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INTEGRATED SMART TRAFFIC SIGNAL TIMER AND PARKING SPOT DETECTION SYSTEM

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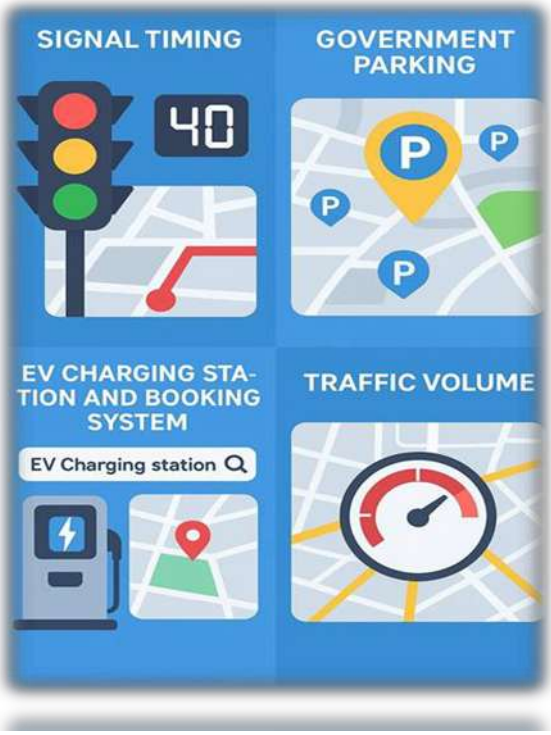
INTRODUCTION

In modern urban areas, traffic congestion and the lack of efficient parking management have become major challenges. To address these issues, an Integrated Smart Traffic Signal Timer and Parking Spot Detection System offers an innovative solution that combines real-time traffic control and intelligent parking management using modern technologies such as IoT (Internet of Things), sensors, and AI-based data analysis.

This system dynamically adjusts traffic signal timings based on real-time traffic density at intersections, ensuring smoother traffic flow and reduced waiting times. Simultaneously, it detects available parking spaces using ultrasonic or infrared sensors, guiding drivers to the nearest vacant spot through a mobile or web-based interface. By integrating these two components, the system not only reduces traffic jams and fuel consumption, but also enhances urban mobility and environmental sustainability.

With the rapid growth of electric vehicles (EVs) and increasing urban traffic, the need for efficient infrastructure has become essential. EV Parking Slot and Station systems play a vital role in supporting sustainable transportation by providing organized charging facilities and smart parking management. These systems not only reduce congestion in parking areas but also encourage the adoption of electric mobility by ensuring the availability of charging points in public and private spaces.

On the other hand, Traffic Volume Analysis is crucial for understanding the flow and density of vehicles on roads. It helps in identifying congestion points, optimizing signal timings, and planning better road networks. When integrated with EV station data, traffic volume analysis can guide strategic placement of charging points And improve urban mobility efficiency.



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LITERATURE REVIEW

EV CHARGING STATION AND BOOKING SYSTEM

In today's world, Electric Vehicle (EVs) is drastically evolving. General public transport as buses, autos, taxis, etc., are rapidly being replaced by EVs, the major cause for this is the rapidly increasing fossil fuel price and the limited resource available. We observe people switching to EVs but still facing charging issues. The proposed system will work on this issue by displaying charging stations, providing the user with a slot at the nearest charging station, guiding them to the destination via GMAPS API, a Chabot for queries and displaying the battery percentage so that they are always aware of the currently available battery.

