



A detailed research study on vehicle parking using number plate

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ABSTRACT

Vehicle parking using license plate recognition is a technology that uses computer vision algorithms to automatically detect and recognize license plates of vehicles entering and exiting a parking lot or garage. This system can be used to automate parking ticket issuance, monitor parking space occupancy, and provide security and surveillance. The license plate recognition system typically consists of a camera that captures an image of the license plate, which is then processed by an algorithm that uses optical character recognition (OCR) to extract the license plate number. The system can then compare the extracted number with a database of registered vehicles to determine if the vehicle is authorized to park in the parking lot or garage. If the vehicle is not authorized, the system can issue parking violation or alert security personnel. License plate recognition technology can be integrated with a variety of parking management systems, including pay-by-plate systems, reservation systems, and access control systems. It can also be used to track parking space occupancy, which can be useful for optimizing parking lot layouts and maximizing space utilization. Vehicle parking using license plate recognition is an efficient and effective way to manage parking lots and garages, improve security, and enhance the customer experience.

Keywords: Optical Character Recognition (OCR); Internet of Things (IoT); Artificial Intelligence (AI)

1 Introduction

1.1 Project description

Vehicle parking using number plate recognition using OCR (Optical Character Recognition) algorithm aims to automate the process of vehicle parking management in a parking lot or garage. The project involves the use of a camera to capture images of the license plates of vehicles entering and exiting the parking area, and an OCR algorithm to recognize the license plate numbers. The system is designed to compare the recognized license plate number with a database of registered vehicles to determine if the vehicle is authorized to park in the parking lot or garage. If the vehicle is authorized, the system will reserve the parking space or process payment automatically. The OCR algorithm is trained to recognize the characters on the license plate, and can handle variations in font, size, and colour. The algorithm extracts the characters from the license plate image and converts them into digital text that can be processed by the system. This system can be further enhanced by integrating it with other parking management systems such as access control, reservation systems, and payment systems. It can also be used to monitor the occupancy of parking spaces in real-time, optimizing the parking lot layout, and maximizing the utilization of available space. The benefits of vehicle parking using number plate recognition using OCR algorithm includes reducing the time spent searching for a parking space, improving traffic flow, enhancing security and surveillance, and increasing revenue by minimizing parking violations and improving efficiency. This approach provides a smart and efficient way to manage parking lots and garages while providing a seamless customer experience. It can be implemented in various parking areas, including public parking lots, commercial parking lots, and private parking areas.

2 LITERATURE SURVEY

In recent days, the usage of vehicles is highly increased. We have addressed the artificial intelligence technique for reducing the number of working hours for a vehicle parking company. This study will be a helpful factor for those who are struggling with the number of parking in urban or metro cities. Moreover, some developed works of literature are assumed in this study for enhancing this present model which is listed below: An efficient license plate recognition system using convolution neural networks developed by Cheng-hung lin.[1]. The usages of license plate detection and character recognition system for commercial vehicles based on morphological approach and template matching addressed by Animesh chandra roy.[2]. An approach of locating korean vehicle license plate based on mathematical morphology and geometrical features formulated by Ihsan ullah.[3]. IRAQI car license plate recognition examined by Omran.[4]. A vehicle number plate detection and recognition using bounding box method discussed by Mahesh Babu.[5].

3 System Description

3.1 System Architecture

A system architecture or is the conceptual model that defines the structure, behaviour, and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviours of the system. It comprises of system components, the externally visible properties of those components, the relationships between them. It can provide a plan from which products can be procured, and systems developed, that will work together to implement the overall system. There have been efforts to formalize languages to describe system architecture; collectively these are called Architecture Description Languages (ADLs).

Various organizations define systems architecture in different ways, including:

- An allocated arrangement of physical elements which provides the design solution for a consumer product or life-cycle process intended to satisfy the requirements of the functional architecture and the requirements baseline.
- Architecture comprises the most important, pervasive, top-level, strategic inventions, decisions, and their associated rationales about the overall structure (i.e., essential elements and their relationships) and associated characteristics and behaviour.
- If documented, it may include information such as a detailed inventory of current hardware, software and networking capabilities; a description of long-range plans and priorities for future purchases, and a plan for upgrading and/or replacing dated equipment and software
- The composite of the design architectures for products and their life-cycle processes.

