Automated License Plate Recognition and Parking System

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Abstract

Automatic License Plate recognition is one of the ways to identify vehicles using their number plate and it'll give all details about a particular vehicle. This process generally comprises three-way. The First step is the vehicle plate recognition, despite the size, angle of the number plate or exposure of the image. The next step is the segmentation of the characters and the last step is the recognition of the characters from the vehicle plate. This process comprises of ways like Image processing, Defragmentation, Resizing, and Character localization. Therefore, this design uncovers the basic idea of different algorithms needed for character recognition from the vehicle plate using OCR. This algorithm mentioned above helped in achieving character recognition of the license plate faster. A parking System is introduced, which contains the database of users along with their vehicle information. Also, the parking slot is allocated by comparing the characters from the vehicle plate and the registered vehicle number. An SMS will be sent with the allocated slot information when a registered vehicle enters.

Keywords - Vehicle Plate Detection, Defragmentation, Character Localization, OCR, Slot Allocation.

I. INTRODUCTION

Number Plate recognition plays a significant role in different situations such as road traffic monitoring, automatic toll plaza payment, parking lot access control, and discovery of stolen vehicles. Identifying a vehicle number plate is effective because of its uniqueness. Real-time number plate recognition plays an important part in the automatic monitoring of road traffic rules. Each vehicle has its identification number, using this slot is allocated in the parking area. The camera is used to capture the image automatically and can be used to allocate parking slots to the vehicle.

This is based on different operations like morphological transformation, image enhancement, edge detection and extraction of number plate from the vehicle image. After this, the recognition of characters from the number plate using template matching is done. This algorithm can recognize number plate accurately from the vehicle picture and can used further.

A. Background of the project:
For the standard number plates the automatic number plate recognition becomes very easy to read and recognizes the character. In India the vehicle number plates has no standard size and font so it become very difficult to read and recognize the characters of the number plate. So we are using machine learning algorithm to solve this problem. And the same is used to allocate parking slot to already registered and unknown vehicles.

B. Statement of Problem:
Number Plate recognition plays an important role in various applications such as traffic monitoring, parking lots access control, detection of stolen vehicles. To identify a vehicle number plate is effective because of its uniqueness of the vehicle. Each vehicle has its identification number, this method of recognition of vehicle number plate is used to allocate slot in the parking area.

C. Aim and Objectives of the project:

Compared to previous character recognition algorithms our algorithm has more efficiency in recognizing the characters from the number plate of a vehicle. Previous approaches includes hardware specifications to recognize the character from number plates. Also, we have include a parking slot allocation system.The objective of this work is recognize the number plate and allocate slot to them digitally therefor provide a effective parking system. This is based on different operations like morphological transformation, image enhancement, edge detection and extraction of number plate from the vehicle image. After this, the recognition of characters from the number plate using template matching is done.

The main objectives of the project are:

- The dataset enhances the system to recognize character from different angle and lighting conditions.

- A database is used to classify the entering vehicle whether it is registered or non-registered vehicle.

- To allocate parking slot in a effective way.

II. RELATED WORKS

This section presents previous work related to our proposed architecture. Many great contributors had placed a significant sign in the field of Machine Learning in Automatic License Plate Recognition.

Identification of cars and their owners is a tedious and error prone job. Automatic number plate detection can provide solutions for parking and traffic control. It is designed using image processing and machine learning. A new system improves detection in less light and bad exposure conditions. The image of the vehicle is used and preprocessed using grayscale conversion, and binarization. The resultant image is then processed using plate localization, for extracting the license plate using CCA (Connected Component Analysis) and ratio analysis. The words of the vehicle plate are segmented using CCA and ratio analysis. Finally, the recognized characters are compared using techniques like SVC KNN, and Extra Tree Classifier. The technique helps to detect well under low light, over-exposed images, and those in which the vehicle is angled. [1]

Number plate recognition technology has been used in parking lot management that have fixed number plate angle and lighting environments. The license plate recognition used in road traffic monitor will encounter difficulties in character recognition due to shooting angle, vehicle speed and environment light and shadow. The supervised K-means helps to classify characters into subgroups. This approach improve the accuracy of character recognition by reducing the classes of characters in each subgroup to further reduce the number of SVMs and their complexity. Results show our hierarchical architecture has an accuracy of 98.89% in character recognition. We get a 3.6% improvement in recognition rate when compared with the number plate recognition technology using SVM, . [2]

