
S3:Fill S4:Fill
S5:Fill S6:Fill
P
STOP
P
PARKING


Sorry Parking Full
S1:Fill S2:Fill
S3:Fill S4:Fill
S5:Fill S6:Fill
P
STOP
P
PARKING

Conclusion :

Finally, this project exhibits the power of automation or microcontroller-based control systems. You may construct an effective and user-friendly parking solution by integrating Arduino, several sensors, and a servo motor. The benefits of such a system are improved management of parking, fewer human interactions, and more client convenience. This project exemplifies how technology advancements may improve the efficacy and management of urban surroundings. This project provides an excellent chance to gain knowledge about and experiment with various electronic components and code, whether you are an enthusiast for technology or a hobbyist. Now that you've completed this intriguing Car Parking System project.