Global Institute of Management & Technology

Palpara More, NH-34, Krishnanagar, Nadia, West Bengal 741102

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Department of Electronics and Communication Engineering
Presents-

" AUTOMATIC CAR PARKING SYSTEM "

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AUTOMATIC CAR PARKING SYSTEM

BASED ON ARDUINO

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Department of Electronics & Communication Engineering
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❖ ABSTRACT

This paper has shown the concept of an automatic car parking system. Everything in the modern world is going automatic, we have built a system which can automatically sense the entry and exit of cars through the gate and then display the number of cars have in the parking lot & which parking slot is empty and which is free. This Automatic car parking system reduces man power & the time taken to check the space for vehicles by displaying the available spaces for parking on a LCD displayer by using infra-red (IR) sensors installed at the entrance & exit and each parking slot. This project is developed using
Arduino Uno.

❖ INTRODUCTION

In Metropolitan cities, office, shopping mall, institutions and many other places car parking issue has some problems with how control the number of the car inside it, how to monitor the movement in/out side of the parking lot, how to check whether there is a place inside for more cars or not and the safety to park. The aim of this project is to solve these problems by designing a system control the parking area using to an Arduino. The Arduino serves as a programming tool to run the whole operation, to reduce the cost in terms of requirement such as job opportunity and to increase security. Moreover, this system is faster, flexible and can meet market needs.

➢ Concept and Operation

In the project "**Automatic Car Parking System**" we have shown the concept of an automatic car parking system. As in the modern world everything is going automatic, we have built a system which will automatically sense the entry and exit of cars through the gate and then display the number of cars have in the parking lot & which parking slot is empty. Even we can set a maximum capacity of cars by the help of user interface given in the hardware in the form of IR sensor so that there is no congestion. We have deployed an Infrared (IR) sensors used to sense the movement of cars and check whether there is a capacity for cars to park, then decide the gate either opens or not. It is also possible to open a gate when any car enters in the parking lot or close the door when a car exits from it.

There are two sets of sensors:

1. **Gate Sensor—**

There are two IR sensors are present on the gate, one IR sensor is installed before (first Sensor) the gate barrier and another is installed after the gate barrier (second sensor).
When a car arrives at the gate for enter (first Sensor), the Arduino receives the signal from the first Sensor and then checks whether there is a space for the car to be accommodated.
Simultaneously, it will display how many slot is available and which slot is empty in the parking lot, and opens the gate using Servo motor if there is a space for the car to park and Arduino reduces the slot count. Otherwise LCD display shows '*Sorry parking full*'. Then when the car is moves to the second sensor the Arduino

receives the signal from the second IR sensor and close the gate barrier.
When a car to exits and arrives at the gate (second sensor), the Arduino receives the signal from the second Sensor then it opens the gate and increase the slot count, and when the car is passes from first sensor then the Arduino receives the signal from the first sensor then Arduino close the gate barrier using servo motor.

2. Parking slot sensor—

After the car enters through the gate, when the IR sensor comes to an empty slot for parking, sensing that a car has arrived here, the sensor sends a signal to Arduino.
Then the Arduino shows **1** to that slot on the LCD display from which the signal is came.
Moreover, if there is no car in slot then it shows **0** on the LCD display.
The sensing of entry & exit of cars is done through infrared transmitters and receivers. It is mounted Before & after the gate and each parking slot, when a car arrives, the infrared beam is blocked by the car and the receiver is devoid of infrared rays and its output changes. This change message is sent to the Arduino and accordingly it increases the count and opens the door if there is some empty position. The procedure for the exit of cars is much similar to that of entry.

➢ Hardware design

Our Car parking system is composed of Arduino Uno, IR Proximity Sensor, servo motor, LCD 20X4 Green Backlight Alphanumeric Display, I2C Interface Module.
The detailed hardware composition is shown in figure 1.