III. PROPOSED SYSTEM

The proposed system observes every character from the range plate one by one using morphological operation. It owns a way to section all the characters in the quantity plate. The detected range plate is pre-processed to reduce the noise then the result is passed to segment the character one by one from the extracted plate. Ultimately the optical character info is going to be regenerated into encoded text. The characters recognized exploitation template matching. The end result should be included within the type of string.
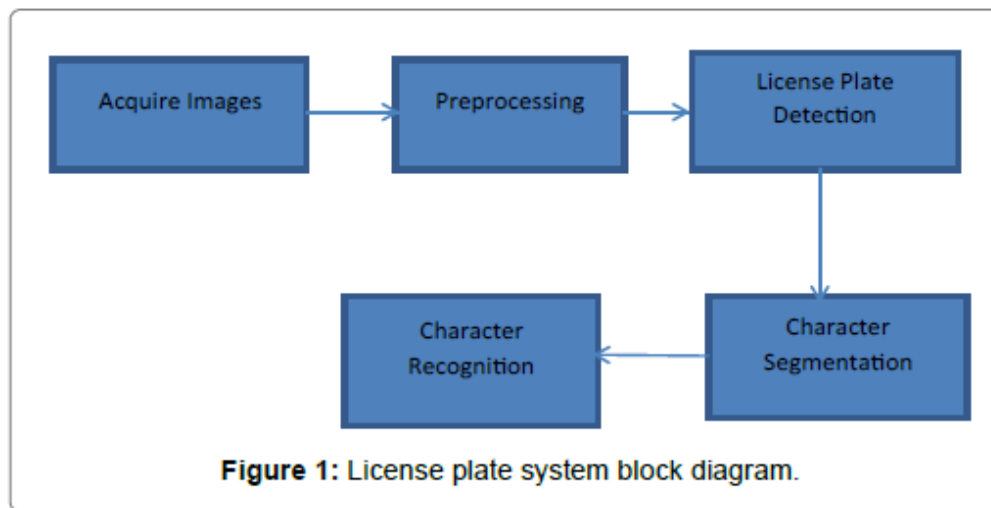
Figure 1: License plate system block diagram.

Fig. 1:
Architect
ure
Diagram

IV. METHODOLOGY

i. Module Description

1) User Register

Going through New User Registration, the user needs to provide their name, phone number, e-mail, Type of vehicle, and vehicle details to register. New User Registration assigns the newly created profile with generic security that is required to access your system. Also if the user wants to update their incorrect information or change of vehicle can also be done here.

2) Number Plate Image Pre-process

a) Gaussian filter

A Gaussian filter is a linear filter. It's usually used to blur the image or to reduce noise. The Gaussian filter alone will blur edges and reduce contrast. The Median filter is a non-linear filter that is commonly used to reduce noise in an image.

b) Edge Detection

Each image has three individual features to achieve detection goals. These features include edges, contours, and points. Among mentioned features, the best option is to use edge pixels. Processing the image pixels enables us to find edges, which is the main feature of passing vehicles in a road video frame. The edge detection process is demonstrated in a binary image (threshold) with the detected edge pixels. The following step is to extract edges from video frames and process the resulting edge to obtain numerous geometric measurements of moving vehicles.

c) Contour

A contour map uses color-coded regions to visualize 3D data in two dimensions. Contour maps are also used to visualize the error surfaces in deep learning/machine learning optimization techniques.

d) Masking

The idea of masking is to have two additional arrays that record whether an input or output is actually present in the image and or whether the input/output is just padding.

e) Training

The training dataset in Machine Learning is the actual dataset used to train the model for performing various actions. This is the actual data the ongoing development process models learn with various APIs and algorithms to train the machine to work automatically.

f) Testing

The patterns that are identified by your machine learning algorithms are used for prediction. The machine recognizes patterns in the data and, the cross-validation data is used to ensure better efficiency and accuracy of the algorithm that is used to train the machine, and the test data is used to see how well the machine can predict based on its training.

3) Character Recognition

In this module, the admin downloads the data from the cloud and converts the text file to excel for the data analysis process. Then data filtering process is carried out to collect the null values.

