

Smart Car Parking in IOT



Team members

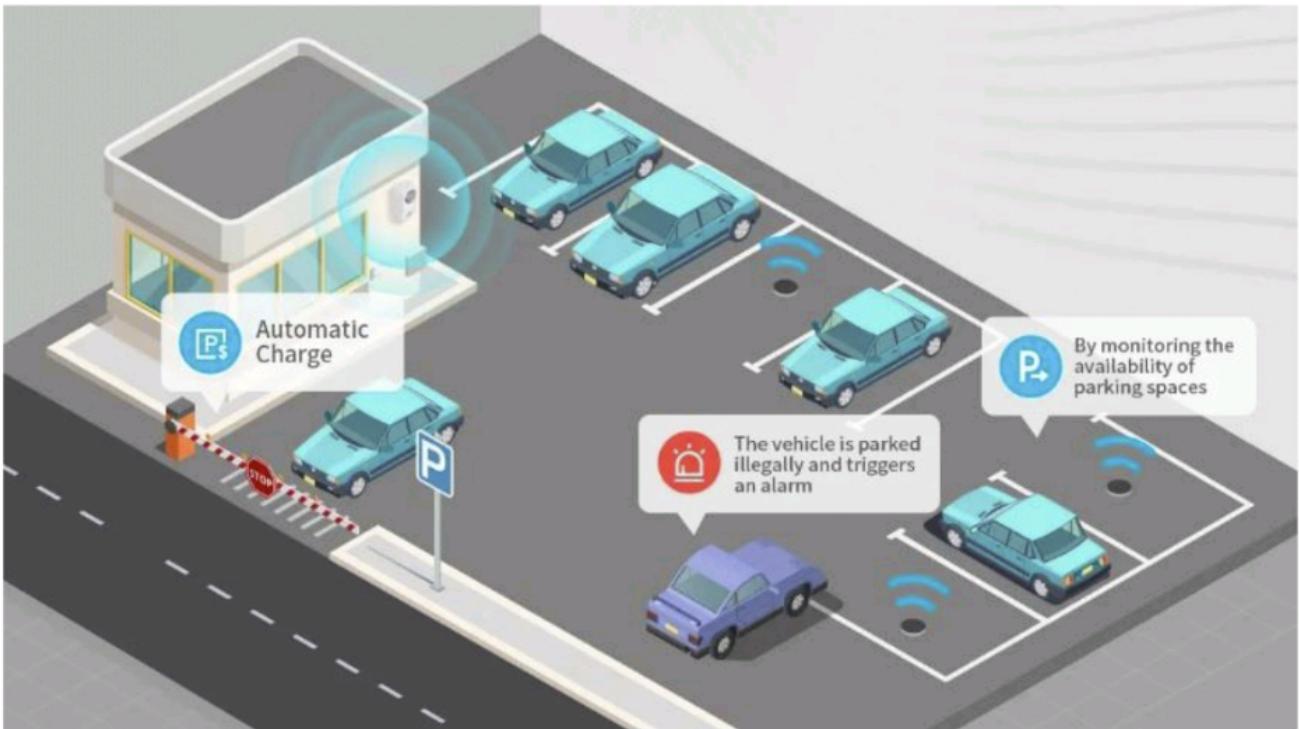
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What issues you would come into while parking vehicles?

- **Parking lot is saturated**– The most severe issue is the increasing number of vehicles with no increase in the parking space, hence, resulting in the jam.
- **Overpay**– Sometimes, drivers or customer don't know how long they will stay at a specific place. Therefore, overpay the parking fees sometimes.
- **Environment impact**– The parking lot accumulated amounts of contaminant that are unable to be absorbed, which are flushed into the water body when raining.
- **On-street or Off-street parking**– There're not enough space on the parking lot of the shopping malls or reservation areas in this case, severe traffic jam will appear.
- **Improper use of existent parking lot**– People are always in a hurry and get impatient to parking properly, which result in insufficient parking space for other vehicles.

Smart parking system using IOT :

- The UN's Department of Economic and Social Affairs predicted that all the world population growth will be living in the urban areas. And the growth rate is anticipated to reach 68% in 2050.
- Population increase is not only a pressing problem of governments, it's also a real daily reality for most citizens. Searching for parking lot will result in the huge loss of time and money, according to the report from USA Today, there're 35% time and 345 dollars wasted.
- Let's dig deeper on the parking issues and the need of smart parking system using IOT.



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The future and opportunities of smart Parking :

Smart parking systems are widely used to improve People's Daily life, so the use of smart parking systems is expected to increase constantly. The system can also add the following advanced functions, making it a multi-functional management tool.

