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INTEGRATED SMART TRAFFIC SIGNAL TIMER AND PARKING SPOT DETECTION SYSTEM

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ABSTRACT

The project titled "Integrated Smart Traffic Signal Timer and Parking Spot Detection System" aims to address major urban challenges such as traffic congestion, long waiting times at signals, and lack of real-time parking information. With the rapid increase in vehicle population, inefficient traffic management and difficulty in finding parking spaces lead to fuel wastage, time loss, and increased stress for drivers.

This project proposes a web-based intelligent system that monitors and records traffic signal timings, displays live countdown timers for users, and provides real-time updates on available parking spaces. The system integrates traffic data, parking availability, and route information into a single user-friendly platform. It also includes traffic density visualization through colorcoded maps, enabling users to identify congested routes and choose better alternatives.

Additionally, the system incorporates an Electric Vehicle (EV) charging station detection and booking feature, providing realtime information on charging slot availability using GPS and sensor integration. By analyzing collected data, the system can suggest optimized routes to reduce travel time and avoid congestion.

The implementation of such an integrated smart system can improve traffic flow, reduce fuel consumption, minimize waiting time, and contribute to the development of sustainable smart cities.

KEYWORDS— *Traffic management, smart signals, parking detection, EV charging, route optimization, smart cities*

1. INTRODUCTION

The rapid pace of urbanization and the exponential growth in vehicle population have placed tremendous stress on the existing road infrastructure of cities. Traditional traffic control systems, static signal timers, unorganized parking, and lack of real-time information have led to severe congestion, fuel wastage, air pollution, and increased travel time. With the increasing demand for sustainable and intelligent transport systems, there is a need for an integrated technological solution that combines traffic management, parking detection, and electric vehicle (EV) infrastructure on a single unified platform.

The project titled "Integrated Smart Traffic Signal Timer and Traffic Volume, Parking Spot Detection System, and EV Charging Stations with Booking System on a Single-Based aims to provide a holistic approach to modem transportation problems. This system integrates single Platform" multiple technologies including sensors, microcontrollers, Internet of Things (IoT), and intelligent data processing management, and promote sustainable electric mobility. to enhance traffic flow, reduce congestion, improve parking.

2. SMART PARKING SPOT DETECTION SYSTEM

- Parking spaces are equipped with sensors that detect vehicle presence.
- The status of each slot (occupied or vacant) is transmitted to a local display or map.
- Drivers can view real-time availability before entering parking zones.

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- Reduces random parking on roads, improves flow, and decreases fuel wastage

- PARKING SPOT DETECTION NEAR D.Y. PATIL COLLEGE



- LOCATION



3. EV Charging Stations with Booking System

- The system displays all nearby EV charging stations on the same digital platform.
- Users can view availability, reserve slots, and monitor charging status.
- The system manages power distribution and prevents overloading.
- Encourages the adoption of green energy transport by making EV charging convenient and effective.

- EV CHARGING BIJLIFY



4. Integration on a Single Platform

- Each module works offline or locally, ensuring continuous operation even without internet connectivity.
- Real-time updates are displayed on a map interface using Leaflet or Google Maps
- Data collected from traffic signals , parking sensors, EV charging is stored in system database for future analysis.

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5. RESULTS AND DISCUSSION

The results show that the proposed system improves traffic efficiency, reduces congestion, and enhances user convenience.
The smart traffic signal adjusts signal timing dynamically based on real-time traffic conditions. This helps reduce unnecessary waiting time and improves fuel efficiency by reducing idling time of vehicles.

Parking detection helps drivers quickly find available parking spaces. This reduces traffic congestion caused by vehicles moving slowly while searching for parking.

The EV charging station detection module supports the growing use of electric vehicles. Many EV users face difficulty finding charging stations, and this system solves that problem by providing location-based information.

The integration of all these systems into a single platform is the main advantage of this project. Instead of using separate applications for traffic, parking, and EV charging, users can access all information in one place.

The system can be further improved by using advanced technologies such as Artificial Intelligence and Internet of Things (IoT) sensors for more accurate prediction of traffic conditions and parking availability.



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FINAL SUMMARY

JUNCTION	Total vehicles per cycle	Total PCU
Narsinh Chowk	44	44 PCU
Kaspate Chowk	126	126 PCU
Kalewadi Chowk	53	53 PCU

JUNCTION	HOURLY VEHICLES	HOURLY PCU
NARSINH CHOWK	1440 veh/hr	1440 PCU/hr
KASPATE CHOWK	2607 veh/hr	2607 PCU/hr
KALEWADI CHOWK	1193 veh/hr	1193 PCU/hr

6. ADVANTAGES

A. Technical Advantages FINAL SUMMARY (HOURLY TRAFFIC VOLUME)

1. Real-time traffic management: Adjusts signal timing dynamically according to traffic density.
2. Offline capability: Works even in areas with no internet connection.
3. Scalability: Can be expanded to multiple junctions cities.
4. Data collection: Stores traffic data for further civil engineering analysts.
5. Energy-efficient: Reduces unnecessary fuel consumption and emissions.

B. Civil Engineering Advantages

1. Improved intersection design: Data-driven signal control helps optimize lane design and function capacity
2. 2. Better parking infrastructure: Identifies underused or overcrowded parking zones.
3. Reduced road congestion: Minimizes vehicle stoppage tume, improving LOS (Level of Service)
4. Support for smart city development: Integrates transport, land-use, and environmental planning.
5. Enhanced safety: Reduces chances of accidents by streamlining traffic movement.

C. Environmental and Economic Advantages

- Reduced carbon emissions: Shorter idle times mean less fuel burn and lower pollution.
- Efficient energy usage: Encourages EV adoption through accessible charging.
- Lower operational costs: Automation reduces human intervention and maintenance expenses
    - Supports sustainability:
    - Aligns web national and global smart city and green mobility missions.

7. CONCLUSION

The proposed Integrated Smart Traffic Signal Timer and Parking Spot Detection System with EV Charging Station Detection on a Single Platform provides an effective solution for modern urban transportation problems. The system successfully combines smart traffic signal control, parking space detection, and EV charging station identification into one integrated platform. The results show that the smart traffic signal timer can adjust signal duration according to traffic density, which helps in reducing traffic congestion and waiting time at intersections. The parking spot detection system helps users easily find available parking spaces, which reduce unnecessary vehicle movement and saves time and fuel. The EV charging station detection feature makes it easier for electric vehicle users to locate nearby charging facilities, which encourages the use of eco-friendly vehicles.

The integration of all these features into a single platform improves convenience for users and supports the development of smart city infrastructure. The system helps in better traffic management, efficient parking utilization, and promotion of sustainable transportation. Overall, the proposed system demonstrates that the use of modern technologies such as IoT and smart sensors can significantly improve urban mobility and reduce transportation-related problems.

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In future, the system can be enhanced by using advanced technologies like Artificial Intelligence and real-time data analysis for more accurate traffic prediction and smart decision making. This project can be implemented in real city environments to improve transportation efficiency and support smart city development.

Overall, the project demonstrates that smart city technologies can significantly improve transportation systems and reduce traffic-related problems.

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