

Review on Automated Parking System using Number Plate Recognition

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Abstract—Finding a suitable parking space has been a significant concern for people, the difficulty roots from not knowing where the parking spaces are available at the given time. The traditional parking methods cannot be used today as they are ineffective at utilizing space and are time consuming. As a result, the purpose of this research is to Automate the parking system using number plate recognition. The system uses image processing of recognizing registration plates of the vehicles for operation of parking system. Overall, the systems run with programmed controller to make minimize the human interaction in parking system.

Index Terms— Parking system, Image processing, Optical character recognition, Automate.

I. INTRODUCTION

When we take into consideration the current world scenario, we see that Covid has taken over our typical lives. One of the vital elements involved in the service being offered to customers around the globe is human touch. An operation carried out by a robot is considered of lesser quality when compared to that action which involves the need of humans. But we certainly cannot assume this right in our current situation. The Covid-19 might seem to be ended but the threat is never nil.

Adding onto the above scenario, we often end up in some situations when we have struggled hard just to find a parking spot which is unoccupied in a certain parking area. It might get complex for someone new and cost them their precious time which is not ideal and needs to be dealt with.

Hence to solve these problems we've come up with an astounding idea to develop an automated parking system which is free of human touch and aids the customer to find a nearest parking spot in the available list of options. Adding on to this we also have added a feature to make this process hassle free by making the payment for the utilized period of time online through our mobile application.

II. RELATED WORK

It's ongoing research to find the most optimal and time efficient way for parking mechanisms in the malls. Many researchers have proposed various methodologies to solve this problem.

In the reference paper[7] used the Faster R-CNN method to detect the number plate using a surveillance camera. Whereas faster R-CNN used a separate network to predict the region that was proposed. The image then underwent character segmentation, image interpolation and Optical Character Recognition(OCR). This method was 99.1% accurate.

In the reference paper[1] proposed the method of recognizing the vehicle's license plate number manually at the parking lot. The methodology they used was conversion of RGB image to Grayscale image and then converting the grayscale image to binary image. Further they applied noise reduction, character segmentation and OCR.

In the reference paper[2] proposed the automation of car parking systems using an android application.

The methodology involves four modules for implementation of this system those are Interfacing of Micro-controller with LCD, GSM and RF module. And an Android Application.

In the reference paper[3] implemented a number plate identification system using image processing concepts.

This system imposed Binary image processing, Contrast extraction, median filtering. Character Segmentation extracted the character from the number plate. The resulting image was taken as input and then compared with the database using the method of OCR.

The reference paper[4] used the method of UAV vision which detected the number plate using a camera at the entrance as well as the exit.

Methodology implemented was Tesseract OCR Engine which is a type of OCR also called as Google OCR that is used for character Recognition. And to improve the OCR they used a look-up table. This method was 70% accurate, Cost and maintenance of drones and the low-quality image from the drones were a major drawback.

In the reference paper[5] proposed an intelligent parking system especially for cities. They used IOT and cloud functions to improve the parking system in the cities.

Methodology on which the parking system is designed was subjected to four stages: device and networking level, Internet of things platform level and parking application level.

(II) Ultrasonic Detector for vehicle detection

(III) Path optimization with ant colony algorithm

In reference paper[6] proposed a method to solve the problem of inefficient and disordered parking with respect to buildings. It was based on methodologies such as License plate detection, Character segmentation, Character recognition, OCR. With time the usage of methodology differed with the result of the accuracy they propose.

For the development of autonomous or intelligent parking systems, a variety of strategies are used. The study of these systems reveals that their proper operation necessitates some or all human interaction. Image processing has been considered as one of the intelligent systems for car parking. A brown circular image of the parking slot is collected and processed in this method to detect a free parking slot. The 7-segment display shows information about the currently available parking spaces. Initially, a brown-rounded image of parking spaces is captured. To make binary pictures, the image is segmented. The image's noise is eliminated, and the object boundaries are traced.

A vision-based automobile parking system is being developed that detects free parking spaces using two types of pictures (positive and negative). The object classifier recognises the needed item inside the input in this function. Pictures of vehicles from various viewpoints may be found in positive images. There are no automobiles in negative photos.