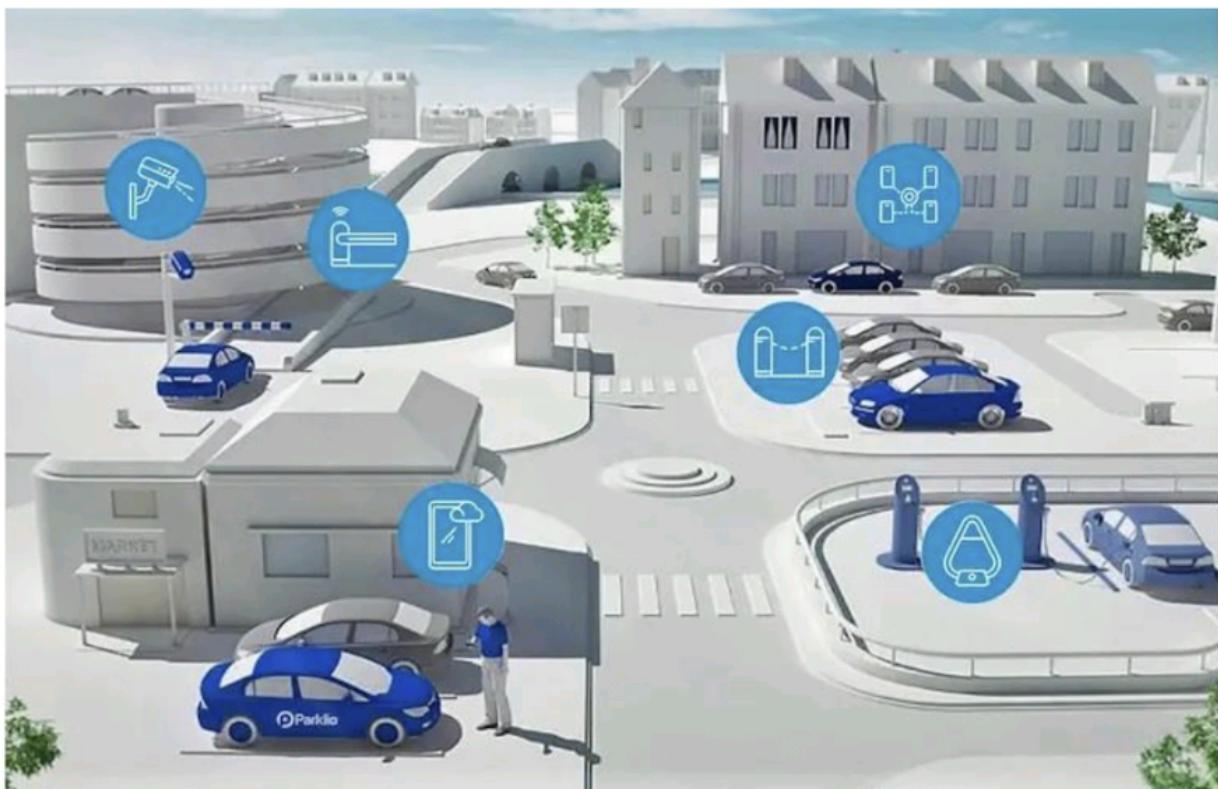
- Parking demand management and space optimization
- Personalized parking guidance

- parking reservation system
- dynamic parking price and policy optimization
- parking area, charging, illegal parking detection

For large parking lots, augmented reality might create a mapping function on real images captured by smartphones. These AR outdoor and indoor navigation systems can guide drivers to their parked cars via virtual paths.

