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SMART CAR PARKING SYSTEM

Sakshi Gaikwad*1, Sakshi Hande*2, Pratiksha Khandge*3, Vaishnavi Narwade*4, A.S. Magar*5

*1,2,3,4Student, Computer Engineering, Jaihind Polytechnic Kuran, Pune, Maharashtra, India

*5Professor, Computer Engineering, Jaihind Polytechnic Kuran, Pune, Maharashtra, India.

ABSTRACT

Most cities today have experienced runaway growth in the volume of visitors and customers because of urban revitalization, expansion of public transportation into suburban regions, and the overall direction toward greater mobility of our society. Consequently, there are too many cars on the road and not enough parking spots. This has resulted to the requirement of an effective parking management system. With the assistance of a computerized system we are able to provide a good service to citizens who wish to park their vehicle into the any organization's premises utilizing Internet of Things (IOT) based on parking management system. In this regard, Internet of Things (IOT) employs sensors to link physical parking space infrastructures with information and communication technologies, where application-based smart management services are offered. An IOT based application would be implemented to apply this idea. This application will enable an end user to view the availability of parking space and park a specific parking lot accordingly. Every parking lot would have a control system that makes it possible to monitor the number of free and occupied parking places and notify users about the parking lot status (open free available parking lot or closed space) Also the app would show payment for parking service based on the duration of the parking. It will also sense if the vehicle has entered at the gate to open the gate automatically. This enables the operator to detect vacant parking space and park the car automatically by way of robot guide lines.

Keywords: Automatic Car Parking System, IOT, Robotic Car parking, Slot Assignment.

I. INTRODUCTION

Traffic issues are certain to happen. This is because the present transport infrastructure and car park facility constructed cannot accommodate the number of vehicles on the road. In order to ease the said issues, the smart parking system has been invented. With the use of the smart parking system, customers can find and occupy an empty parking space at any car park that they find convenient. Vehicle entry and exit are also made more convenient with the use of hassle-free payment system. With the aid of a computerized system, we can provide a good service to citizens who wish to park their vehicle into the premises of any organization by utilizing Internet of Things (IOT) based on the parking management system. Here Internet of Things (IOT) utilizes sensors for interconnecting the physical parking space infrastructures to information and communication technologies wherein stand-alone-based intelligent management services are delivered. In order to introduce this idea, a stand-alone based application will be created.

This stand-alone application will enable an end user to verify the availability of parking space and reserve a specific parking lot accordingly. Every parking lot would have a control system that allows tracking of the number of free and occupied parking spots and notification of users regarding the parking lot status (open with/without free available parking spots or closed) In addition, the application would show parking service payment based on parking time duration. Also it will detect if a car has arrived at the gate for auto gate opening. This provides users to search for available parking space for easy parking. Therefore, the system solves the parking problem.

ESP 32 Wi-fi Module:

ESP32 is a universal microcontroller by Espressif Systems, intended for IoT and embedded applications. It includes a built-in dual-core processor, Wi-Fi, and Bluetooth (BLE) for reliable wireless communication. Compatible with many interfaces such as PWM, ADC, I2C, SPI, and UART, the module provides flexibility to cater to varying projects. Having power-saving measures in place with security functions like encryption and secure boot, ESP32 finds widespread applications in smart automation, robotics, and industrial control.

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Figure 1: ESP 32 Wifi Module

Internet Of Things:

Figure 2: Internet Of Things

The Internet of Things (IoT) is a network of physical devices, vehicles, appliances, and other objects equipped with sensors, software, and connectivity functionalities, which make them capable of gathering and sharing information over the internet..

II. METHODOLOGY

Problem statement

The Smart Car Parking System enables customers to choose a parking space, upon which the car moves independently and parks itself, with the aim of being efficient and convenient.

Motivation

The Smart Car Parking System is meant to improve parking efficiency through the combination of automation and user control. In conventional parking systems, the search for and alignment with a space can be time-consuming and susceptible to mistakes. These issues are overcome by this project in that the users can select a parking spot manually, and then the car drives itself and parks. With the use of IoT and automation, the system maximizes space usage, decongests, and reduces human effort. Not only does it enhance parking precision and safety while also saving time, thus making the process more convenient and efficient for users.

III. MODELING AND ANALYSIS

The Smart Car Parking System has been designed with the aim to improve parking efficiency through automation and user control. In conventional parking systems, approaching and fitting into a slot takes time and can be error-prone. These issues are dealt with in this project by permitting users to pick a parking spot manually, and then the vehicle automatically moves in and parks by itself. The system maximizes space utilization, decreasing congestion, and minimizing manpower. Not only does it enhance parking accuracy and safety, it also saves time, hence rendering the process easier and faster for users. Smart Car Parking System is formulated to offer an automatic and effective parking solution via IoT based technology. The system consists of hardware units like a motor driver, battery cells, and LED lights, and track identification sensors, which allow a self-driven car to drive and park in a specific slot without the intervention of humans. As shown in the