4) Parking allotment

Based on the comparison with the database the allotment of slots for already registered vehicles or unknown vehicles is carried on. The time period and the details of the vehicle parked are obtained and displayed when the vehicle exits.

ii. Character Segmentation

The character segmentation further segments the character individually from the number plate. The first process is to crop out the number plate characters from starting to the ending point leaving all the extra wide spaces from top to below and from right to left as it is from the input image. Characters are then fitted exactly in the plate region. For easy comparison of the input character with the character in the data base the result is normalized as the size of the images in the database.
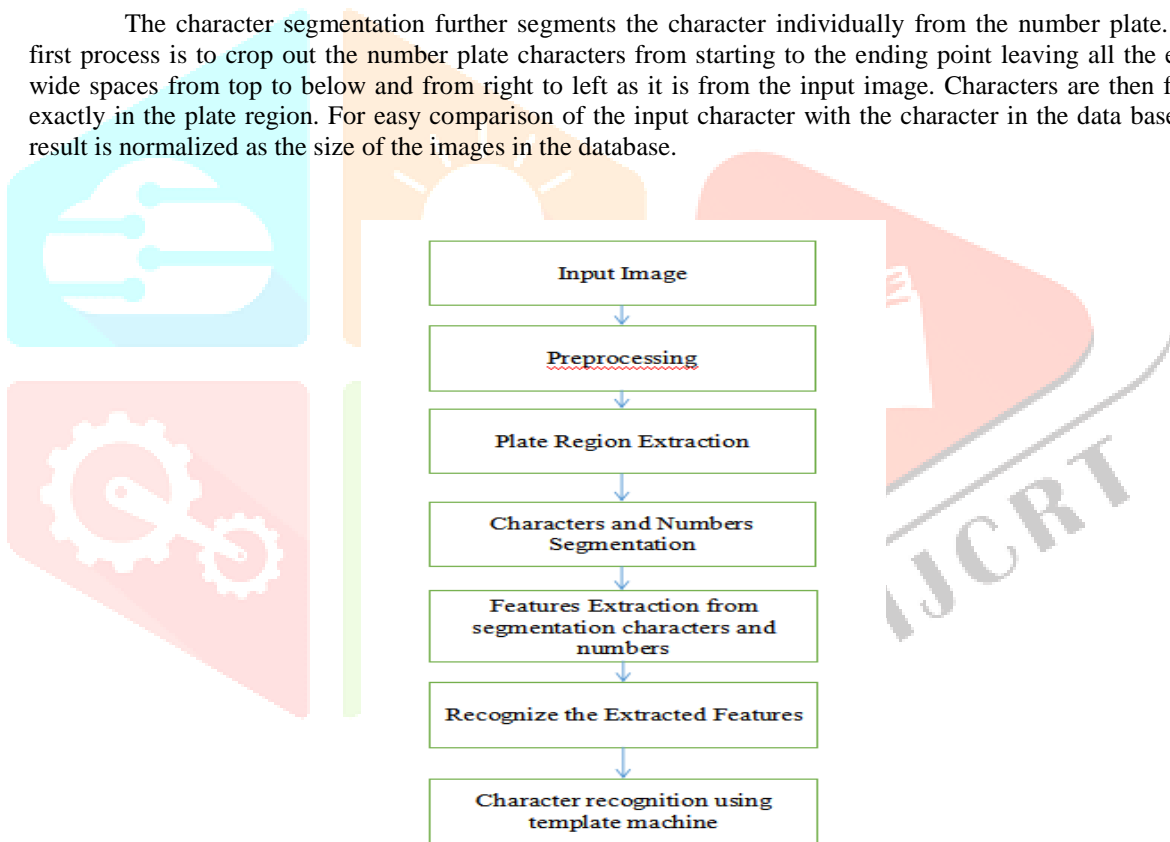
Input Image

↓

Preprocessing

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Plate Region Extraction

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Characters and Numbers Segmentation

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Features Extraction from segmentation characters and numbers

↓

Recognize the Extracted Features

↓

Character recognition using template machine

Fig. 2: Data Flow Diagram

iii. Optical Character Recognition

The Optical Character Recognition is a method in which the input is an image and the output is a string. OCR is a process that separates the characters taken from an image. Template matching is one of the methods in OCR. The cropped image is then compared with the template stored in database. OCR automatically identifies and recognizes the characters without any input. If the characters on the plate have the same font then the OCR for number recognition is less complex.

iv. Data Pre-Processing

The entries are present in the dataset. The null values are removed using df = df.dropna() where df is the data frame. The categorical attributes (Date,High,Low,Close,Adj value) are converted into numeric using Label Encoder. The date attribute is split into new attributes like total which can be used as feature for the model.

a) Data Cleaning:

The data can have irrelevant and missing parts. To handle, data cleaning is done. It involves handling of missing data, noisy data, etc.

b) Data Transformation:

This step is done in order to transform the data into a form that is suitable for the mining process.

c) Data Reduction:

Data mining is a technique used to handle large amounts of data. While working with a large volume of data, analysis became difficult in some cases. In order to overcome this, we use the data reduction method. It aims to enlarge storage efficiency and decrease data storage and analysis costs.

