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Car Parking Space Detection using Digital Image Processing

Amogh Deshpande[1], Dhananjay V Jahagirdar[2], Madan G S[3], Bhaskara P K[4], Mahesh K S[5]

[1, 2, 3, 4]*B.E Student,* [5]*Assistant Professor, Computer Science and Engineering Department, JSS Science & Technology University, Mysuru*

(Formerly known as SJCE).

Abstract: ***Nowadays, people are facing problems finding parking spaces available in a parking lot because of the massive rise in the occupancy of cars and the increase in urbanization. We have embedded techniques of image processing in each phase of the method. It will benefit all drivers entering a parking lot from the information given by the system about the location of parking spaces available and the number of vacant parking spaces.***

Keywords - Digital Image Processing, Hough Line Transform, Canny Edge Detection, License Plate Recognition, Convolutional Neural Network, Character Segmentation.

I. INTRODUCTION

There is no standard system for checking for parking places in today's parking lots. Human interaction with the physical space and entity is critical to the system's success. This wastes manpower and, in certain cases, parking places. Human-to-Human Interaction (HHI) is used in these parking lots, which is inefficient. Various strategies have been proposed in the past to solve similar issues.

The analogy is when a driver enters a certain parking lot, the first thing that the driver does is look forward to some sign telling that the parking lot is vacant or occupied. The driver also does not know how many parking spaces are there in total and where to find a vacant parking spot for the car. Even if the total occupancy is high, some parking divisions may stay vacant. This results in inefficient parking division use as well as traffic congestion near the parking lot's entrance. As a result, providing drivers with pertinent parking lot information as they enter a parking lot becomes a critical issue.

Given the circumstances, we attempted to create a system that assists people in detecting vacant parking spaces using an aerial image of the parking lot.

II. LITERATURE SURVEY

Image processing has been a hot study topic for a long time, and there is still room for some new advancements in unique applications. Image processing is necessary in all of society's key developing and advanced industries, including medical, security, engineering, entertainment, and media, among others. It is critical to use distinct image pre-processing algorithms to achieve higher precision using techniques such as RGB(Red, Green, Blue) to grayscale image, blurring, thresholding, and contouring [4].

The author of the paper looked into the techniques of parking survey collection and parking provision. The SPSS (Statistical Package for the Social Sciences) software was used to create the parking demand models. She had created three sorts of survey poll parking spaces, with enrollment accumulation as the method of study. Interview for the purpose of determining willingness to pay. It was discovered that the greatest amount of buildup occurs in the morning between 12:00-14:00 and 17:00-8:00 at night[2].

The author uses a wide-angle camera as a sensor, which detects and records only available parking places. The entering user is then assigned a parking place based on these records. Using optical character recognition (OCR), the Intelligent Transportation System (ITS) and Electronic Toll Collection (ETC) produce a record for all entering vehicles.This makes a tagless entry for all vehicles in the parking lot, but it does not provide the user a spot. Because there isn't a standardised OCR algorithm, it's tough to construct these records[1].

Jihoon Yang, the author, proposed a new technology that used a global positioning system (GPS) to help users locate parking spaces remotely. The sensors, on the other hand, could not be layered on top of each other[6]. Artificial Intelligence (AI) supplied a backdrop for image processing using a camera sensor, which assisted the administrator in identifying occupied parking spaces[7].

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III.PROPOSED SYSTEM AND ARCHITECTURE

A. Car Parking Space Detection

The suggested system employs Image Processing to detect the presence of a car in a parking spot as well as provide information on the number of available parking spaces. In the beginning, an aerial view image of a parking spot is provided to the system, which then analyses the image to count the available parking spaces.Once we have the results, we can prevent congestion, which is the main cause of traffic in metropolitan cities.

In the image below, the prediction of available parking spaces is processed.

