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Smart Parking System Using IOT

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I. ABSTRACT :

Imagine a smart parking system powered by the Internet of Things (IoT) that helps users find parking spots in busy areas by providing real-time updates on availability. This innovative technology simplifies the entire parking experience, from when you drive in to when you pay and leave. It uses a Microcontroller, five infrared sensors, and a couple of servo motors to accurately detect cars and check if parking slots are free. Two of the infrared sensors are positioned at the entry and exit gates to monitor vehicle movement, while the other three check the availability of parking spaces. The servo motors control the gates, responding to the sensors to open and close as needed. All this data is sent to the Adafruit IO platform, allowing for global monitoring. With a total of five infrared sensors and two servo motors connected to the Microcontroller, it oversees everything and relays information about parking availability and duration to Adafruit IO.

In essence, this IoT-based smart parking system uses sensors and wireless communication to provide up-to-the-minute data on available parking spaces, guiding users to open spots and maximizing the use of parking areas. The goal is to enhance parking efficiency, cut down on congestion, and improve the overall parking experience for drivers.

Keywords: Microcontroller, smart, sensor, smart, LM2596, Servo motor.

INTRODUCTION

A Smart Parking System powered by the Internet of Things (IoT) is a cutting-edge way to manage parking spaces more effectively. By utilizing sensors, connectivity, and cloud services, this system can detect available parking spots and share real-time information with users through a web or mobile app. It streamlines the process of space allocation and helps cut down on the traffic that builds up when drivers are on the hunt for parking.This innovative approach leverages IoT technology to pinpoint available parking spaces in real time, making it easier for drivers to find a spot. Not only does it help reduce traffic congestion, but it also saves time and enhances the overall parking experience. An IoT-based smart parking system employs sensors and internet connectivity to manage parking spaces efficiently, providing real-time availability and reservation options through mobile apps or digital displays. This means drivers can quickly locate parking, ease congestion, and even save money by being alerted to peak times and pricing.Parking in today's urban environments is a major challenge. With too many cars on the road and not enough parking spots, the need for effective parking management systems has never been clearer. To bring this idea to life, the team uses infrared sensors to monitor parking slot occupancy, along with a direct current motor to simulate the motors that open gates. Right now, a Wi-Fi modem handles their internet communication, while a microcontroller keeps everything running smoothly.

LITERATURE SURVEY

Paper 1 Author:

S. C. Koumetio Tekouabou, E. A. Abdellaoui Alaoui, W. Cherif, and H. Silkan, "Improving

Parking availability prediction in smart cities with IoT and ensemble-based model,

Description:

The rapid growth of urban populations, driven by a significant rural exodus, has pushed cities to optimize their resources. In this context, the collaboration among city stakeholders and advancements in information and communication technologies (ICT) have led to the emergence of "smart cities" (Bélissent, 2010). This trend of smart cities is gaining momentum worldwide, aiming to integrate ICT solutions that enhance the quality of life for citizens and improve their interactions with government officials. One of the key challenges urban areas face is traffic and mobility, particularly as the demand for parking spaces continues to rise, which strains the capacity of transport, traffic, and parking systems. A classic example of a smart city initiative is the development of public transport applications that offer personalized information to users. To design these applications—often optimized for mobile devices—users need to provide valuable information to help streamline their travel. Meanwhile, transport companies are compelled to enhance their service quality to tackle the challenges of smart urban mobility.

Paper 2 Author:

Khanna and R. Anand, "IoT based smart parking system," in 2016 International Conference

on Internet of Things and Applications (IOTA), IEEE, Jan. 2020

Description:

The idea behind the Internet of Things (IoT) began with devices that have their own identities and can communicate. These devices can be tracked, controlled, or monitored through remote computers that are connected via the Internet. IoT takes the Internet a step further by enabling communication and creating a network of devices and physical objects, which we refer to as 'Things'. The two key terms in IoT are "internet" and "things." The Internet is essentially a massive global network that links servers, computers, tablets, and mobile devices using standardized protocols. It allows for the sending, receiving, and sharing of information. The word 'Thing' in English can refer to a variety of concepts, including a physical object, an action, an idea, a situation, or an activity, especially when we want to keep things vague. Overall, IoT is about connecting a network of devices and physical objects, allowing numerous items to collect data from remote locations and communicate with the systems that manage them.

Paper 3 Author:

M. Ramasamy, S. G. Solanki, E. Natarajan, and T. M. Keat, "IoT Based Smart Parking System for Large Parking Lot,"

Description:

Parking in modern cities has become quite a challenge. With so many cars on the road and not enough parking spaces, it's a real headache. The team saw the need for smart parking management systems. To bring their idea to life, they use infrared sensors to check if parking spots are taken, along with a direct current motor that mimics the ones used for opening gates. Right now, a Wi-Fi modem helps them stay connected online, while a microcontroller keeps everything running smoothly. They even offer a website where users can create graphical user interfaces (GUIs) for easy online access and Internet of Things (IoT) management. The system uses infrared (IR) sensors to monitor whether parking spots are available or occupied. It gathers data on the number of free and taken spots and syncs this information with a cloud server, allowing for real-time updates on parking availability. Users can check this information from anywhere, making their parking experience much more convenient. Ultimately, this system tackles the parking dilemma in urban areas and offers a user-friendly parking management solution powered by the Internet of Things (IoT).

Paper 4 Author:

D. Ashok, A. Tiwari, and V. Jirge, "Smart Parking System using IoT Technology," in 2020

International Conference on Emerging Trends in Information Technology and Engineering (ic-

ETITE), IEEE, Feb. 2021

Description:

Parking in modern cities has become quite a challenge. There are simply too many cars on the road and not enough parking spaces to go around. The team realized the importance of having effective parking management systems in place. Along with a direct current motor that mimics the motors used for opening gates. Right now, a Wi-Fi modem helps them stay connected to the internet, while a microcontroller manages the whole system. They even offer a website where users can design graphical user interfaces (GUIs) for online access and Internet of Things (IoT) management. The system utilizes infrared (IR) sensors to determine whether parking spots are available or taken, keeping track of how many slots are free or occupied.

METHODOLOGY

1. Problem Identification

We kicked things off by surveying and analyzing the common parking headaches people face in urban areas. We pinpointed a few key issues:

- Wasting time searching for parking spots
- Traffic jams caused by poor parking management
- A lack of real-time info on parking availability

2. System Design and Planning

Next, we designed a prototype layout for a parking lot featuring multiple slots. We created block diagrams, flowcharts, and the overall architecture for our IoT system. We also mapped out the hardware and software components, which included:

- Microcontroller (ESP32/ESP8266)
- Sensors (Ultrasonic)
- Cloud platform (Firebase/ThingSpeak)
- User interface (Mobile/Web App)

3. Hardware Implementation

Sensor Setup:

We installed ultrasonic sensors in each parking slot to detect whether a vehicle is present.

Microcontroller Programming:

Using the Arduino IDE, we programmed the ESP32 to gather sensor data and send it over Wi-Fi.

LED Indicators (optional):

We set up LEDs to indicate the status of each slot (Green = Free, Red = Occupied).

4. Cloud Integration

We connected the ESP32 to a cloud service (like Firebase) using the HTTP/MQTT protocol. Data, including slot ID and status (free/occupied), was pushed to the database in real time. We made sure there was real-time synchronization between the microcontroller and the cloud.

5. Software Development

Mobile/Web Application:

We built a user-friendly interface using MIT App Inventor / Flutter / Web tools. The app pulls data from the cloud and shows users which slots are available.

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