V. RESULT AND DISCUSSION

In this experiment, results of our implemented system as well as the relevant details can be divided into 6 consecutive parts which work together:

i. User Page.
ii. Registration Page.
iii. Add Vehicle Page.
iv. Slot Allocation for Registered vehicle.
v. Slot Allocation for unknown vehicle.
vi. Time Calculation.
vii. Database for registered users

I. *User Page*

The admin uploads the vehicle picture here from which the character recognition takes place, and also register a new user or add a new vehicle to the user.
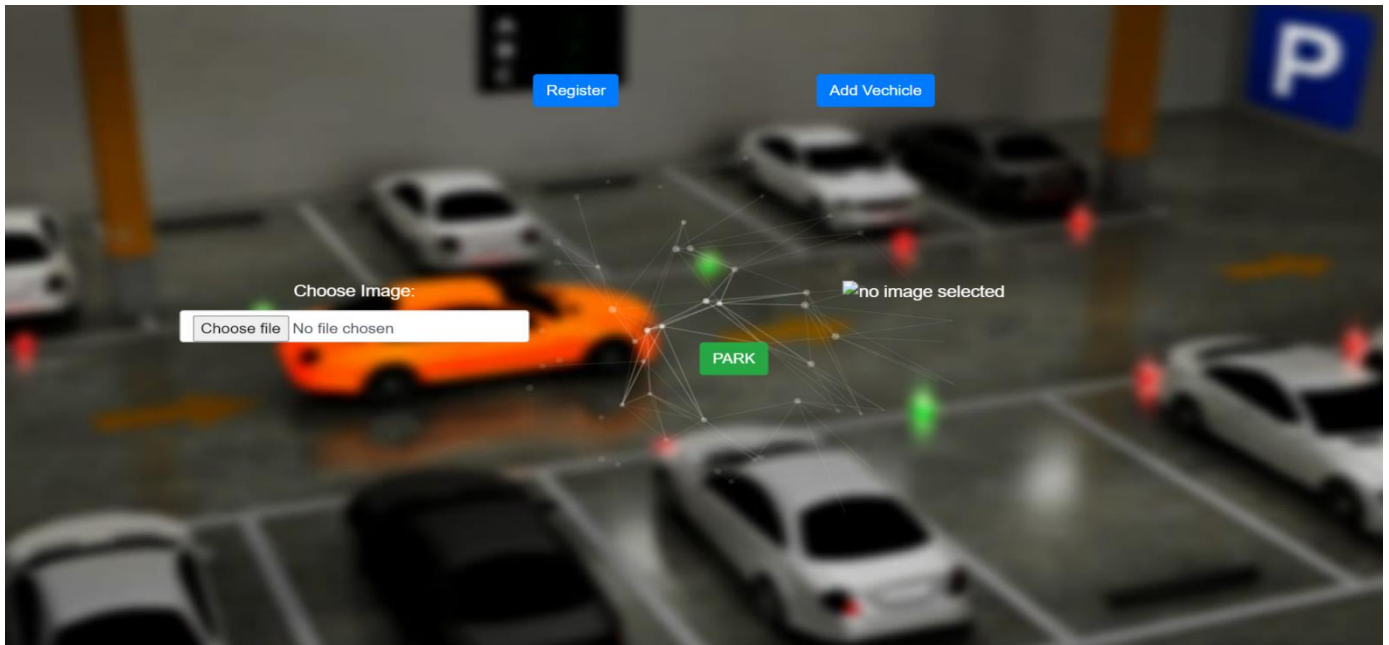

