Intelligent Parking System

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ABSTRACT--- As a key part of Automated vehicle technology Intelligent Parking System has become a popular research topic. Intelligent Parking System can grant permission to access the parking area with less human inference. This system can capture image of the vehicle, identify the type of vehicle and allot best fit and optimal parking slot based on its size. It extracts the vehicle's License plate number, entry time, exit time and calculate total time of the vehicle present with in the parking space. Here, sensors are utilized to identify the presence of the vehicle during entry and exit. Two cameras are utilized to extract features. One camera is used to identify the Region of Interest, Vehicle license plate and identify the characters from the license plate. Tesseract Engine and Optical Character Recognition (OCR) functions are used to detect characters from the image. Another camera is utilized to extract features like dimensions of the vehicle using machine learning operations such as Convolutional Neural Network (CNN). Based on the size of the vehicle, best fit parking slot is allotted which gives optimal usage of parking area. These days the quantity of vehicles is expanding exceptionally, so that, searching for an empty parking slot turns out to be increasingly troublesome. By installing the Intelligent Parking System, in places like, shopping malls, train stations, and airports the need for searching of parking slot significantly reduces. A past study has demonstrated that traffic because of vehicle's parking slot searching in downtowns of significant urban communities can represent half of the absolute traffic. With such a hefty traffic jam and time delay in parking slot identifying, Intelligent Parking System will be in great demand.

Keywords — License Plate Recognition, Vehicle type Classification, Optimal Parking slot Allotment.

I. INTRODUCTION

As a key part of computerized vehicle recognition technology, Intelligent Parking Assistant System has turned into a well-known research point. These days the quantity of vehicles is expanding exceptionally, so that searching for an empty parking slot turns out to be increasingly troublesome, particularly in some places. For example, shopping malls, train stations, and airports. In such vast territories, a few areas of the parking might be intensely utilized while others may have numerous empty spaces. Past study has demonstrated that traffic jam because of vehicle's parking slot searching in downtowns of significant urban communities can represent half of the absolute traffic. With such a hefty traffic and time delay in vehicle's parking search, Intelligent Parking Assistant System turned into a need.

Normally, as per the vehicle measure, vehicle types can be partitioned into three classifications: SUV, Sedan, Mini. Identifying and differentiating the vehicle has turned into a critical part of machine learning in view of its potential applications. Diverse conditions, for example, obstructions, difference in lighting, exceptional camera settings, shadows, parallax errors and turns, make car group differentiation until now a testing thing, particularly for actual time operations.

Vigorous Car type differentiation technique depends on multi-class Principal Feature Analysis with self-grouping. Car front part is separated by inspecting car frontal area span and also the region of the license number plate. Yu-Chen Wang [1], in 2014 proposed Vehicle Type Classification from Surveillance Videos on Urban Roads, in which vehicle type is identified from traffic surveillance videos by extracting features like colour, shape and texture from Histogram of Gradient. Image is converted to small blocks, Individual histogram is applied and concatenated to obtain HOG Descriptor. Yu Peng [2], in 2012 proposed Vehicle Type Classification using PCA with Self-Clustering in which vehicle type can be classified in to two categories like small and large cars based on Self-Clustering. Vehicle features are extracted such as length, width.

Visual related car group differentiation regularly divided into two classes: strategies utilizing car's side region view and strategies utilizing car's frontal area (or rear) view. For the side region view ones, edge-based and model-based methodologies are generally utilized. Methodologies dependent on edge can incorporate parameterized edge model to depict the topological framework of car, and afterwards fed system into a multi-layer perceptron networks-based classifier. Despite the fact that classification rate is satisfactory with high resolution pictures, but this method is bounded for performing on low quality images.

There are numerous methodologies of recognition utilized in contemporary Vehicle Number plate Identification frameworks [9,10]. The vast majority comprises of three fundamental stages: Car License number plate identification, character separation and Optical Character Recognition (OCR). All of these stages must possess superior performance rates so as to build reliable and accurate structure. B. Pechiammal [3] in 2017 proposed An Efficient Approach for Automatic License Plate Recognition System where, vehicle plate is extracted by Gabor Filtering. RGB image is converted to Grey-scale image, Gabor filter is applied to remove noise. Character segmentation and OCR were used to extract Vehicle License Plate. Wang Naiguo [4], in 2017 proposed License Plate Segmentation & Recognition of Chinese Vehicle Based on BPNN where, vehicle plate character recognition is done by Neural Network. If wrong recognition of a character then it is added

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to the library of machine learning for better training [11]. It is called Back Propagation Neural Network (BPNN). In this work, the Car license number plate detection algorithm which is associated with the separation part. Character separation can give important data about the profile of car license number plate characters. This is accomplished by making connected feature component analysis (CCA) and Optical Character Recognition (OCR) on the pictures. The profile is used to locate, identify and extract each character in the plate.