To identify the presence of automobiles in the area, the given co-ordinates of parking lots are utilised as input. For feature detection, car-like characteristics are employed. However, depending on the type of camera utilised, this technique may have limits. Furthermore, because the coordinate system picks precise parking spaces, the camera must be fixed. The method may be limited by a limited collection of positive and negative pictures.

The number plate recognition approach, which is being used to construct an automated automobile parking system, is based on image processing. The picture of the vehicle's licence number plate is captured in this method. It's then divided to get the number plate's component characters.

Free parking spaces are detected using ultrasonic sensors. The number plate photos are then captured and analysed. At the same time, the current time is recorded in order to compute parking rates. The LCD shows a 'FULL' indicator, indicating that no parking space is available. However, the method has several constraints, such as the backdrop colour being required to be black and the character colour being white. In addition, the study is limited to one-row number plates. A mechanical model with image processing capability was presented as part of the Smart Parking system concept. The automobile would be parked on numerous floors using lifts. In order to prevent unauthorised automobile entrance, image processing is also employed to record the number plate and store it in a database for comparison.

As a result, we want to offer an automobile parking system that is totally automated with minimal human interaction, and that overcomes the limits of current systems.

III. MOTIVATION

With rising urbanization and increased population density in cities, mobility solutions are in greater demand. Many individuals in industrialized economies choose private autos as a form of mobility. As the level of living rises in many regions of the world, an increasing number of people and businesses purchase new automobiles.

The difficulty of finding place to park these automobiles in cities has arisen as a result of this. The parking lot concept has grown significantly over time, from just a space where individuals may park their automobiles to areas where automated solutions are used to assure security and operating efficiency.

Malls and other commercial hubs are sprouting up all over cities, drawing a rising number of individuals who prefer to drive in. This has boosted the need for mall parking lot management systems, not only to ensure that customers have a pleasant experience, but also to avoid squandering money and resources.

Information management is also problematic with paper-based ticketing systems. The administration should be able to offer information about any car parked in their spot instantly in the event of any unpleasant situations. This is made feasible by automated electronic systems.

IV. PROBLEM DOMAIN

We aim to implement our system at the parking lot using two cameras capturing the registration plates of the vehicles and a terminal to process the captured image. Once the number plate is captured successfully, and registration number has been identified, it will be sent to the server.

The server contains a database of registered users along with their phone number, name, amount in wallet and other personal details. When the server receives the registration number of a vehicle, it will check for it in the database. If it is not present in the database, then the user is asked to register. If the number is registered, a nearest empty slot will be found for the vehicle.

System aims mainly to reduce the distance that a user has to take the vehicle to park. Hence a nearest empty slot will be assigned to the user. The nearest empty slot will be sent to the user's mobile. The vehicle number along with the slot assigned and time of entry is recorded.

The same number plate recognition happens when a vehicle is exiting the parking lot. The time of entry and exit will be used to calculate the parking fare. The fare amount will be automatically deducted if the user has sufficient amount in the wallet, else the user will be asked to add enough money to the wallet. Then the gate will be opened for user to exit the parking system.

V. PROBLEM DEFINITION

The traditional parking systems such as multilevel or multi-store car parking systems (non-automated), robot car parking systems, automated multilevel car parking systems etc. have been implemented on a huge scale. But these systems have a major disadvantage of large space consumption which is successfully eliminated with the use of "Automatic car parking system". In an automated car parking, the cars are left at the entrance and are further transported inside the building with mechanical structure. Similarly, they are retrieved by mechanical structure and placed at the exit for the owner to drive away. Our proposed system presents an Autonomous car parking that regulates the number of cars that can be parked in a given space at any given time based on the parking space availability. When a car arrives at the entrance, it will be stopped at the main gate and the driver de-boards the car.

If the availability of Parking space is confirmed, the user commands the car to get parked to the designated slot. The car traces its path to the entrance of the parking area. Here, it waits and the details required for parking of car at the proper slot are communicated to the Car Control Unit. On receiving the information, the car will further trace its path To free parking spot. On successful parking, the data on the LCD will be updated automatically.