Fig. 3: User Page

II. *Registration Page*

This registration page is used to register new vehicle owners by providing their name,phone number and email id.
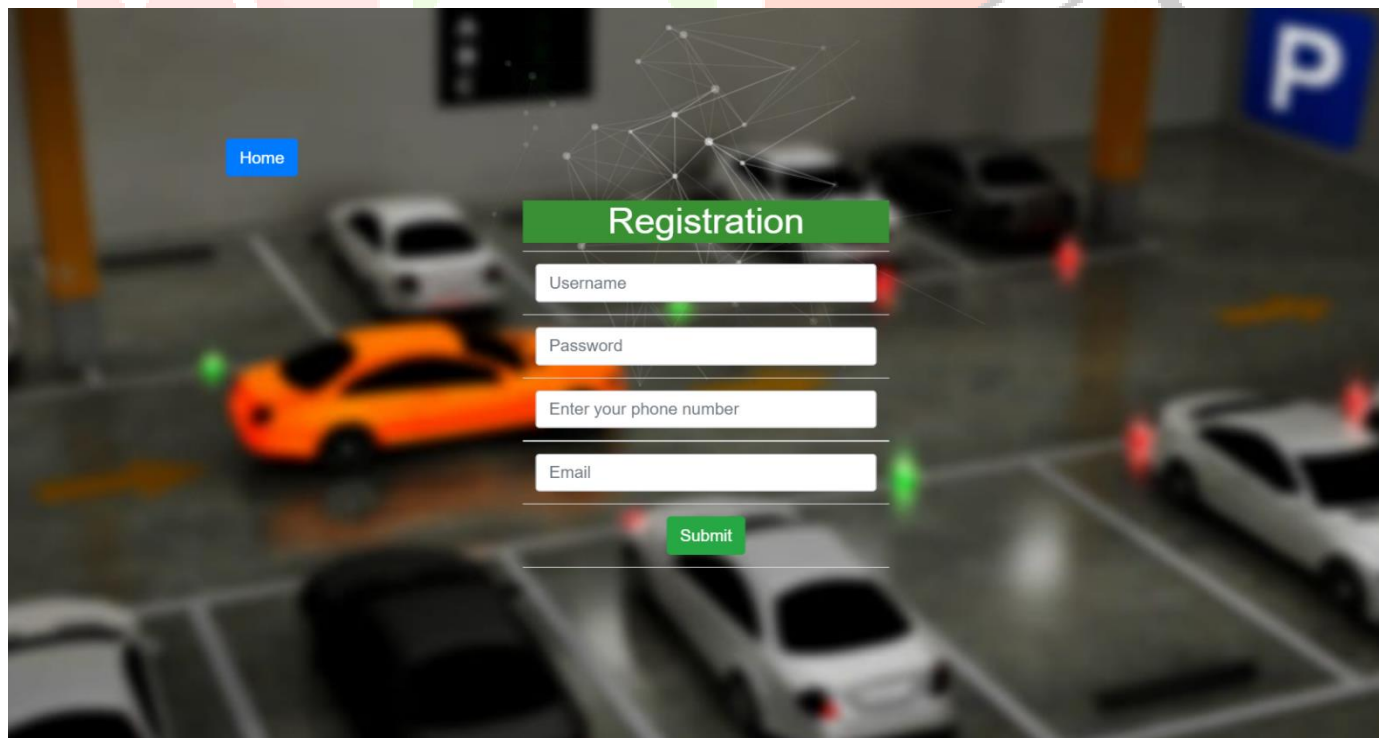

