

SMART CAR PARKING SYSTEM

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Abstract: The smart car parking system is an innovative solution designed to address the growing challenges of urban parking management. It utilizes advanced technologies and automation to optimize the utilization of parking spaces, enhance user convenience, and improve overall parking efficiency. The system leverages real-time data collection, analysis, and smart communication infrastructure to provide drivers with real-time information about parking availability, guiding them to the nearest vacant parking spot. Furthermore, the system incorporates intelligent sensors, computer vision, and machine learning algorithms to monitor parking spaces, detect occupancy, and ensure proper enforcement of parking regulations.

Through a user-friendly mobile application and integrated payment systems, drivers can easily locate, reserve, and pay for parking spaces, eliminating the hassle of searching for parking and enabling a seamless parking experience. Moreover, the smart car parking system offers administrative tools for parking operators, enabling them to monitor and manage parking operations efficiently, optimize revenue generation, and implement dynamic pricing strategies based on demand patterns. Overall, this system aims to alleviate congestion, reduce environmental impact, and enhance user satisfaction by transforming traditional parking into a smart and connected ecosystem.

Keywords: Smart car parking, Parking management, Urban parking, Intelligent sensors, Automation.

I. INTRODUCTION

The increasing urbanization and growing number of vehicles have led to a significant rise in the demand for efficient car parking systems. Traditional parking management methods often result in congestion, wasted time, and frustration for drivers searching for available parking spaces. To address these challenges, a smart car parking system has emerged as an innovative solution that leverages advanced technologies and automation to optimize parking space utilization, enhance user convenience, and improve overall parking efficiency.

The smart car parking system utilizes a combination of real-time data collection, analysis, and smart communication infrastructure to provide drivers with up-to-date information about parking availability. By employing intelligent sensors, computer vision, and machine learning algorithms, the system can monitor parking spaces, detect occupancy, and ensure proper enforcement of parking regulations. This real-time monitoring enables drivers to quickly locate the nearest vacant parking spot, reducing the time spent searching for parking and alleviating congestion in urban areas. A key component of the smart car parking system is the user-friendly mobile application. Through this application, drivers can easily access information about available parking spaces, reserve parking spots in advance, and make convenient payments. The integration of payment systems simplifies the payment process and eliminates the need for physical cash or ticket-based transactions, enhancing the overall parking experience.

II. LITERATURE SURVEY

More than half of the world population lives in the urban areas so the cities have reached its full occupancy. As a result number of vehicles in the cities is also increased. Due to this most of the people spend their valuable time on searching parking slots to park their vehicles. It is hectic job to find parking space to park their vehicles. Work proposed in this paper is an attempt to solve above mentioned problem. The system developed here is an integration of internet of things (IoT), cloud technology, android application and user authentication for ADAS system. Internet of things is the internetworking of physical device embedded with electronics that enables those physical devices to connect to internet. IoT was first introduced in 1999 at auto ID center and first used by Kevin Aston. In this system IoT technology is used to connect parking slots in parking area to the internet.

The information related to the availability of unoccupied lot; before the driver enters the facility is provided by the parking availability information system. An empty parking lot can be reserved by the driver through the parking reservation system. The continuous entry and exit system facilitates a driver by getting rid of time consuming processes such as getting a ticket, and the freedom of any payment method. The in-facility navigation system is used for finding the vacant lot and then guiding the driver to that parking space. Further modifications result in even better systems, such as reserving the parking space online and using a smart card with it will help the driver find the destination quickly, safely and easily. Despite the system requiring no man power, it will still be able to know about the entrance and exit of the vehicles as well as the occupancy rate of the facility. These systems will also decrease the traffic congestion as the number of vehicles parked on the street will decrease. These new systems will boost the parking business by the increase in the number of customers [1].

The modern development in technology has also resulted in In-vehicle advanced information systems, which is the standard equipment in the expensive and luxurious cars. These systems consist of cell phones, electronic maps and satellites for navigating the real time situations of road through wireless technologies. The latest advancement in intelligent parking service is the parking space negotiation system which is much different than the parking information system. Parking space negotiation system uses the linking and integration of the parking facilities which results in negotiation and coordinates between their-vehicle information system and parking facility.