For some drivers, particularly the learners, finding and exploring a vehicle into a suitable parking space is a tough task. The primary reason is that the driver can't see around the vehicle or decide the size and state of the parking spot. This has been driving many research foundations and vehicle makers to give incredible work on the improvement of self-parking technology. In reality, a self-parking technology IPS can be viewed as an extraordinary kind as it gives best fit and optimal parking area to the vehicle based on its size to unmanned aerial vehicles. Dharmini kanteti [5], in 2014 proposed Intelligent Smart Parking Algorithm in which they use sensors to find the empty parking slots. They use Bluetooth module for data transmission and range finding sensors to find the vacant parking slots. Junzhao Liu [6], in 2013 proposed A Multi-Classifier Image Based Vacant Parking Detection System in which they implement and examine an Image based system for recognition of empty parking slots. Directly after edge recognition, consolidate edge density, closed contour density and foreground & background pixel ratio to know the presence of the vehicle.

As the novelty of this paper, is to put together all these concepts and allot best fit and optimal parking area of the vehicle based on its size captured from the image. In this paper the overall system work process is divided into four major segments. Section 2 gives an overview of vehicle license plate localization and character recognition. Section 3 describes about vehicle type identification and clear-cut idea of how it works. Under Section 4, a novel method for allotting best fit and optimal parking slot is presented. Section 5 Exhibits our analytical result. At last, this paper is done in section 6 with conclusions and future extension, followed by references.

II. CAR'S LICENSE NUMBER PLATE DETECTION & TEXT IDENTIFICATION

In this section localizing license number plate is the initial thing utilized to extricate areas where license number plates are present. Vertical edge characteristics are moreover considered as suitable for number plate identification. These strategies estimate vertical edges of car's license plate and look for most dense regions in the picture. Colour edge identifier is utilized, as the Car's License Number Plate can also include distinct colours. That are the reason pixels with such different colours can be anticipated in two different ways and the locales with high density are taken as Number plate characters. After License plate characters are discovered they ought to be examined by some identification strategy. Heuristic examining and priority selection methodology is utilized for the license number plate character recognition. This methodology incorporates a few unique heuristics: the altitude of the band, quantity of peak in vertical projection, an estimation of region under the chart close to peaks, the angle proportion or aspect ratio of the License number plate. After these heuristics are assessed, they are joined together figuring their weighted entirely.

In In this system raspberry pi is utilized as main processing unit. Two range finding sensors are used to know the presence of the car. When a car is present at the entry section webcam turns towards the entry side and captures the image of license plate. Convert the image to text format, and display the license plate of the vehicle on the LCD Module. If it matches driver need not to press any push button. If it doesn't match the driver need to press the pushbutton. So that again the camera captures the image of the vehicle's license plate and stores the car's license plate and corresponding entry time of the vehicle. It gives access to the vehicle to enter the parking area by lifting the boom-barrier. When a car is present at the exit section webcam turns towards the exit side and captures the image of license plate. Convert image to text format, compares the license plate with existing license plate of the vehicles. If it matches with the existing data it gives total time and billing amount of the vehicle.

Fig. SEQ "Figure" * MERGEFORMAT 1.Vehicle License Plate Number identified from an image using Tesseract functions and Optical Character Recognition.

Fig. 2. Work flow of accessing vehicle to the parking area and displaying total time of car present with in the parking area.

A. Image Acquisition

This stage coordinates getting a picture by an acquisition method. In our proposed framework, a high or low assurance automated camera is used and adequate light source to verify the data picture.

B. Number Plate Extraction

This stage expels the area of interest, that is, the license plate, from the captured picture. The proposed methodology incorporates "Covering of a region with high or low probability of license plate and a short time later analyzing the whole hidden region of license plate.

C. Number Plate Character Segmentation

License Plate Segmentation, once a while insinuated as Character Isolation takes the region of interest and tries to identify it into explicit characters. The proposed system is done in the OCR portion.