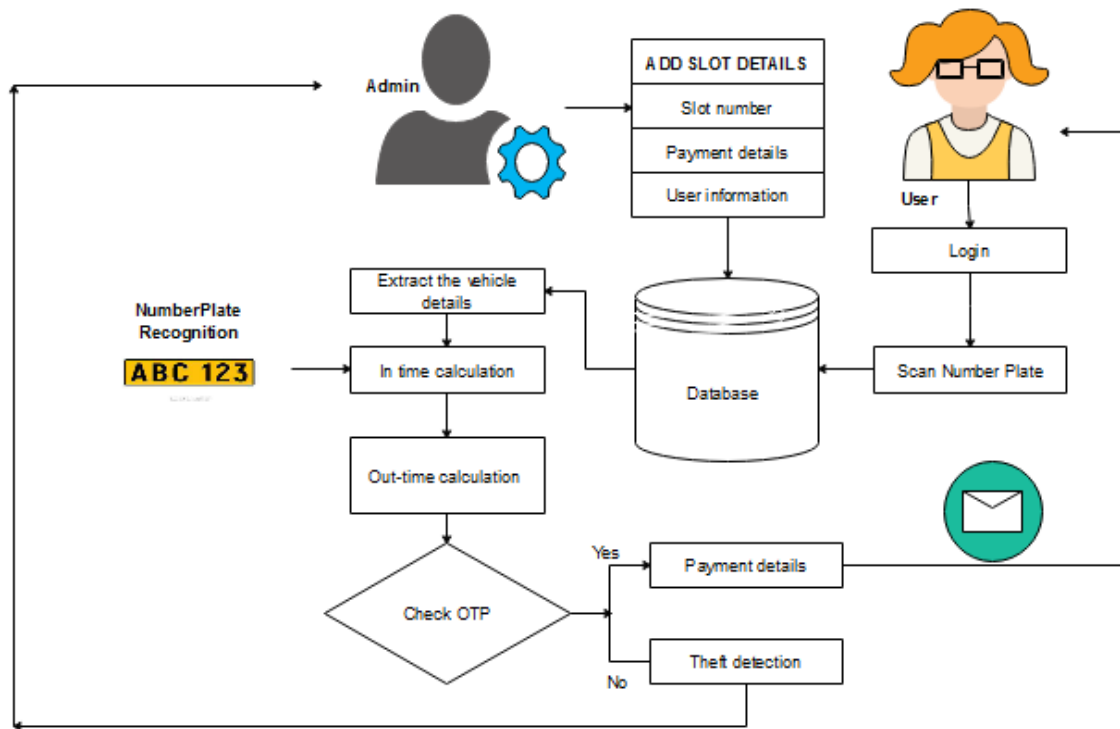


Fig 3.1 System Architecture

3.2 System Requirements

Hardware Requirements

- Processor : Dual core processor 2.6.0 GHZ
- RAM : 4 GB
- Hard disk : 320 GB
- Compact Disk : 650 Mb
- Keyboard : Standard keyboard
- Monitor : 15 inch colour monitor

Software Requirements

- Operating system : Windows OS
- Front End : Python

- Back End : MySQL SERVER
- IDLE : Python 2.7 IDLE

3.3 System Analysis

Existing system

The parking management problem is a common issue in urban areas, where the demand for parking spaces exceeds the available supply. This can cause a variety of problems, such as congestion, frustration among drivers, and reduced revenue for businesses. In the existing parking system searching for parking space is always been a difficult process. In metropolitan cities it became a major issue due to space problem, no parking zones, hence comes the need of such a system which can automatically assists us to search the nearest available parking space in the surrounding area.

Parking is an ever-growing challenge in cities and towns across the world. So the demand for Reservation based parking System is expected to grow rapidly in the near future to eliminate or reduce this problem with parking facility by just reserving their parking slot. Ultimately, the goal of parking management is to provide convenient, safe, and affordable parking options for drivers while maximizing revenue for businesses and the local government.

Disadvantages

- Time consuming process
- Manual work needed
- Traffic can be occurred at the time of parking
- Difficult to calculate in and out time

Proposed System

The proposed system for vehicle parking using number plate recognition with OCR (Optical Character Recognition) algorithm is a smart and efficient way to manage parking lots and garages. The system involves the use of a camera to capture images of the license plates of vehicles entering and exiting the parking area, and an OCR algorithm to recognize the license plate numbers.

The proposed system has the following features: License Plate Recognition: The OCR algorithm is trained to recognize the characters on the license plate, even in different fonts, sizes, and colours. The algorithm extracts the characters from the license plate image and converts them into digital text that can be processed by the system.

Vehicle Authorization: The system compares the recognized license plate number with a database of registered vehicles to determine if the vehicle is authorized to park in the parking lot or garage. If the vehicle is authorized, the system will reserve the parking space or process payment automatically.