This system initializes the negotiation process for the parking charges, the advance reservation of the parking lot, search for the best possible path from current position to the parking facility and then to the destination. Coordination work is an important task for the negotiation corporation. Negotiation is just like a business where both sellers and buyers decide the terms of business, for getting the best possible deal for both parties. The parking information system along with the parking space negotiation system laid the foundation for the intelligent parking service and it can counter all the traffic related issues working hand in hand with each other[2].

The system consists of low-cost wireless sensors which are installed in a car parking facility. Each parking space has a sensor node for detecting and checking the occupation of the parking facility. Sensor node is used for detecting the status of the parking field, which is forwarded regularly to the database through the installed wireless sensor and its gateway. For performing various management functions such as, finding unoccupied parking lot, auto-toll, management of security and statistic report; the data base is accessed by the upper layer management system.

The prototype of the system was implemented using crossbow mote. Nodes are loaded with light, sound and acoustic sensors for the WSN-based car park management system. A wide-area architecture used for pervasive sensing networks is proposed in Irisnet1. This will allow the users for getting the information of available parking vacancies on their ways, through distributed accessing methods. For the detection and recognition of the automobiles, this system uses video cameras, microphones and motion detectors. All the data of the sensors is processed in networking environment, which is then posted on web. This information can then be retrieved by the user from internet. As the data generated by the video camera is huge, a great amount of resources such as communication bandwidth, processing cycles and energy is required for transferring and processing the data. But the mentioned resources are limited in a wireless network. Wireless network based transportation applications are discussed in Traffic Plus Technology[3].

There are other solutions as well that focuses on the use of sensor technologies (magnetometers and video cameras, etc) for parking lot applications. However, magnetometers are sensitive to environmental issues; which results in an inaccurate detections at times. We also have to place the magnetometers close to the cars since it measures the change in magnitude and direction of Earth's magnetic field resulting from the presence of the car.

Though it's possible in the proximity of the parking lot's entrance; but it's not possible in upper floors as there is no entrance marking and the vehicles also move at a higher speed. The solutions based on video cameras are very expensive and the huge amount of data generated is difficult to be transmitted over multiple hops in a wireless network. These discrepancies and the movement of other objects in a parking space including human beings, reduce the applicability of either magnetometers or video cameras alone for parking lot management. The traffic surveillance system of [4].

III. METHODOLOGY

The methodology of a smart car parking system typically involves a combination of hardware and software components working together to provide efficient and automated parking solutions. Here is a general outline of the methodology:

1. Sensor Installation:

The first step is to install sensors at appropriate locations within the parking area. These sensors can be of various types, such as ultrasonic sensors, infrared sensors, or camera-based sensors. The purpose of these sensors is to detect the presence or absence of vehicles in specific parking spots.

2. Data Acquisition:

The installed sensors continuously gather data about the occupancy status of each parking spot. This data is then transmitted to a central control system or a server.

3. Data Processing:

The central control system or server receives the data from the sensors and processes it to determine the availability of parking spots. This processing may involve analyzing sensor readings, checking occupancy patterns, and generating real-time parking availability information.

4. Parking Availability Display:

The processed data is then presented to users in the form of a parking availability display. This can be in the form of digital signage, mobile applications, or website interfaces. The display provides real-time information about the number of available parking spots in different areas or levels of the parking facility.

5. User Interaction:

Users can access the parking availability information through the provided interfaces. They can check the availability of parking spots, reserve a spot, or navigate to an available spot using the system.

6. Reservation and Payment:

If the smart parking system supports reservation functionality, users can reserve a parking spot in advance. This can be done through a mobile app or website. Additionally, integration with payment systems allows users to make payments for parking fees through the same interface.