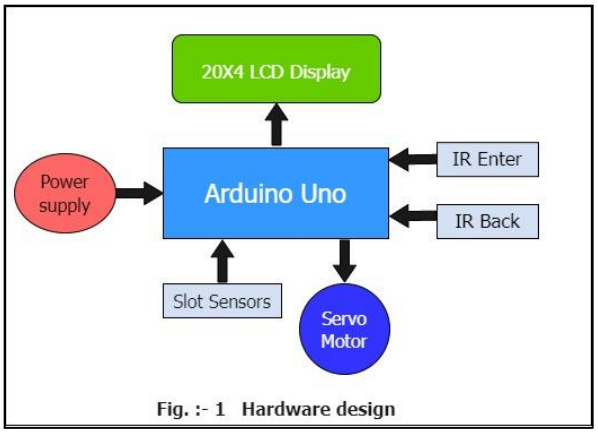


Fig. :- 1 Hardware design

1. Arduino Uno—

The Arduino used in the project is Arduino Uno atmega328p. This part is the heart of the project. It executes the program and control the instructions. It checks for the entry and exit of car, it checks parking slot empty or full, control servo motor for gate open & close. It continuously polls the pins from where we receive the signal from the sensor.

Fig. :- 2 Arduino Uno

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.
The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.
The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.
It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.
It is similar to the Arduino Nano and Leonardo.

2. Display unit –LCD—

LCD makes this instrument user interface friendly by displaying everything on the display. It is a Liquid-crystal 20X4 Green Backlight Alphanumeric Display. It has inbuilt controller which convert the alphabet and digit into its ASCII code and then display. This LCD will display the number of total slot and available slot.

Fig. :- 3 20x4 Display

It's Display Format is 20 Characters x 4 lines, it has HD44780 Built-in controller, Duty cycle 1/16, Supply voltage 5V.

3. Servo Motor—

In this project we use Servo Motor SG90. Servo Motor is used to open and close the gate. It is interfaced with microcontroller and takes command from the microcontroller to rotate some particular specified angle.

Fig. :- 4 SG 90 Micro Servo Motor

- **Torque:-**2.0kg/cm(4.8V),2.2kg/cm(6V)
- **Speed:** 0.09s/60°(4.8V), 0.08s/60°(6V)
- **Rotate angle:** 180°
- **Operating Voltage:** 4.8 to 6V

4. I2C Interface Module—

This module is use for control the 20x4 LCD display and communicate with Arduino. Due to limited pin resources in a microcontroller/ microprocessor, controlling an LCD panel could be tedious. Serial to Parallel adapters such as the I2C serial interface adapter module with PCF8574 chip makes the work easy with just two pins.

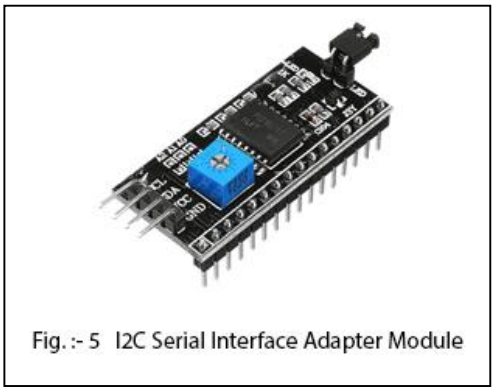


Fig. :- 5 I2C Serial Interface Adapter Module

The serial interface adapter can be connected to a 20x4 & 16x2 LCD and provides two signal output pins (SDA and SCL) which can be used to communicate with an MCU/MPU. Its operating voltage 5V DC. I2C control using PCF8574.

5. IR proximity sensor—

The entrance & the exit and each parking slots are detected by using infrared modules. Each module will contain an IR transmitter and an IR receiver. One IR sensor is installed before (first Sensor) the gate barrier and another is installed after the gate barrier (second sensor) for detects & count cars.

And other 8 is installed in the parking slot for detects & count slots.

The Infrared transmitter will continuously transmit IR waves and the receiver will continuously receive IR waves. Arduino receives

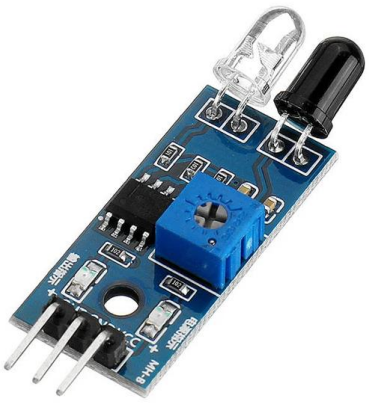


Fig.6 - IR proximity sensor

the signal from the IR Sensor. IR Sensor module has great adaptive capability of the ambient light having a pair of infrared transmitter and the receiver tube, the interred emitting tube to emit a certain frequency, encounters an obstacle detection direction (reflecting surface), infrared reflected back to the receiver tube receiving, after a comparator circuit processing, the Red LED lights up when the signal output will output digital signal (a low-level signal), through the potentiometer knob to adjust the detection distance, the effective distance range 2-10cm working voltage of 3.3V to 5V. It's detection range: 2cm ~ 30cm (depending on the obstacle's color, farthest for white), and detection angle: 35°.