D. Optical Character Recognition

There are various methodologies used to see limited characters. In the proposed structure Optical Character Recognition is utilized.

III. VEHICLE TYPE DETECTION

Type	Size Range
SUV	>610
Sedan	540> && <610
Mini	<540

Table 1. Vehicle Classification

Normally, as per the vehicle measure, vehicle types can be partitioned into three classifications: SUV, Sedan, Mini. Vehicle pictures caught under both good lightening conditions and bad lightening conditions independently is considered. Vehicle frontal area part is separated by inspecting car frontal area span and the region of the license number plate. Additionally, open database including adequate pictures are utilized to develop own database that is, including pictures of vehicle front view. Actual procedure of vehicle type characterization includes frontal area segmentation, vehicle recognition, characteristics extraction and differentiation, which make it also slow for accomplishing real time operations. Vision based vehicle type characterization is of two types: techniques utilizing vehicle's side region view and techniques utilizing vehicle's frontal area (or back) view. For the side region view thing, edge-based and model-based strategies are generally utilized. Edge-based methodologies incorporate parameterized edge. Model-based methodologies that use additional prior shape information.

For Vehicle feature extraction Initially, A settled region of interests in a specific video arrangement is set. Setting ROI has a few points of interest, for example, constraining the vehicle pictures to an appropriate size range. Additionally, by setting appropriate areas, the required zone will be diminished and the principle features of vehicles can be ensured. At that point, a pretrained Convolutional Neural Network which can yield precise vehicle features has been executed to identify vehicles in the chosen area. The vehicle pictures will be acquired from a video. The recognition procedure is connected to the front piece of the video, a vehicle informational collection for the specific video scene would be produced so as to finish the vehicle identification steps.

Fig. 3. Model is plotted against adequate and random dataset

Initially, the system with adequate dataset is trained. The dataset consists of 1000 high resolution images of each set of vehicles. Then training the system with an approximate epoch value of 100 for better, accurate and rigid system. Principal Feature Analysis (PFA) is utilized to detect the vehicle. Whenever the system with some set of images is trained it performs some mathematical operations on the image, it also identifies the common thing in all the images of the dataset, plot the graph of the images with the key features and set a range of values to every key feature of the image. It also generates a model with set of scores of the input image at each pixel value which includes the key features.

In Neural Network an image is received and transform when it pass through series of hidden layers. Each hidden layer is made up of set of neurons. Each neuron is fully connected with other neurons in previous layer. When an input is given it holds raw pixel value. Then it is sent through convolutional layer where it performs dot product between their weights followed by Pooling operation where downsizing the spatial dimensions of the image. It gives the final class score of the image.

While performing deep learning of the image, it has two data sets- Training data and Validating data. Training data is utilized to train the system. Validation data is utilized for testing the system. For every epoch validation loss gets lower and accuracy gets higher. Epoch is teaching the system with one full pass of training set. It has few iterations.

While testing is done it extracts key features or objects from the image, by performing some mathematical operations it gets some set of value or score of every pixel of the image, that is the final class score. If the final score of the image matches with trained data it gives true or else false. The probability of matching depends on the dataset provided or accuracy of the system.

Fig. 4 Getting Pixel length of car

IV. ALLOT BEST FIT PARKING AREA

Generally, there are two methodologies utilized for recognition of Empty slots: Sensor based and Picture based system. Comparing Sensor based parking lot arrangement systems, Picture based methodologies are more reliable and cost friendly. Sensor based parking recognizes the existence or absence of the vehicle. Aside from recognizing the vehicle, the sensor can give additional data like displaying the vacancy slots for parking. The chance of occurrence of error is more by the usage of sensors. As it requires a greater number of sensors to be placed i.e., at every parking slot it requires a sensor. Disruptive communication between the sensors may lead to errors. That is, the signal from transmitter may not be received by the receiver, then the sensor may be prone to errors. It may show vacant slot as occupied and vice versa. Moreover, the power consumed by the sensors is high due to repeated utilization. Sensors requires continuous monitoring at entrance section and exit sections.