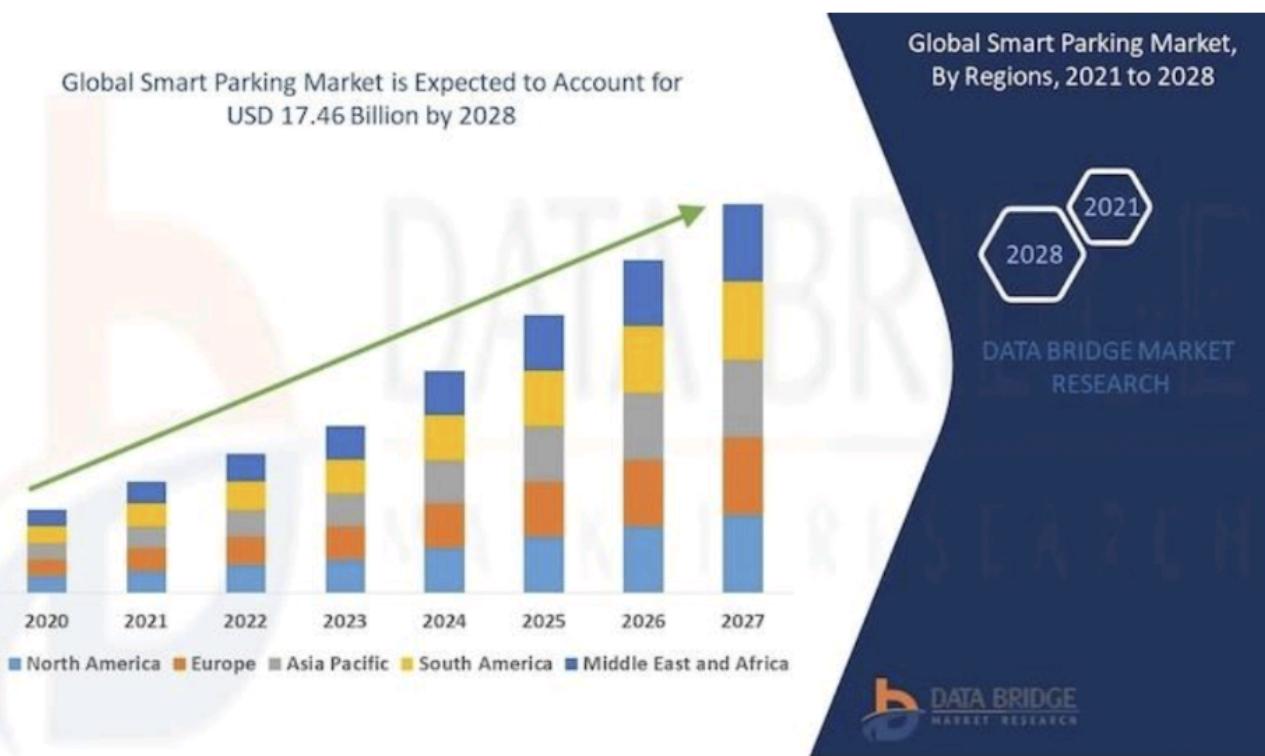
Another innovation is the use of visual image processing technology to catch the license plate number of a car and identify it with the help of optical character recognition technology. It then automatically opens the gate to the parking lot and the system lead the driver to a suitable parking lot space.

The future of smart parking systems seems prospective. The technologies behind this solution include the Internet of Things, artificial intelligence, machine learning and augmented reality, which are also driving the digital transformation of enterprises in industry 4.0 terms. Leveraging these innovations, Parking 4.0 will improve the efficiency of parking systems by addressing urbanization challenges.



Smart parking system the modern trend or a growing need?

The parking issue is not common, especially in the big cities. According to an IOT analysis report, the market expenditure of smart parking product and service will increase at a compound annual growth rate of 14% by 2023 and surpass 3.8 billion dollars. It's actually a great news as it force people to find ways to solve the traffic issues rather than doing nothing. This issue is pretty obvious, but the bigger problem is that what can technology do to solve this issue and is there any ways for it?



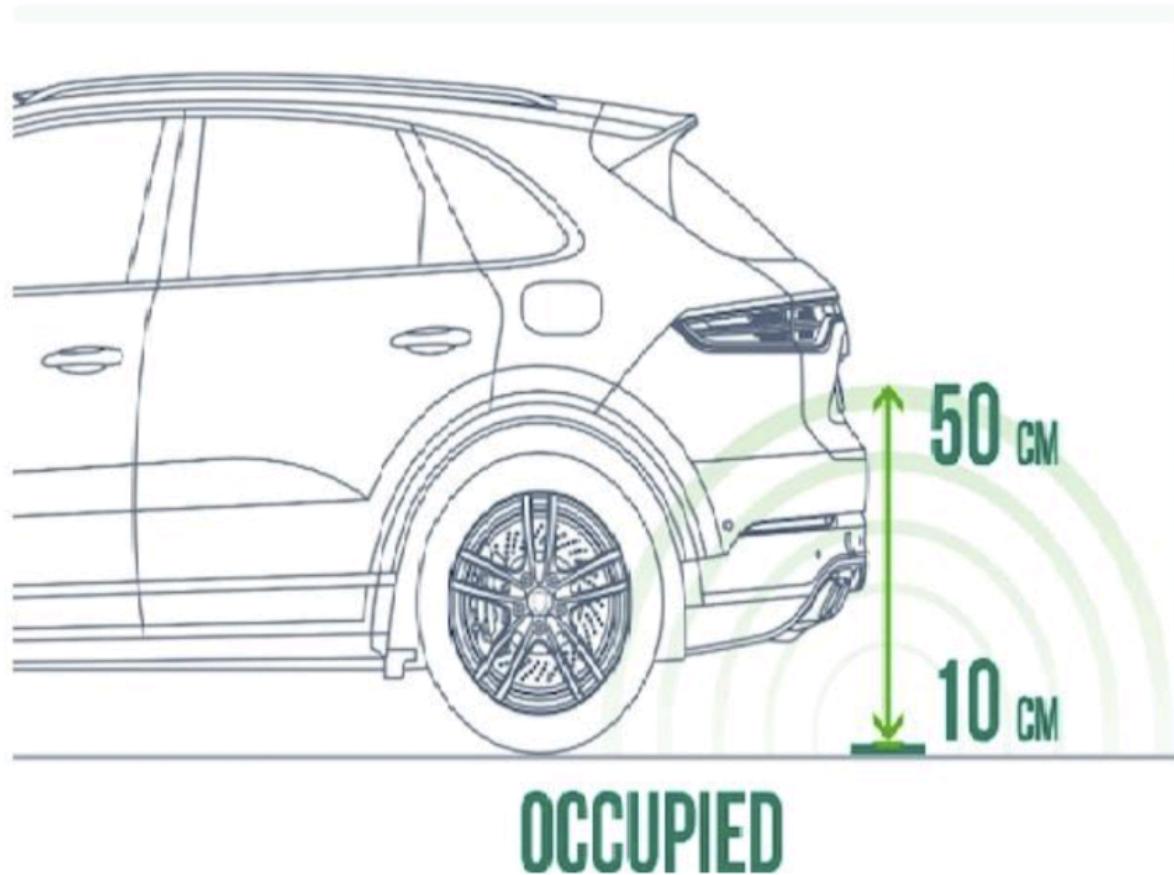
Smart parking system using IOT:

Ultrasonic, electromagnetic field detection, and infrared are several types of iot smart parking sensors.

- Ultrasonic:** The precision of the smart parking sensor is improved by using ultrasonic wave. The disadvantage of this type of sensor is that it can get clogged with dirt.
- Electromagnetic Field Detection:** The sensor can detect small changes in the magnetic field when a metal object is near it.

- **Infrared:** This type of sensor measures changes in ambient temperature and detects movement.

How can you install a smart parking sensor using IOT?



- Different kinds of sensors are installed in different ways. For example, camera is tricky, so it needs to be installed in a certain distance and angle to avoid blind spot.
- Laser radar sensor usually be installed in a pillar with 30~80 centimeter and be located repeatedly in a certain range, but it makes sense only when conducting massive processing.

- The in-ground vehicle IoT sensors are the most easiest to be installed, which usually be installed on the ground of every parking lot to detect the vehicle parked above.
- Such IoT sensors can be simply glued on the surface or fixed with screws.
- Additionally, such IoT sensors are easy to be transformed without any unique installation practice and most of them don't need any maintainance.
- The smart parking system using iot can communicate with gateway through parking site and transfer the data to the internet.

What components involved in the smart parking system using IoT?

- A sensor that can detect the presence of the vehicle.
- A micro control that can help you processing the data.
- A cloud platform will restore the data.
- A mobile application enables you to control the smart parking process.



- Detect the presence of vehicle in two steps. First, the IoT solution device need to identify the presence of cars parked in the specific parking lot.
- Second, you need to make sure that the parking lot is detected as occupied as there're only one car. Both of these steps can be realised through various engineering technology approaches, which allow the smart parking system using IOT to offer searching, navigation and reservation of parking lot.

The working principle of smart parking sensors:

- Detect the presence of vehicle in two steps. First, the IoT solution device need to identify the presence of cars parked in the specific parking lot.
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- Both of these steps can be realised through various engineering technology approaches, which allow the smart parking system using IoT to offer searching, navigation and reservation of parking lot.
- Computer vision, proximity detection, distance detection, and even RF/magnetic presence can be used for building smart parking sensor.
- Such technologies offer advantages such as high precision parking detection, wide angle parking detection, energy saving, and monitoring multiple parking slots simultaneously.
- Hence using mixed parking sensor with remote communication is the best choice. LoRa parking sensor offers the extended range required and decrease the overall cost of system due to the minimal numbers of gateway devices.

How does lora smart parking work :



LoRa technology from MOKOSmart enables connectivity, real-time monitoring of occupancy and activity, resource optimization and integration of smart city.

1. Each parking space is equipped with a battery-powered occupancy sensor that detects the absence, arrival, presence and departure of vehicles. Due to their low-power design, these sensors can be self-configured to assign each unit a unique MAC address associated with a serial number and bar code. The unit can run up to 10 years without external wiring amounted.
2. When an occupation sensor detects vehicle activity, the embedded lora receiver will send a short message package containing the change in status to any wireless network gateway within its range.
3. Gateway can be a part of private lora network or a node of public lorawan service provider. It transmits packets to the PIN parking cloud service application, which can reside on a cloud-based server or a

dedicated server. This turnkey parking management solution uses sensor information to track open and occupied Spaces. It can present the parking events in the web page and offer parking data to third party application that generate billing information and notify the available parking space for drivers through smart phones and other wireless devices. Moreover, it can also be customized to offer a wider specialized service.