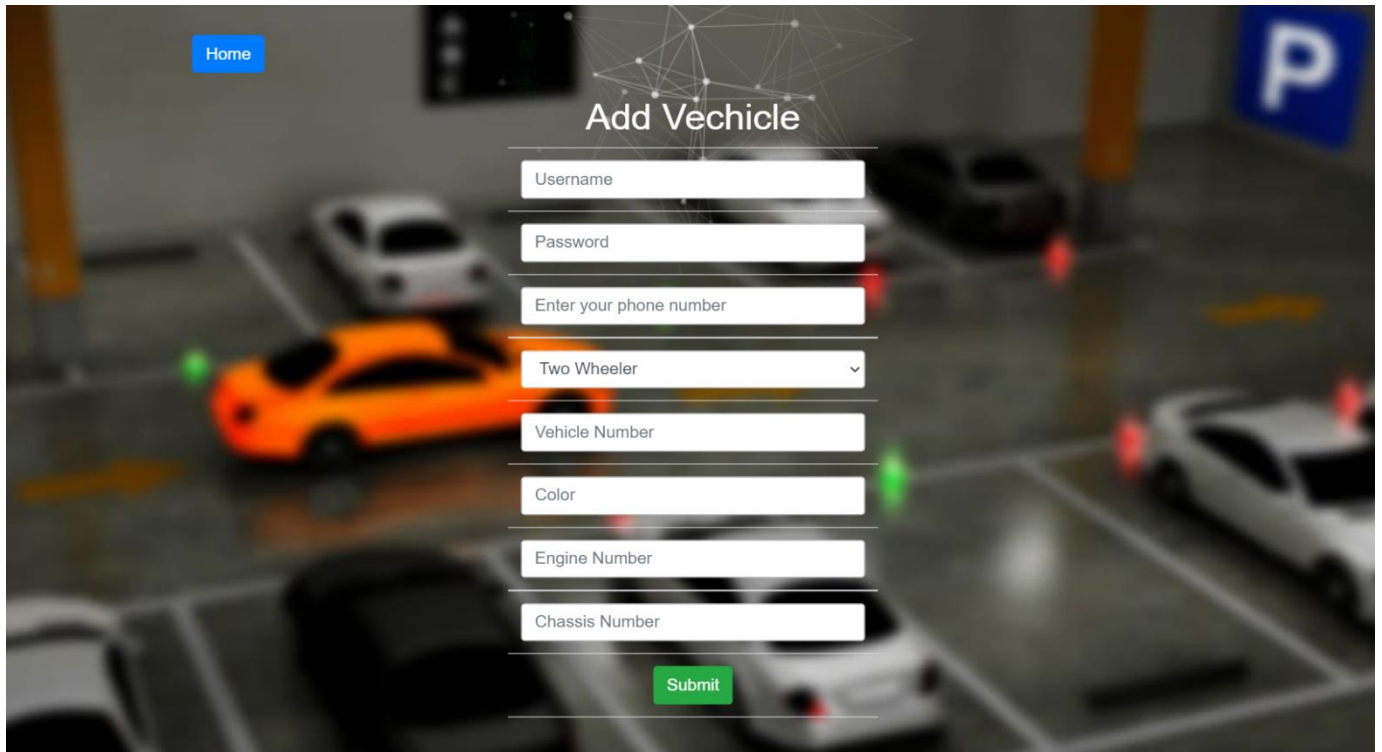Fig. 4: Registration Page

III. *Add Vehicle Page*

Fig. 5: Add Vehicle Page
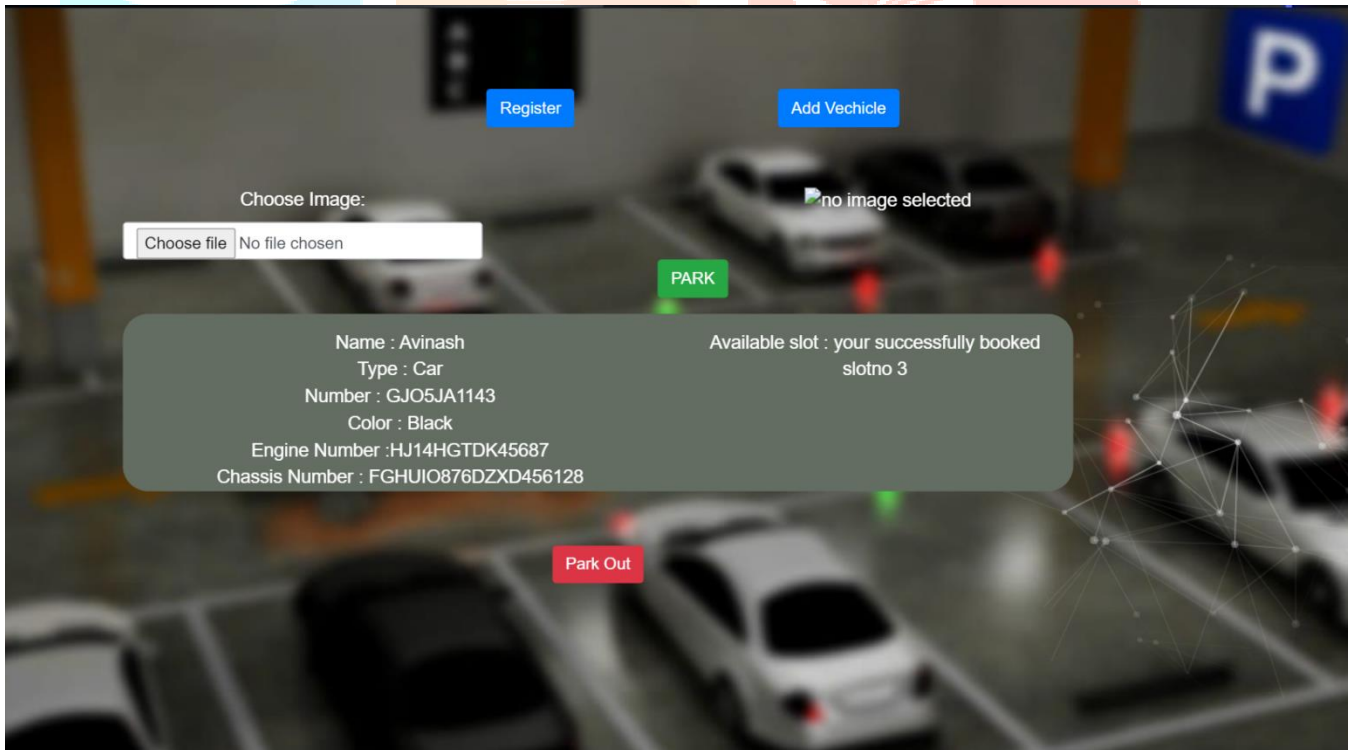
IV.   Slot Allocation for Registered vehicle