❖ Flow Chart: —

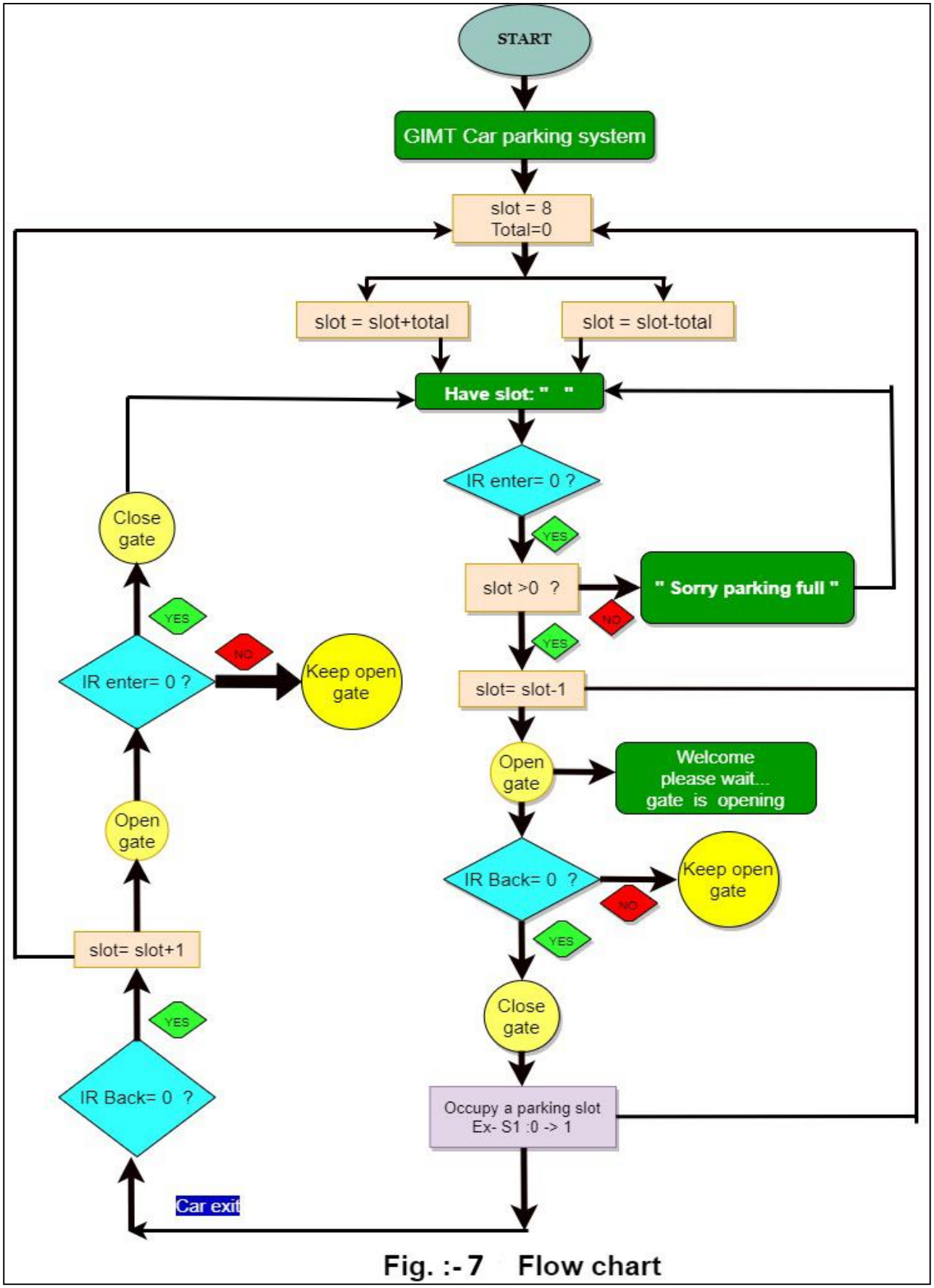