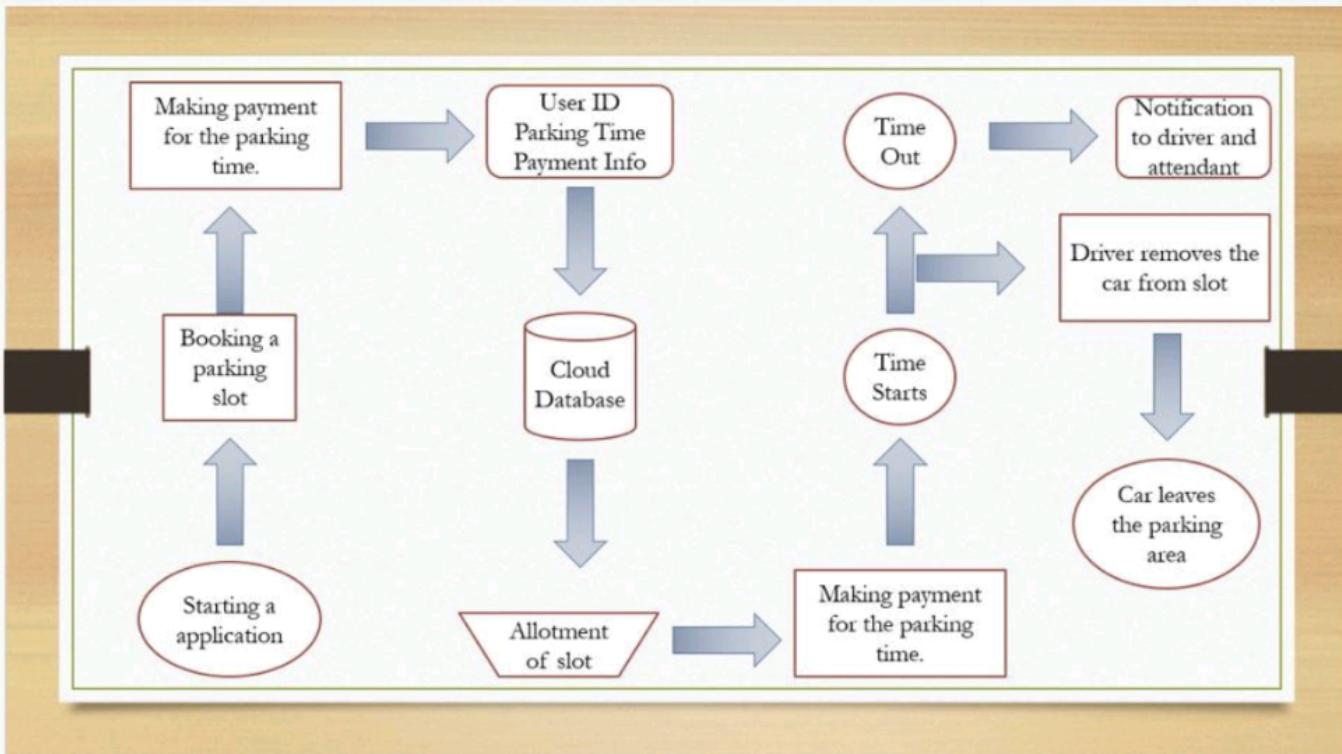
4. The LoRaWAN protocol supports two-way communication capabilities, allowing parking lot administrators to query sensors.

5. PIN's parking cloud service shares real-time parking data with other smart city services run by municipal and district governments. It utilizes the information collected from many parts of a city's infrastructure so as to offer unique application such as remote parking enforcement. Sensor-based parking monitors and street cameras work with other parking technologies to eliminate "camping" in short term.

Solutions using IoT-based parking :

- IoT-based smart parking system transmits available and occupied parking spaces via a web/mobile application.
- Each parking space has an IoT gadget, which includes sensors and microcontrollers. The user gets real-time updates on the availability of all parking spaces and, therefore, an option to choose the best one.
- This solution alone initiates a chain-reaction of benefits, from lesser traffic congestion to reduced fuel efficiency, in urban areas where parking is often painstaking.

A basic flowchart for the whole process of smart parking IoT looks like this:



Architecture of Smart Parking System

It consists of the following components:

Parking Sensors

The role of the parking sensors is to track space in the parking lot. Ultrasonic sensors are used to detect the presence of vehicles.

Processing Unit

The processor-on-a-chip acts as a central point between the sensors and the cloud platforms, relaying data to and from.