VI. STATEMENT

Automatic parking system is where you can park your car with no hustle. Due to automation we save time and there is no risk of contamination.

VII. PROBLEM FORMULATION

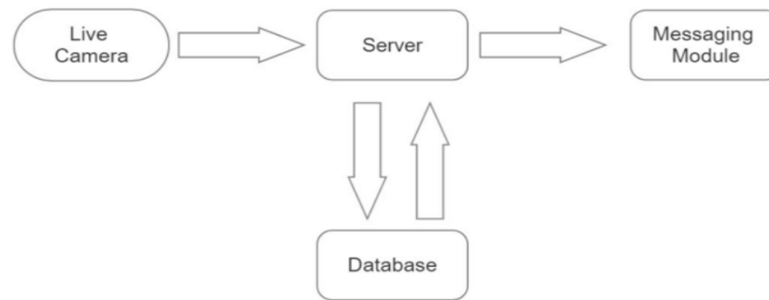


Figure 1. System Flow

A camera near the society gates that can record images of automobiles together with their licence plates and send them to the server runs an algorithm to extract only the licence plates from the obtained picture. The number plates are retrieved using the clever Edge detectors, which will only identify the automobile number plates in the image and delete all other unneeded elements.

VIII. PROBLEM SOLVING

A. Module 1

Initially, the picture is converted to a B/W format since it's easier for the Canny Edge detector to work in that particular format, after which the image is resized to fit the right size suitable for detection. A bilateral filter is applied in the later stages, to reduce the noise obtained from the original image. Then finally the actual edge detector is applied to crop out the other things from the image retaining only the number plate.

Tesseract OCR an optical character recognition engine (OCR Engine) can detect text on car registration plates automatically. Py-tesseract is a python-based optical character recognition (OCR) tool. It will detect and "read" text contained in photos, in other words. Tesseract-OCR Engine from Google is wrapped in Python-tesseract. Because it can read all image kinds such as jpeg, png, gif, bmp, tiff, and others, it may also be used as a standalone script. Python-tesseract will also output the recognised text rather than saving it to a file if used as a script. It can identify over 100 different languages.

OpenCV is a computer vision library that is free to use. There are about 2500 optimised algorithms in the collection. These algorithms are frequently used to find and recognise people, identify items, recognise landscape, and produce markers for augmented reality overlays, among other things.

B. Module 2:

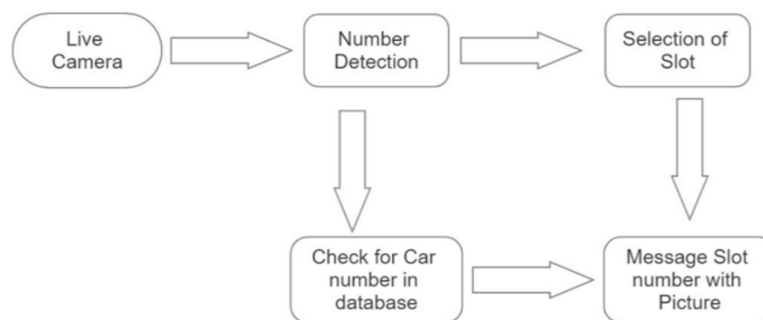


Figure 2. Entry Flow

Once the numbers from the number plate are obtained, that number is checked from the database to obtain the owner's info, once we get that information a basic linear algorithm is run to assign the nearest slot for the car, and the slot details along the map route is sent to the owner's message, which can be followed along to reach the allotted slot.

C.Module 3:

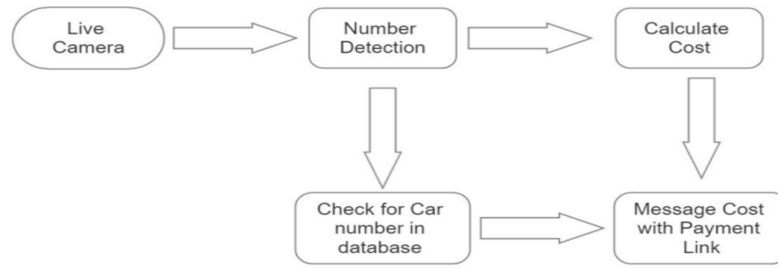


Figure 3. Exit Flow

IX. DATA MODEL

TABLE I. USER TABLE

Attribute	Data Type	Description
UserID	INT	Unique key given to the user
Ph No	INT	User's phone number used to send the message
Car No	STRING	Number detected by the algorithm using the number plate
Name	STRING	Name of the user