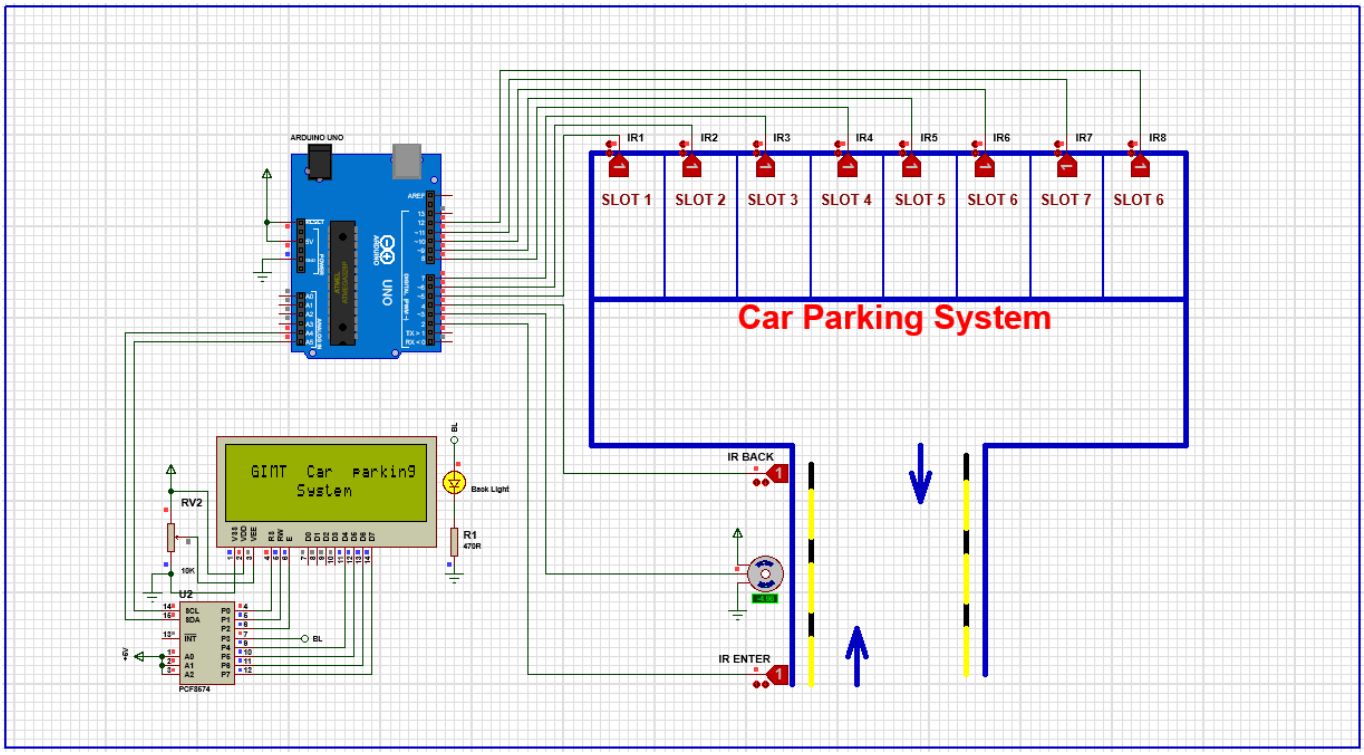


