

SMART PARKING SYSTEM

Phase 2

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SMART PARKING MANAGEMENT SYSTEM USING IOT

Introduction to Smart Parking Using IoT:

In the rapidly urbanizing world, the challenges associated with finding a parking space in crowded city centers have become a ubiquitous frustration. Smart Parking, powered by the Internet of Things (IoT), is a revolutionary solution that addresses these challenges by leveraging technology to create a more efficient, convenient, and sustainable parking experience. Smart parking systems incorporate a network of IoT sensors, cameras, and data analytics to transform traditional parking facilities into intelligent, data-driven environments. These systems provide real-time insights into parking space availability, allowing drivers to locate open spots quickly and efficiently.

Innovations to solve the problems in smart parking:

- **IoT Sensors:** Internet of Things (IoT) sensors are a fundamental innovation in smart parking. These sensors can be embedded in parking spaces to detect the presence or absence of vehicles. They provide real-time data on parking space availability, allowing drivers to find open spots quickly.
- **Mobile Apps:** Smartphone apps have become essential tools for smart parking. These apps provide real-time information on available parking spaces, enable mobile payments, and even allow users to reserve spots in advance.
- **Data Analytics:** Advanced data analytics and machine learning algorithms are used to predict parking space availability based on historical data, traffic patterns, and events. This helps in optimizing parking space allocation and reducing congestion.
- **Smart Payment Systems:** Innovations in payment systems, such as mobile wallets and contactless payments, have made it easier for users to pay for parking without the need for physical tickets or cash.
- **Automated Parking Garages:** Automated parking garages or robotic valet systems can maximize the use of space by efficiently parking and retrieving vehicles without the need for human intervention. These systems save space and reduce the time and effort required for parking.

- **Dynamic Pricing:** Dynamic pricing models adjust parking fees based on demand and availability. This encourages users to park in less congested areas or during off-peak hours, reducing congestion in popular areas.
- **Reservations and Pre-Booking:** Some systems allow users to reserve parking spots in advance, ensuring they have a guaranteed space when they arrive at their destination. This is particularly useful in busy urban areas and for special events.
- **Electric Vehicle (EV) Charging Integration:** To promote sustainable transportation, many smart parking solutions include EV charging stations. These stations can be monitored and reserved through mobile apps.
- **Parking Guidance Systems:** LED displays and signage are used to guide drivers to available parking spots efficiently. These systems reduce the time spent searching for parking spaces and help alleviate traffic congestion.
- **Multi-Modal Integration:** Smart parking can be integrated with other transportation modes, such as public transit, ridesharing, and bike-sharing services. This encourages users to combine different modes of transportation for a seamless travel experience.

Design For Smart Parking Management:

Components Required:

Hardware:

- Node MCU ESP8266
- IR Sensor- 5 nos
- Servo Motor-2nos



ESP8266



IR sensor



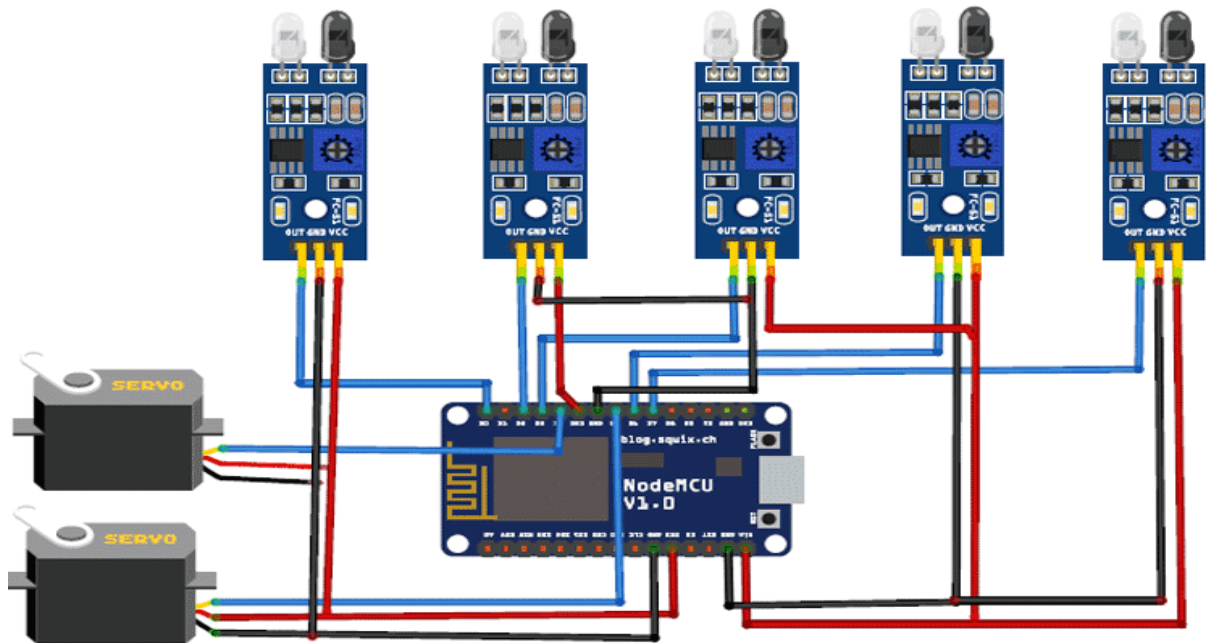
Servo motor

Online Services:

- ADAFRUIT IO

Circuit Diagram:

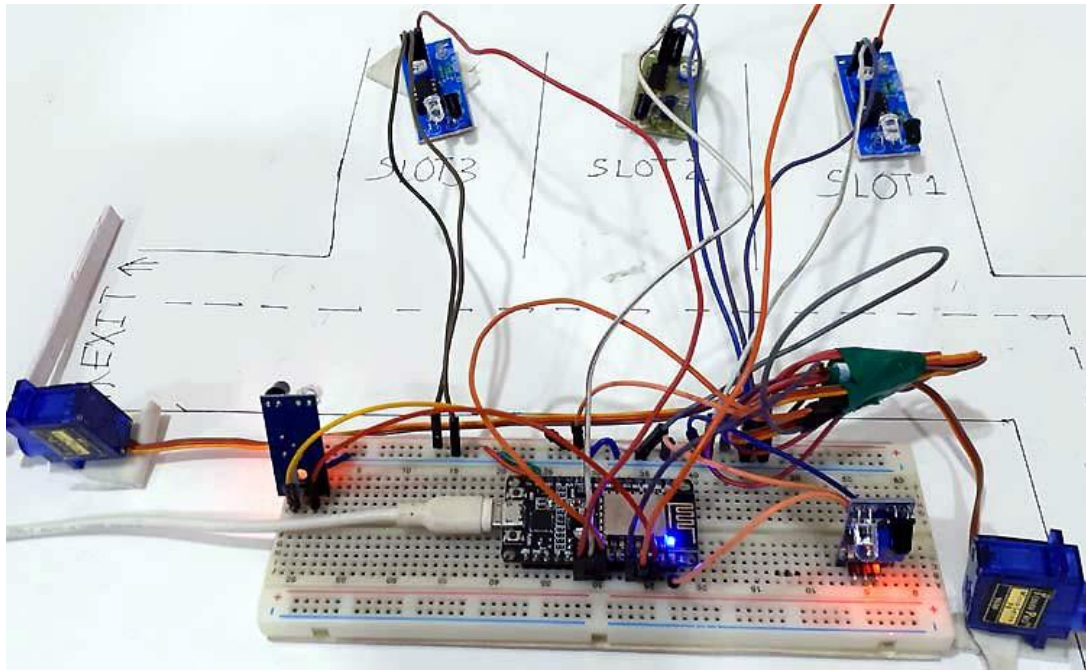
The circuit diagram for this **IoT based smart parking system project** is given below.



In this Smart Parking System using IOT, we are using five IR Sensors and two servo motors. IR sensors and Servo motors are connected to the NodeMCU. NodeMCU controls the complete process and sends the parking availability and parking time information to Adafruit IO so that it can be monitored from anywhere in the world using this platform. Two IR sensors are used at entry and exit gate so that it can detect the cars at entry and exit gate and automatically open and close the gate.