7. Methodology:

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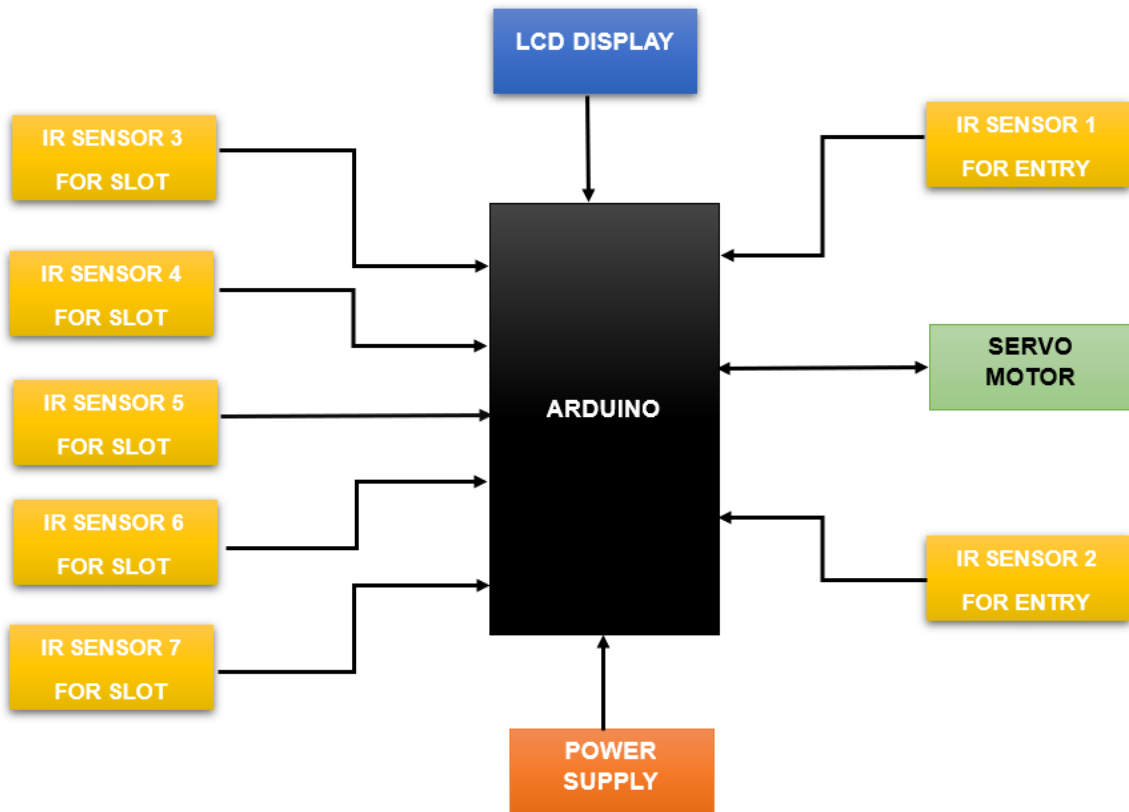
8. Security and Monitoring:

The smart parking system may incorporate security features such as surveillance cameras and access control systems to enhance the safety of the parking area. These security components can be integrated with the overall system, allowing real-time monitoring and alerts in case of any suspicious activities.

9. System Maintenance and Upgrades:

Regular maintenance and updates are essential to ensure the smooth operation of the smart parking system. This includes monitoring the performance of sensors, software updates, addressing any hardware issues, and optimizing the system based on user feedback.

IV. BLOCK DIAGRAM



V. FLOW CHART



**VI. IMPLEMENTATION**

The increased number of vehicles results in shortage of parking areas. This project aims to present an intelligent parking system for vehicles that identifies the parking slot automatically through sensors and displays it without making the drivers to circle around the parking area. The availability of parking slots will be displayed to the drivers at the entrance. It also captures the number plate of vehicles by using camera and recognises the number using image processing and stores it in the server at the entrance and also at the exit of parking area for ease of payment purposes. All the information's will be simultaneously updated in the IoT server and can be used for future use. It is found that the system decreases the manual work and provides high efficiency and high accuracy.

VII. CONCLUSION

Smart car parking systems optimize the utilization of parking spaces by efficiently guiding drivers to available spots. This reduces the time and effort spent searching for parking, resulting in improved efficiency for both drivers and parking operators. With real-time information on available parking spaces, drivers can quickly locate and secure a spot, reducing the time spent circling around. This leads to time and fuel savings, as well as reduced traffic congestion in crowded areas. Parking operators can maximize their revenue by utilizing smart parking systems. They can implement dynamic pricing models, charging higher rates during peak hours or in high-demand areas. This optimization helps generate more income for parking facility owners. Smart car parking systems provide a seamless and user-friendly experience for drivers. Through mobile apps or digital displays, users can easily access information about available parking spots, reserve a space in advance, and receive navigation instructions to guide them to the designated spot.

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