Real-Time Occupancy Monitoring: The system can monitor the occupancy of parking spaces in real-time, optimizing the parking lot layout, and maximizing the utilization of available space.

Integration with Parking Management Systems: The proposed system can be integrated with other parking management systems such as access control, reservation systems, and payment systems.

Automated Payment Processing: The system can process payments automatically, eliminating the need for manual payment processing.

Security and Surveillance: The system enhances security and surveillance in the parking lot or garage by capturing images of vehicles and license plates entering and exiting the area.

Advantages

- Reduce the time complexity
- Automatic system
- Easy to track the in and out time
- Maintain all reports quickly

Proposed Method

In this system, step by step process of automated parking management system is discussed and is shown in below.

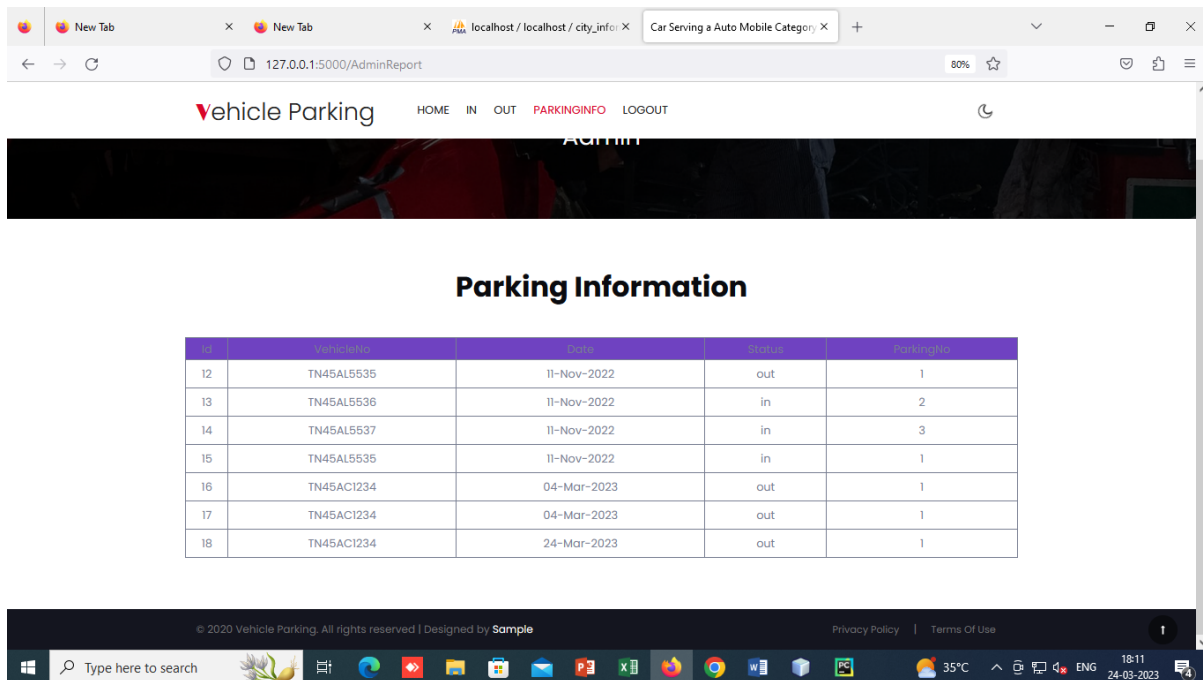
Step 1: Initially, the vehicle image is captured and is considered as input image.

- Step 2: The input color image is converted into gray-scale image to identify important features of the image information and also shades of gray-scale image gradually changes from byte to byte.
- Step 3: Median filter is applied on the gray-scale image to reduce the noise like salt and pepper from the images where it reduces noise and preserve edges.
- Step 4: Morphological image processing is done on the median filtered image since the image may contain numerous imperfections. Dilation and eroding operations are applied using structural element. For probing and expanding the characters in the image dilation is used and for shrinking eroding is used. Morphological image is generated by subtracting the eroding image from dilation image for edge enhancement.
- Step 5: Edge brightening is done on the morphological image for easy extraction of the characters and is converted into binary image.
- Step 6: Further, thinning is applied on the binary image to fill the entire characters in the license plate.

- Step 7: Selection of a region: It removes all the small objects from the binary image and selects the particular region in the license plate i.e., Characters with in the license plate.
- Step 8: Finally at the entry station, the extracted characters i.e., license plate number and entry time are stored in the entry level number plate database.
- Step 9: At the exit station, the steps:1-8 are repeated, the extracting license plate number and exit time are stored in the exit level number plate database.
- Step 10: Using template matching algorithm, the characters of the entry and exit number plates are compared with the help of correlation.
- Step 11: After matching, the parking bill is generated based on the entry and exit time based on parking bill rates.