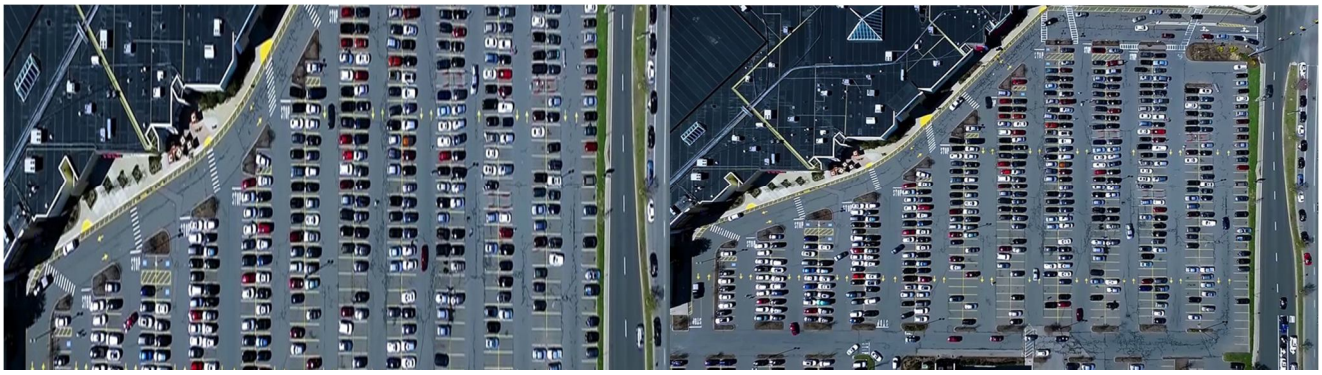

Fig.1 The real image used for processing.

Consider the workflow of the model as depicted in figure 2.

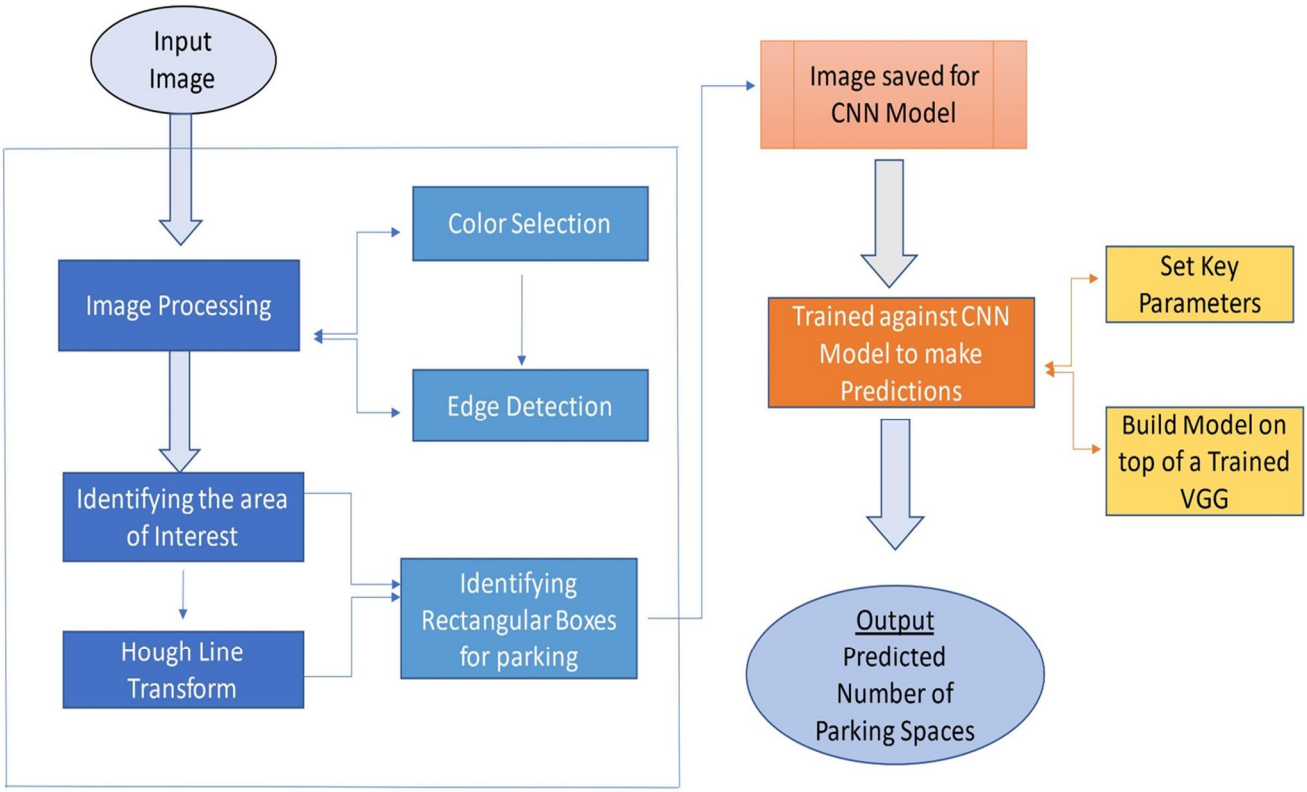

Fig.2 Complete workflow from Image Processing to Parking Slots Availability Prediction.