Fig. 6: Slot Allocation for Registered vehicle
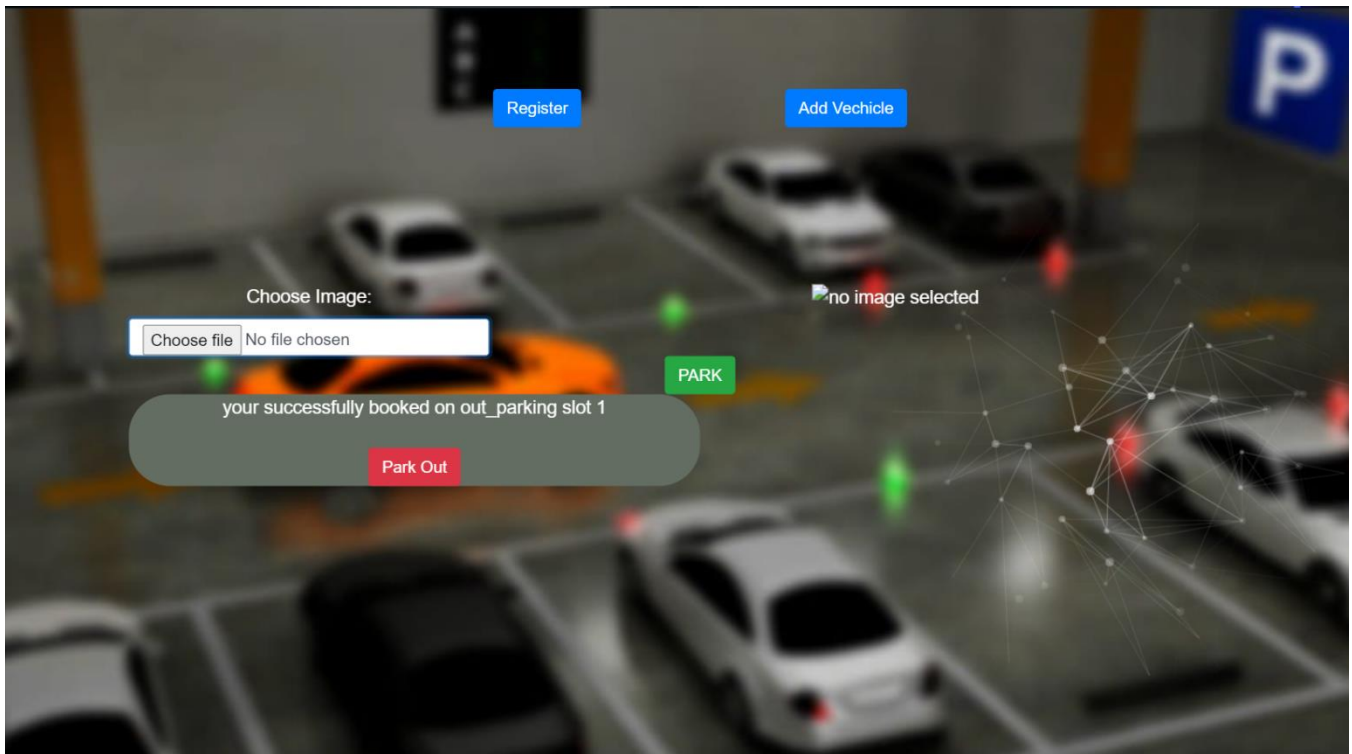
V. Slot Allocation for unknown vehicle