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diagram, the process starts when a car enters the parking facility. At the entrance checkpoint, the system identifies the car and authenticates its car information, which can include technologies such as RFID scanning, license plate recognition, or infrared sensors. After the vehicle is authenticated, the system pulls real-time slot information and calculates an optimal parking location based on factors like availability, distance, and priority. The decision-making module calculates this information and sends a signal to the vehicle, directing it to drive towards the designated parking space. The navigation process is controlled by track identification sensors, enabling the car to drive along a predetermined path to the intended parking bay. The slot direction module always directs the vehicle along the right path, avoiding collisions and swerving. Moreover, LED indicators are utilized for indicating turns, halting, and movement, improving the car's autonomous feature. Since vehicle arrives at its designated space, the system will instruct it to stop automatically, providing accurate and structured parking. The parking database is updated to indicate that the slot is occupied, and the system is ready for subsequent vehicle entries. This system greatly improves space utilization, decreases congestion, and does away with the time-wasting activity of manually looking for parking spaces. Through the use of automation, it guarantees that vehicles are parked in a systematic and organized way, minimizing human intervention and maximizing overall efficiency. Additionally, the incorporation of smart sensors and automatic decision-making facilitates smooth traffic flow within the parking lot, avoiding congestion and reducing parking delays. The Smart Car Parking System is a significant leap forward in contemporary urban parking technology, playing its part in smart city efforts by utilizing sustainable and technology-based parking management.

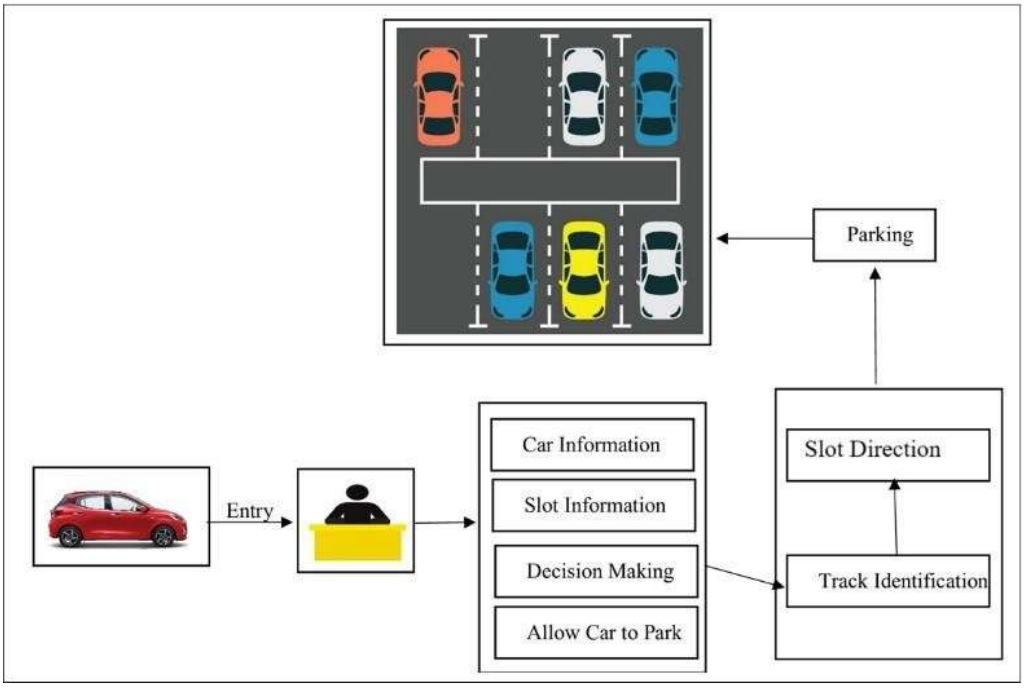

Figure 3: System Overview Design.

Module description:

Module A: System Admin Login

- Input: credentials
- Process: validation
- Output: Store in Database

Module B: Car Info management

- Input: Car Info
- Process: Finding parking slot
- Output: Allocating Track

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Module C: Car Parking

- Input: allocated Slot and track
- Process: Track following
- Output: Parking car and Updating Info

IV. RESULTS AND DISCUSSION

The IoT-driven Automated Parking System effectively scanned for slots and directed cars without human intervention minimizing parking time and human intervention. It maximized the use of space and allowed for real-time monitoring for dynamic slot allocation. Sensor misalignment and environmental interference challenged accuracy requiring calibration. While effective in controlled settings, real-world deployment needs obstacle detection and adaptive routing. With respect to manual parking, the system enhanced efficiency but needs enhancement such as AI integration for enhanced scalability and reliability.

V. CONCLUSION

Urban renewal, transit development to suburbs, and social mobility have increased visitor and patron growth in most cities. Sadly, the road has too many vehicles and limited parking spaces. An efficient parking management system is needed. Organizations can enhance citizen parking through IOT-based parking management systems. IoT-parking garages provide stand-alone-based intelligent management. A application would implement this concept. Look up parking availability to park the car with ease. Control systems tally available and occupied parking spaces and alert users of slot status. Application would display parking service payments by time. It automatically opens gates upon arrival of vehicles. To make it convenient, look up parking availability to leave the car to the Robot to do the parking efficiently.

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