4 Result/output

The implementation of a vehicle parking system using number plate recognition with OCR algorithm can yield several benefits, including improved parking management efficiency, enhanced security, and reduced traffic congestion. The OCR algorithm plays a critical role in the system as it allows the automated identification and registration of vehicles in the parking lot or garage. By using OCR, the system can recognize the characters on the license plate, even in different fonts, sizes, and colours, allowing for accurate identification of vehicles. This significantly reduces the chances of errors in registration, reservation, and payment processing, leading to an efficient and seamless parking experience for customers. Furthermore, the integration of the number plate recognition system with other parking management systems, such as access control and payment processing, allows for real-time tracking and monitoring of parking lot occupancy, optimization of parking space usage, and reduction of parking violations. The system also enhances security and surveillance in the parking area by capturing images of vehicles and license plates entering and exiting the area. This can help prevent unauthorized access to the parking lot or garage, thereby enhancing the safety of customers and their vehicles. In terms of system performance, the accuracy of the OCR algorithm plays a critical role. The algorithm must be trained to recognize the characters on license plates accurately, and any errors or inconsistencies in the recognition can result in misidentification of vehicles or errors in payment processing. Moreover, the system's performance may be affected by environmental factors such as lighting, weather conditions, and camera quality. These factors can affect the clarity of the license plate images captured and, consequently, the accuracy of the OCR algorithm.



The screenshot shows a web browser displaying a 'Vehicle Parking' application. The page title is 'Vehicle Parking' and the URL is '127.0.0.1:5000/AdminReport'. The page features a navigation menu with 'HOME', 'IN', 'OUT', 'PARKINGINFO', and 'LOGOUT'. Below the navigation is a large image of a parking lot. The main content area is titled 'Parking Information' and contains a table with the following data:

ID	VehicleInfo	Date	Status	ParkingInfo
12	TN45AL5535	11-Nov-2022	out	1
13	TN45AL5536	11-Nov-2022	in	2
14	TN45AL5537	11-Nov-2022	in	3
15	TN45AL5535	11-Nov-2022	in	1
16	TN45AC1234	04-Mar-2023	out	1
17	TN45AC1234	04-Mar-2023	out	1
18	TN45AC1234	24-Mar-2023	out	1

The footer of the application shows '© 2020 Vehicle Parking. All rights reserved | Designed by Sample' and 'Privacy Policy | Terms Of Use'. The Windows taskbar at the bottom shows the system tray with a temperature of 35°C, the date 24-03-2023, and the time 18:11.

5 Conclusion

Vehicle parking system using number plate recognition with OCR algorithm can provide several benefits, including efficient parking management, enhanced security, and reduced traffic congestion. However, the system's accuracy and performance are critical, and the OCR algorithm must be accurately trained to recognize characters on the license plate. Environmental factors must also be considered to optimize system performance.

In this system, vehicle license plates are designed as the crucial task for parking management system. It performs a crucial task in future traffic control and parking system. This system studies the license plate recognition of the vehicles based on neural networks. The recognition task is performed on 50

license plate images of the vehicles, out of 44 are matched successfully on an average 87 percent which is a great success rate, thereby fulfilling the principles of the about tasks. Key element of the system successfully designed and implemented.

The proposed system recognizes the license plate and generates the parking bills along with its entry-time and exit-time of the vehicles. License plates recognition system has many applications. These can be used at the parking lots where the parking of the vehicle is done without wasting time, and there is no need for involvement of man power.

This system can also be used at the toll gates in the highways and also used for identifying the vehicles which are not following the traffic rules, also in finding the theft vehicles by maintaining these systems on the highways for locating the vehicles. Using this manual work can be reduced thus it improves the efficiency of the parking system.

This system showed the evolution of technology within our society and community. The main focused was on a subset of the work related to it of which it focuses on the implementation of an advanced parking system which utilizes sensors and different latest technologies. This report highlighted the hypothesis together with the aims and objectives of the project along with methods to be used for the development of the project. The justification of the project choice was either made on personal preferences, solution on the state of the art or just a basic interest in the particular approach. 0

Work that should be done in the current project had been elaborated along with plans on the future work which also have been briefly explained. The expectation of this research is to show some ways in which automated parking system may help improve the life style of many car owners and also save their time while needing a parking around a certain area such as mall, school, or any way around.

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