Fig. 7: Slot Allocation for unknown vehicle
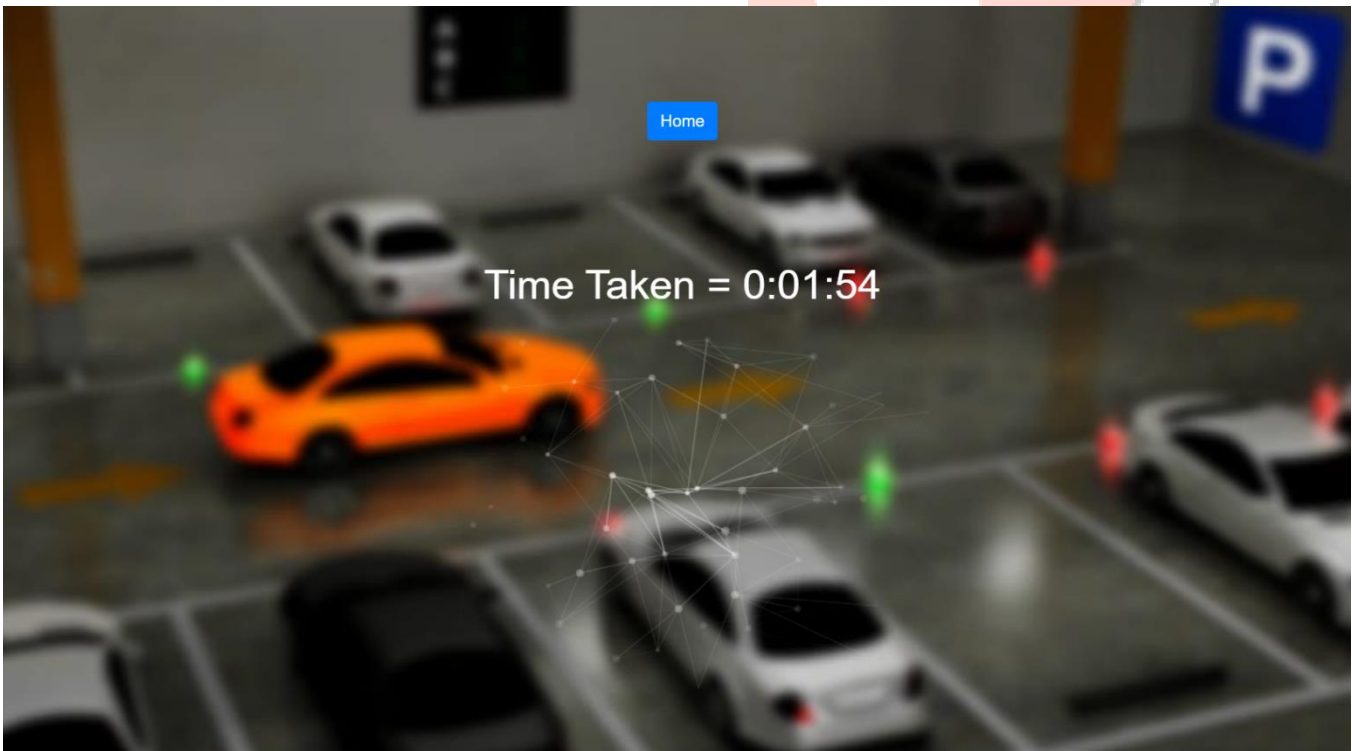
VI.   Time Calculation

Fig. 8: Time Calculation

VI.   FUTURE ENHANCEMENT

Future work lies in producing more accurate results with lesser response time according to the prescribed specifications of vehicle number plates and automated system software is to be developed in future work.

VII.   CONCLUSION

In this work, we have presented technique to recognize number plate of vehicles. For this, we introduced Image capture, preprocessing, edge detection, segmentation, character re-sizing, feature extraction and finally recognized character of number plate using machine learning algorithms and allocation of parking slot using the extracted characters. Datasets consists of images of vehicles that are captured real time from parking.

VIII.   REFERENCES

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