Mobile Application

It is a visual interface for end-users to interact with the smart parking system.

The Cloud

1. The cloud serves as a repository for all records related to parking spaces and end-users who have access to the system.
2. The deployment of smart parking systems is expected to increase thanks to the rising issue of parking and reducing costs of implementing a smart parking system.
3. Another innovation is using visual image processing to capture a vehicle license number to identify it with the help of Optical Character Recognition technology. It then automatically opens the gate in the parking lot, and the system directs the driver to the appropriate parking lot.
4. The future looks very promising for smart parking systems. The technologies behind this solution are IoT, artificial intelligence, machine learning, and augmented reality. By using these new approaches, smart parking will increase the efficiency of parking systems.

Components Required :

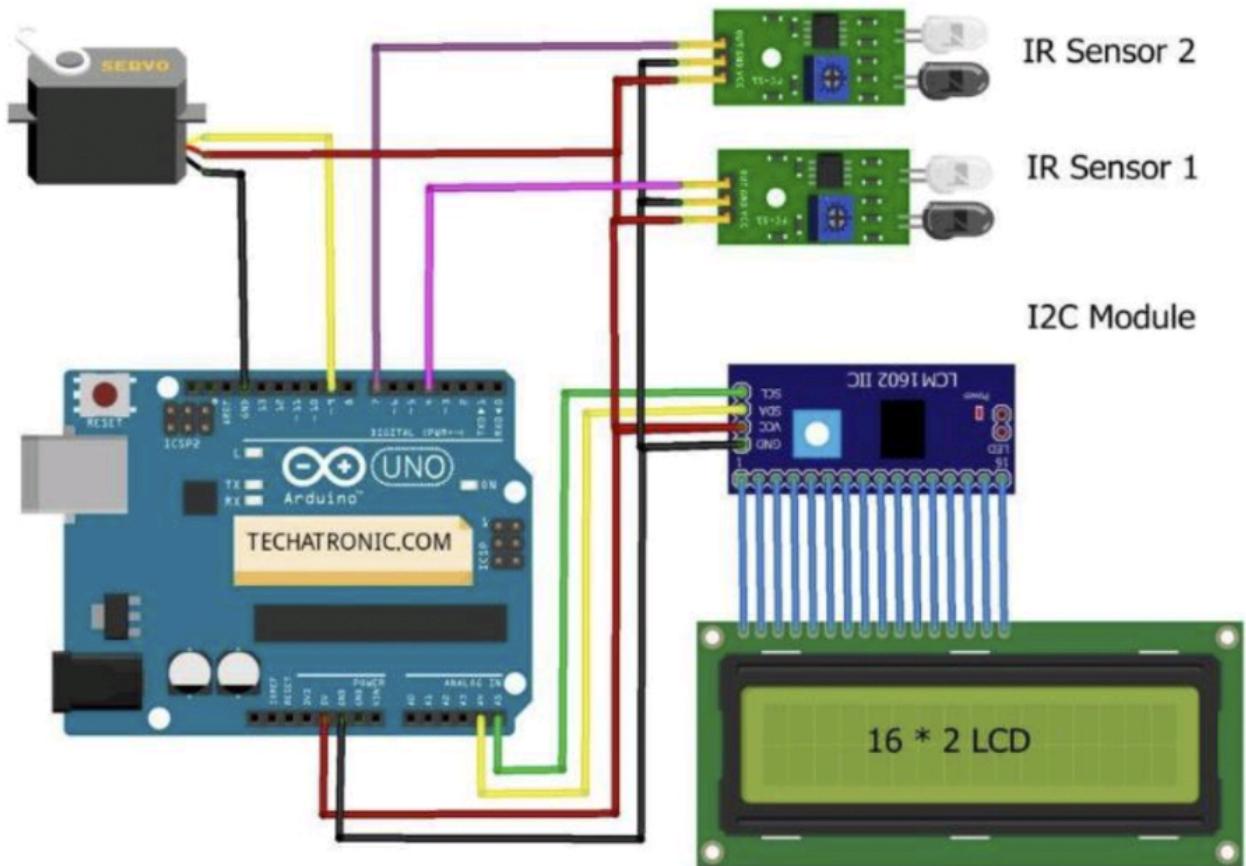
- Arduino UNO
- Two IR sensors
- Servo motor
- Jumper wires and a breadboard
- 16×2 LCD and an I2C module
- USB cable for uploading the code

Before starting please check the address of the I2C module that you are using and modify the code accordingly.

Then connect the 5 volts pin of the Arduino with the VCC pin of the I2C module, the red wire of the servo motor, and the VCC pin of both the IR sensors.