Fig. 9. Work flow of allotting best fit and optimal parking slot to the vehicle

In the Image based parking lot arrangements the camera can be utilized to detect the unoccupied space through image recognition. The picture is captured and it is permitted to Image segmentation and edge recognition by boundaries. The moving vehicle is to be parked at explicit zone, at first the parking region must be recognized at the zone then the parking slot must be detected. Check whether there is any empty slot, and it is accessible or not. In The parking region

the Image Processing Technique have been Implemented that will experience the Image Segmentation and Edge Detection.

In Parking slot allotment if a vehicle is present, it captures the image of the car. It performs mathematical operations and detects the length of car and classify the cars in to 3 types SUV, Sedan, Mini based on its size. Intelligent Parking System allots best fit and optimal parking area to the vehicle.

V. EXPERIMENTAL RESULTS

Experiment Details	No of Experiments Conducted	No of Experiments Correctly
Number Plate Recognition	100	80
Vehicle type Identification	100	90

Table 2. Experimental Results

An experiment conducted with an epoch value can reach an accuracy range of 40-50%. By changing an epoch value to 100 under good lighting conditions an accuracy of 80-85% can be achieved. Previously, the detection rate using webcam was as low as 50-60%, using Deep Learning based Region of Interest selection algorithms, the detection rate was increased to 80%. For text recognition in Vehicles License plate this system is capable of identifying all character fonts of different sizes.

CONCLUSION

In this paper, the presented methodology is effectively able to allot best fit and optimal parking area to the vehicle based on its size. It can be able extract features like length, size. It performs machine learning operations like Convolutional Neural Network to detect dimensions of car.

In character recognition of license plate, it is able to identify characters only in few fonts, for future work the Extracted feature can likewise be utilized to prepare neural system for higher precision. In acknowledgment, as well much variety in character geometry prompts misclassification. So as to reduce these, classifier is should be trained with various character textual styles which was detected from individual training dataset.

REFERENCES

1. Y. C. Wang, C. C. Han, C. T. Hsieh, and K. C. Fan, "Vehicle type classification from surveillance videos on Urban roads," *Proc. - 2014 IEEE 7th International Conference on Ubi-Media Computing and Workshops. U-MEDIA 2014*, pp. 266–270, 2014.
2. Y. Peng, J. S. Jin, S. Luo, M. Xu, and Y. Cui, "Vehicle type classification using PCA with self-clustering," Proc. 2012 IEEE International Conference on Multimedia and Expo Workshops. ICMEW 2012, pp. 384–389, 2012.
3. B. Pechiammal and J. A. Renjith, "An efficient approach for automatic license plate recognition system," ICONSTEM 2017 - Proc. 3rd IEEE International Conference on Science Technology Engineering Management vol. 2018–January, pp. 121–129, 2018
4. N. Wang, X. Zhu, and J. Zhang, "License plate segmentation and recognition of Chinese vehicle based on BPNN," Proc. 2016 – IEEE 12th International Conference on Computer Intelligence Security CIS 2016, pp. 403–406, 2017. 11
5. D. Kanteti, DVS Srikar and TK Ramesh, "Intelligent Smart Parking Algorithm" *IEEE 2017 International Conference on Smart Technology for Smart Nation*, vol. 11, no. 4, pp. 942–953, 2017.
6. Junzhao. Liu, M. Mohandes, and M. Deriche, "A multi-classifier image based vacant parking detection system," Proc. IEEE International Conference on Electron Circuits, Syst., pp. 933–936, 2013.
7. P. Sawangchote and T. Yooyativong, "Automated parking area optimization for garage construction using geometric algorithm," *2nd Jt. International Conference Digit Arts Media Technology 2017 Digit. Econ. Sustain. Growth, ICDAMT 2017*, pp. 286–290, 2017.
8. M. Sundaresan and S. Ranjini, "Text extraction from digital English comic image using two blobs extraction method," Proc – 12 *International Conference on Pattern Recognition, Informatics and Medical Engineering PRIME 2012*, pp. 449–452, 2012.
9. Jeba Blessingson, Y.Bevish Jinila (2010), " Multi Utility / Tracing Kit for vehicles using RFID Technology", Recent Advances in Space Technology Services and Climate Change –2010, PP. 273 – 276, IEEE
10. Sethuraman, R., Sathish, E. "Intelligent transport planning system using GIS" International Journal of Applied Engineering Research 01/2015; 10(3):5887-5892. 547
11. P.Ajitha, A. Sivasangari, K.Indira," Predictive Inter and Intra Parking System", International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-8, Issue-2S, December 2018