Fig. :- 7 Flow chart

❖ Circuit Diagram—



❖ Components Requires—

SL No.	Component's Name	Quantity	Price
1.	Arduino UNO R3 Board ATmega328P	1	699
2.	LCD Display 20X4	1	499
3.	I2C LCD Module	1	229
4.	Male Header Female Header	M-1 F-2	15
5.	IR Proximity Sensor	10	499
6.	Mini Servo Motor SG-90	1	90
7.	LEDs	12	9
8.	5v 2Amp DC SMPS	1	75
9.	Wires		20
10.	Tape	2	20
11.	Double sided tape	1	40
12.	Casing	1	30
13.	Thermocol	1	45
14.	Cuter	1	10
15.	Pin		5
		Total	2355

❖ Source 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
#define ir_car7 11
#define ir_car8 12
int S1 = 0, S2 = 0, S3 = 0, S4 = 0, S5 = 0, S6 = 0, S7 = 0, S8 = 0;
int flag1 = 0, flag2 = 0;
int slot = 8;

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_car7, INPUT);
  pinMode(ir_car8, 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("  GIMT  Car  parking  ");
  lcd.setCursor (0, 2);
  lcd.print("       System     ");
  delay (2000);
```

```
  lcd.clear();

  Read_Sensor();
  int total = S1+S2+S3+S4+S5+S6+S7+S8;
  slot = slot-total;
}
void loop() {

  if (digitalRead (ir_enter) == 0 && flag1 == 0) {
    if (slot > 0) {flag1 = 1;
      if (flag2 == 0) {myservo.write(180);slot = slot - 1;}
      lcd.setCursor (0, 1);
      lcd.print ("      Welcome       ");
      lcd.setCursor (0, 2);
      lcd.print ("    please wait...   ");
      lcd.setCursor (0, 3);
      lcd.print (" gate  is  opening   ");
      delay (1000);
      lcd.clear();
    }
    else {
      lcd.setCursor (0, 0);
    lcd.print(" Sorry Parking Full ");
      delay(900);
    }
  }

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

  if (flag1 == 1 && flag2 == 1) {
    delay (900);
    myservo.write(90);
    flag1 = 0, flag2 = 0;
  }

  delay(1);

  Read_Sensor();

lcd.setCursor (0,0);
lcd.print("   Have Slot: ");
lcd.print(slot);
lcd.print("    ");

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

```
  lcd.setCursor (5, 1);
  if (S2 == 1) {lcd.print("S2:1 ");}
  else {lcd.print("S2:0");}

  lcd.setCursor (10, 1);
  if (S3 == 1) {lcd.print("S3:1 ");}
  else {lcd.print("S3:0");}

  lcd.setCursor (0, 2);
  if (S4 == 1) {lcd.print("S4:1 ");}
  else {lcd.print("S4:0");}

  lcd.setCursor (5, 2);
  if (S5 == 1) {lcd.print("S5:1 ");}
  else {lcd.print("S5:0");}

  lcd.setCursor (10, 2);
  if (S6 == 1) {lcd.print("S6:1 ");}
  else {lcd.print("S6:0");}

  lcd.setCursor (0, 3);
  if (S7 == 1) {lcd.print("S7:1 ");}
  else {lcd.print("S7:0");}

   lcd.setCursor (5, 3);
  if (S8 == 1) {lcd.print("S8:1 ");}
  else {lcd.print("S8:0");
}

void Read_Sensor() {
  S1 = 0, S2 = 0, S3 = 0, S4 = 0, S5 = 0, S6 = 0, S7 = 0,S8 = 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;}
  if (digitalRead(ir_car7) == 0) {S7 = 1;}
  if (digitalRead(ir_car8) == 0) {S8 = 1;}
```

❖ Significance in the perspective of theory and application

- ✓ It will enable the drivers at the exit & enter gate if there is any empty space in the parking and disable them to enter when there is no empty space.
- ✓ It will manage the main parking spaces by alerting the drivers if there are spaces to park in or not.
- ✓ It will provide an Automatic system that whenever there is no space no one can access the parking and when there is space drivers can access the parking.
- ✓ In terms of money, this project has two things in general; It will reduce the number of people needed at the gate to guide drivers.
- ✓ It will provide a way of getting money for any institution that has this system because it can be put on the market and people use it for their interest like in a commercial sector where an institution has movement of clients that have vehicles and the institution cannot support them at the same time; hence this Automatic system can be a solution.

❖ Conclusion

The system can be used at all places starting from domestic to the industrial sectors. The simplicity in the usage of circuit helps it to be used by a large number of people, because people with less knowledge of hardware can also use it without facing any problem. This Automatic car parking system enables the parking of vehicles and thus reduces the time taken to check the space to be used by displaying the spot where the space for parking is available on an LCD display by using IR sensors at the entrance.

❖ Reference—

i. Wikipedia.
ii. Arduino uno atmega328p datasheet.
iii. ERH India
iv. RoboCraze
v. SunRobotics
vi. Proteus Simulation