Join the SDA pin of the I2C module with the analog-4 pin of the Arduino and the SCL pin of the I2C module with the analog-5 pin of the Arduino in this automatic car parking system project.

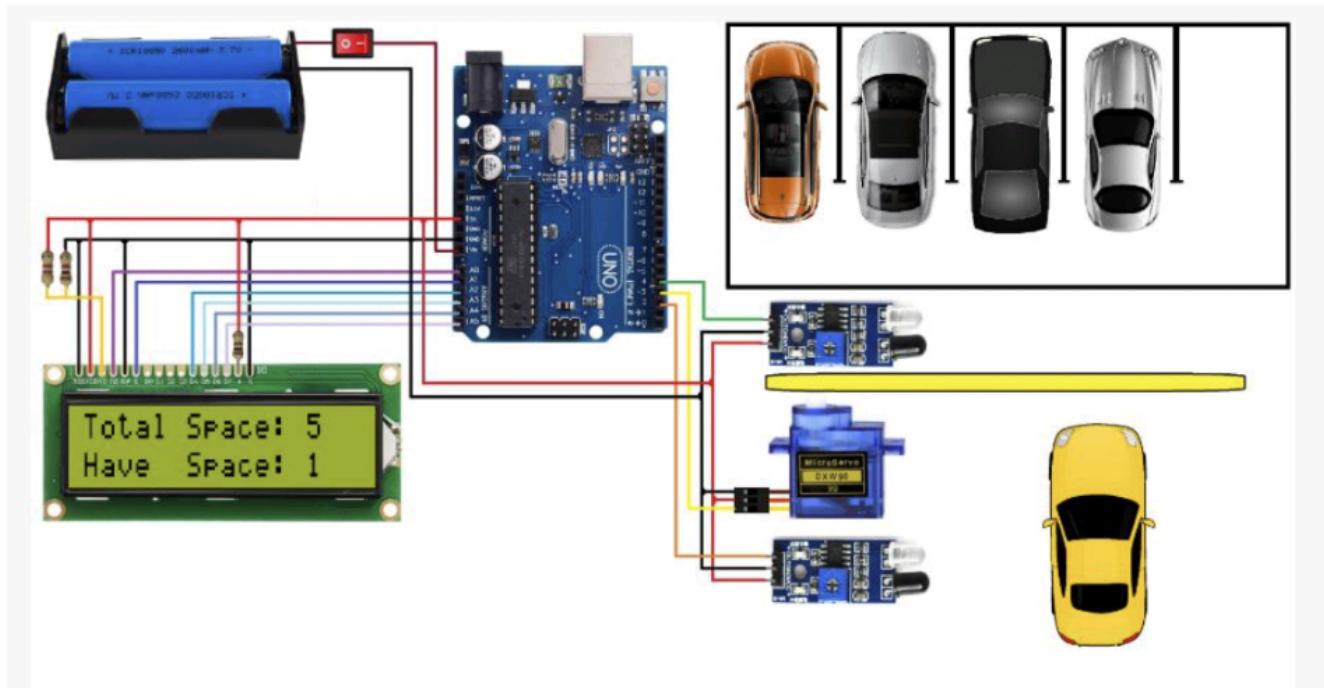
Connect the GND pin of the Arduino with the GND pin of the I2C module, the brown wire of the servo motor, and the GND pin of both the IR sensors. Attach the orange(signal) wire of the servo motor to the digital-9 pin of the Arduino.