SMART PARKING SPOT DETECTION IN MAP

Smart Parking systems typically obtains information about available parking spaces in a particular geographic area and process is real time to place vehicles at available positions. When deployed as a system, smart parking thus reduces car emissions in urban centers by reducing the need for people to needlessly circle city blocks searching for parking. It also permits cities to carefully manage their parking supply Smart parking helps one of the biggest problems on driving in urban areas; finding empty parking spaces and controlling illegal parking. The aim of this research is to develop & implement an automatic parking system that will increase convenience & security of residential parking system. The automatic parking system will be able to have less interaction of humans

TRAFFIC VOLUME SHOW IN MAP

The fundamental objective of traffic engineering is to guarantee the safe, convenient, and timeefficient transit of both individuals and goods via roadways. The movement of people and products is regulated by various traffic parameters, with volume, speed, and density being the three most critical. Traffic volume data is essential during the research, planning, design, and regulatory phases of traffic engineering and plays a vital role in establishing priorities and timelines for traffic enhancements.

SMART TRAFFIC SIGNAL TIMER SHOWN IN MAP

The vehicle population in the world is growing rapidly. Therefore the urban traffic is increasing in proportion. Also, it increases associated problems such as accidents, stress, and pollution. According to the statistics in the India city of Pimpri Chinchwad, the average speed of a vehicle would be around 10 km per hour. However to reduce this traffic most cities used traffic light systems. A traffic light system controls the flow of automobiles in a junction, pedestrian crossing, or other special locations. The city traffic is changing within the day. In most cities, traffic increases in the morning and evening. Due to this timely variation of traffic flow, most traffic lights are not able to control or minimize this traffic by changing to a pre-defined logic or a timer. In most of the cases, police officers manually adjust these traffic lights. This is inappropriate and day by day the city traffic will increase. The main research objective is to make the traffic light systems more efficient by monitoring and dynamically changing the waiting time of the traffic lights in real-time. In most of the cases, the traffic lights time is adjusted manually according to the traffic size, or sometimes those timers cannot adjust. So this is the main problem identified by the authors. Therefore, in this research, it is proposed to implement a dynamic traffic light controlling system by using Google Maps . This proposed solution is expected to avoid or minimize these unnecessary traffic jams by identifying traffic density and dynamically change the waiting time of the traffic lights. Moreover, emphasis was placed on the ease of applicability of this system directly to the present traffic light systems.

Scope

Smart Traffic Signal Control

To analyze real-time traffic volume data.
To reduce traffic congestion at intersections.
To collect and display live signal timing data on the web platform.

Traffic Volume Analysis

To monitor and record traffic flow.
To generate reports and graphs for better traffic

Smart Parking Spot Detection

To detect availability of parking spaces.
To provide real-time parking slot updates to drivers via the web interface. To reduce time spent searching for parking and improve fuel efficiency.

EV Charging Stations with booking system

To map and display nearby EV charging stations on the same web platform.
To encourage use of electric vehicles

METHODOLOGY

The project aims to develop an integrated smart system that combines traffic signal control, parking management, and electric vehicle (EV) charging facilities on a single platform. The first step is to study the existing traffic conditions, parking problems, and charging station facilities in the selected area. Based on this study, a suitable design is prepared for placing sensors and control units at important locations such as road intersections, parking areas, and charging stations.

For the smart traffic system, sensors or cameras are used to count the number of vehicles on each road. The signal timings are then adjusted automatically depending on the traffic volume, which helps reduce waiting time and congestion. All the collected data is sent to a central server for further analysis.

In the parking management system, sensors are installed in each parking slot to detect whether the slot is occupied or empty. The information is updated in real time on a mobile or web-based application so that drivers can easily find available parking spaces. This helps in reducing unnecessary vehicle movement and saves fuel.

For the EV charging stations, a booking system is added to the same platform. Users can check which charging stations are available and book a slot in advance. This ensures proper utilization of charging points and saves time for vehicle owners.

All three systems—traffic control, parking management, and EV charging—are connected to a single cloud- based platform. The

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cloud stores all the information and allows easy monitoring through a dashboard or application. The system is tested under different traffic and parking conditions to check its performance and reliability.

Finally, the collected data is analyzed to understand how effectively the system improves traffic flow, reduces congestion, and manages parking and charging facilities. The project provides a smart and sustainable solution for modern urban transport systems and supports the concept of smart cities.

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