TABLE II. PARKING TABLE

Attribute	Data Type	Description
Parking ID	INT	Unique ID given to each parking operation
UserID	INT	Unique key given to the user
Entry time	DATE TIME	Entry time of the user into parking area
Slot ID	INT	Slot number assigned
Exit time	DATE TIME	Exit time out of the parking area
Fee	INT	Total amount payable

TABLE III. SLOT TABLE

Attribute	Data Type	Description
Slot	INT	Slot number assigned
IsFilled	BOOLEAN	Checks whether the slot is filled or not
Distance	INT	Distance from the entry

X. JUSTIFICATION OF THE RESULTS

Proposed system ensures minimal contact with humans. Which is key in present world scenario. Provision of way point to the assigned parking slot proves to eliminate the hustle every customer undergoes when he/she enters a parking area.

Payment through UPI where the user is sent a link which is redirected to a portal where the total amount is displayed for the time elapsed. This can be redirected to desired app which supports UPI payments. Both the links with way point and payment portal is sent through SMS to the user on his/her phone.

XI. CONCLUSION

While developing a life-size model, the model was analyzed. The model has been created, and the programme has been successfully implemented. It depicts how the planned automated smart parking system operates. Space optimization, cost effectiveness, and execution are the primary advantages. of incommunicado.

XII. FUTURE WORK

This system may be improved in the future by adding other applications, such as online booking through GSM. The motorist or user can reserve a parking spot at home or while driving to the mall. This might save the user time when looking for an empty parking spot. Different elements can be included as a follow-up research to

increase this system's ability to recognize the item and assist the driver or users as quickly as possible. This may be done with low-cost maintenance and development in mind.

REFERENCES

- [1] [1] Worawut Yimyam and Mahasak Ketcham."The Automated Parking FeeCalculation Using License Plate Recognition System":converting RGBImage to Grayscale Image, Grayscale Image to Binary Image.2017;978-1-5090-5210-3/17.
- [2] [2] D.J. Bonde,Ketan Suresh Gaikwad,Rohit Sunil Shende,Akshay Sambhaji Kedari and Amol Uday Bhokre"Automated car parking system commandedBy Android application":Interfacing of microcontroller by LCD,GSM,RFModel and Android Application.2014;978-1-4799-2352-6/14.
- [3] [3] Abhishek Kashyap,B. Suresh,Anukul Patil,Saksham Sharma and Ankit Jaiswal. "Automatic Number Plate Recognition":This system uses binary Image processing,Contrast extension and median filtering.2018;978-1-5386-4119-4/18.
- [4] [4] Jun Ryeol Park, Nasir Rahim, Seung Ju Lee, Amin Ullah, Mi Young Lee and Sung Wook Baik."License Plate Recognition for Parking ManagementSystem using UAV Vision":Tesseract OCR Engine for character recognitionAnd Look-up table to improve OCR.2018;Vol.150 (AST 2018), pp.66-70.
- [5] [5] Ming Wang, Huifang Dong, Xu Li, Liangliang Song, Dandan Pang."A Novel Parking System Designed for Smart Cities":Ultrasonic Detectorfor vehicle detections and Path optimization with ant colony algorithms.2017;978-1-5386-3524-7/17.
- [6] [6] Abdul Quadir,C.R Dhruv, Arun Kumar Sivraman, Rajiv Vincent."Automatic Number Plate Recognition System for Parking":License plate detection , Character segmentation , Character recognition, OCR.
- [7] [7] N.Palamivel Ap, T Vigneshwaran, M.Srivarappadhan and R.Madanraj."Automatic Number Plate Detection in Vehicles using Faster R-CNN":Used the Faster R-CNN method to detect the number plate using a surveillance camera.2020;978-1-7281-6202-7.