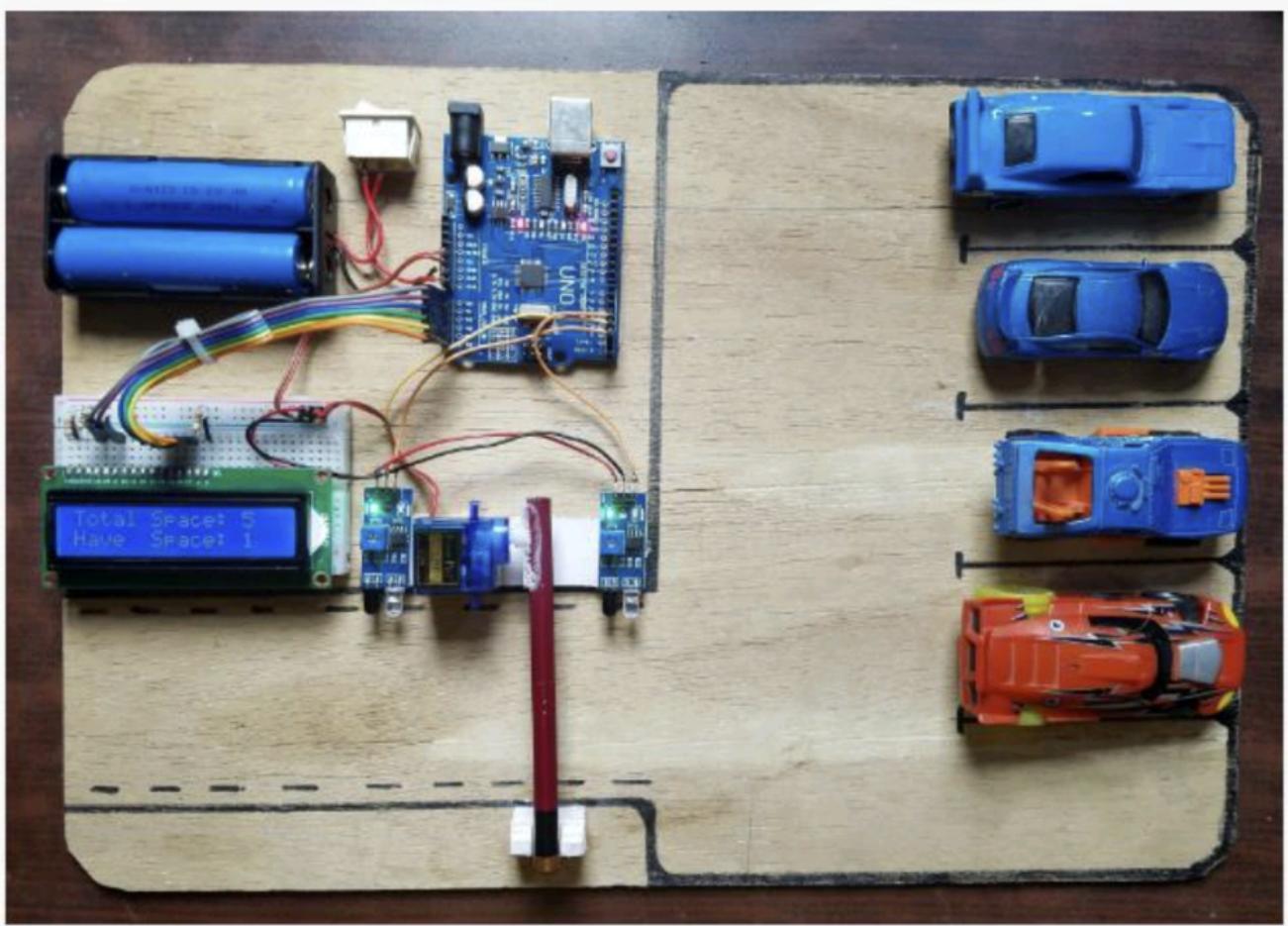
Now connect the pins of the I2C module with the pins of 16×2 LCD.

You can check here the interfacing of 16×2 LCD with the I2C module. At last, connect the OUT pin of the first IR sensor with the digital-4 pin of the Arduino and the OUT pin of the second IR sensor with the digital-7 pin of the Arduino.

Circuit Diagram :



Working Principle :



Arduino Code :

```
#include
LiquidCrystal lcd(A0, A1, A2, A3, A4, A5);
#include

Servo myservo1;

int ir_s1 = 2;
int ir_s2 = 4;

int Total = 5;
int Space;

int flag1 = 0;
int flag2 = 0;

void setup() {
pinMode(ir_s1, INPUT);
pinMode(ir_s2, INPUT);

myservo1.attach(3);
myservo1.write(100);

lcd.begin(16, 2);
lcd.setCursor (0,0);
lcd.print(" Car Parking ");
lcd.setCursor (0,1);
lcd.print(" System ");
delay (2000);
```

```
lcd.clear();

Space = Total;
}

void loop(){

if(digitalRead (ir_s1) == LOW && flag1==0){
if(Space>0){flag1=1;

if(flag2==0){myservo1.write(0); Space = Space-1;}
}else{
lcd.setCursor (0,0);
lcd.print(" Sorry not Space ");
lcd.setCursor (0,1);
lcd.print(" Available   ");
delay (1000);
lcd.clear();
}
}

if(digitalRead (ir_s2) == LOW && flag2==0){flag2=1;
if(flag1==0){myservo1.write(0); Space = Space+1;}
}

if(flag1==1 && flag2==1){
delay (1000);
myservo1.write(100);
flag1=0, flag2=0;
}
```

```
lcd.setCursor (0,0);
lcd.print("Total Space: ");
lcd.print(Total);

lcd.setCursor (0,1);
lcd.print("Have Space: ");
lcd.print(Space);
}
```

- Upload the code to the Arduino board. Perform the Circuit diagram.
- Although this is a very small-scale model, a concept like this can be implemented very easily on a large-scale parking lot. This would make the process of managing a parking lot very easy.

Thank You