The Parking Space Detection can be broadly categorised into three main stages:

1) *Training and Testing of the Data:* This is the very first step of the model in which we train the model with necessary data and information.
2) *Image Processing:* Various image processing techniques are applied to refine the image for analysis.

a) *Color Selection And Edge Detection:* In the initial stage the image will be in RGB form. Here, in this step we apply the white and yellow masks to the image, convert it into gray-scale and finally to binary form for further processing.

b) *Identifying The Area Of Interest:* The complete image is not useful for the processing, we just need to find the portion of the image which is necessary. In this step, only the region necessary is detected by applying the mask using the vertices to the input image.

c) *Hough Line Transform:* Prior to this step, we need to have the image in Canny Edge Detected form. The feature extraction in this stage can be performed with the help of HLT(Hough Line Transform).

d) *Identifying Rectangular Blocks of Parking:* In this step, we find the exact blocks of parking in the area of interest with the help of Hough line transform.

3) *Identifying Free Spaces:* This is the step in which we use trained and tested models to anticipate the number of available free parking spaces. The Convolutional Neural Network (CNN) model is used to forecast the quantity of available parking spaces. We have obtained the validation accuracy of the model to 93.88 percent. The following figure shows the output of our trained model.

Fig.3 Output image of the Car Parking Space Detection.

Here, we can observe that the total number of parking slots is 551. The number of available parking slots is 131 and 132 from the left side and the right side of the image respectively.

B. License Plate Recognition(LPR)

In addition to the Car Parking Space Detection, we have included another module, i.e, License Plate Recognition. The main motto of this additional module is to find the amount of time a particular car has been parked in the parking space. Using this module, the company or the organisation can apply some charges(fees) on the owner of the car for using the parking space for some stipulated time.

The image used for this module is as follows:

Fig.4 Image of a car used for License Plate Recognition

Here, in this module, the input is the image of a car and the output is the license plate of the vehicle. The module can be categorised into three main stages:

1) *Detection of License Plates (Plate Localization):* The input is the image of the car and we identify the position of the license plate in the image. In order to perform this we need to convert the image into gray-scale first, and then into binary. Then we use the Connected Component Analysis approach to find all of the image's connected regions. We can observe that numerous other places that aren't essential are also mapped after this stage.We just need the region that contains the license plate. To obtain the license plate we will use some of the characteristics of a standard license plate. They are:

a) They are rectangular.
b) The height of the plate is observed to be esser than that of the width.
c) The width of the licence plate region to the complete image varies between 15% and 40%.
d) The proportion of the number plate region's height to the whole image is between 8% and 20%.

By applying these mathematical characteristics, we finally obtain the required license plate which can be further used for later stages.

2) *Character Segmentation:* Here, in this step also we use Connected Component Analysis strategy to categorize each character from another. We have used 20 pixels x 20 pixels for the segmentation process. The following figure depicts the output of this stage:

Fig.5 Character Segmentation of the License Plate.

3) *Recognizing the Characters:* This is the last stage of the License Plate Recognition module.To forecast the characters, we employ machine learning. We have two separate datasets, one measuring 10 pixels by 20 pixels and the other measuring 20 pixels by 20 pixels. We used the 20px by 20px size because each character had previously been reduced to that size. Except for O and I, each letter has ten different graphics. Support Vector Classifiers were employed (SVC). To determine the accuracy of the model, we used 4-fold cross-validation.

The output after the prediction is as shown below in the figure:

```
[array(['5'], dtype='<U1'), array(['5'], dtype='<U1'), array(['5'], dtype='<U1'), array(['5'], dtype='<U1'), array(['A'], dtype
='<U1'), array(['T'], dtype='<U1'), array(['0'], dtype='<U1'), array(['1'], dtype='<U1'), array(['K'], dtype='<U1'), array
(['L'], dtype='<U1')]
5555AT01KL
KL01AT5555
```

Fig.5 Output of the module.