Two servo motors are used as entry and exit gate, so whenever the IR sensor detects a car, the servo motor automatically rotates from 45° to 140°, and after a delay, it will return to its initial position. Another three IR sensors are used to detect if the parking slot is available or occupied and send the data to NodeMCU. Adafruit IO dashboard also has two buttons to manually operate the entry and exit gate.

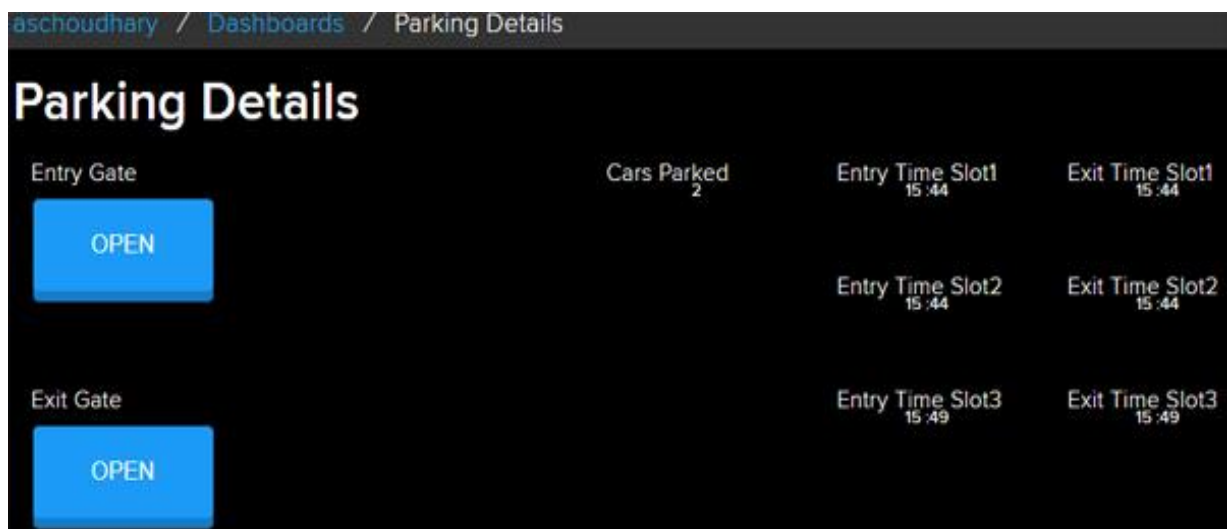
This is how this complete setup for **Smart Parking System using IOT** will look:



Adafruit IO for IOT Parking System:

Adafruit IO is an open data platform that allows you to **aggregate, visualize, and analyze live data on the cloud**. Using Adafruit IO, you can upload, display, and monitor your data over the internet, and make your project IoT enabled. You can control motors, read sensor data, and make cool IoT applications over the internet using Adafruit IO. For test and try, with some limitation, Adafruit IO is free to use.

To use the adafruit io along with nodeMCU you have create account and create new block for smart parking in adafruit io and also program the nodeMCU in Arduino IDE. After finishing the procedures the final output lokks like given below.



So this is how a **Smart Parking System using IoT** can be built. You can add more sensors to increase the parking slots and can also add a payment system to automatically pay the parking fee. Comment below if you have any doubts regarding this project.

CONCLUSION:

In conclusion, smart parking using IoT is a transformative solution that addresses the challenges of urban parking by harnessing the power of connected devices and data analytics. It offers a win-win situation for both drivers and urban planners, making parking more efficient, less frustrating, and environmentally friendly. As cities continue to grow, the adoption of smart parking systems is poised to play a pivotal role in shaping the future of urban mobility.

The implementation of Smart Parking systems utilizing IoT technology offers significant advantages in urban mobility and resource management. By leveraging real-time data and sensor technology, these systems optimize parking space utilization, reduce traffic congestion, and enhance the overall parking experience for users. Furthermore, the integration of IoT enables remote monitoring and management, providing valuable insights for urban planners and authorities to make informed decisions. As cities continue to grow, Smart Parking solutions stand as a pivotal tool in creating more efficient, sustainable, and user-friendly urban environments.