IV. CONCLUSION

The main objective is to minimize manual work, By adding specific features and algorithms to make a system robust and efficient in the result. In our project, we summarized the two different parking assists which are number plate detection and parking space detection. For both the two specific features, Digital image processing is a better technique to manage traffic. It visualizes reality so it functions much better. The analysis can thus be improved with multiple sequential cameras along an entry of parking space and in addition to localized congestion control. With the aggregate of different image datas, the congestion control strategies can make global decisions. Overall, the system is good but it still needs improvement to achieve efficient accuracy. It can be used for multi purposes like parking space detection for apartament CCTV's, self-driving vehicles and many more.

V. ACKNOWLEDGEMENT

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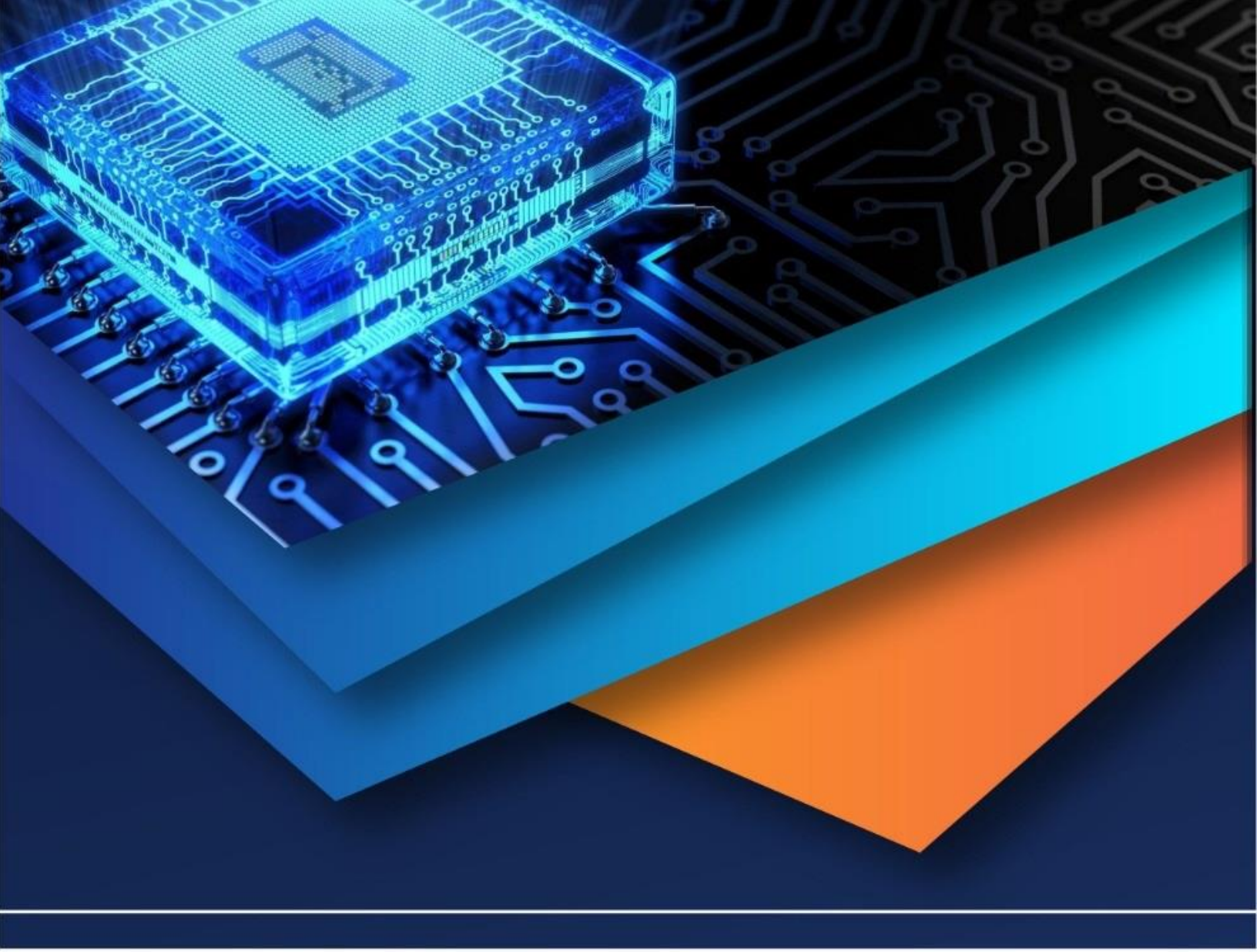
REFERENCES

[1] Hilal Al-Kharusi, Ibrahim Albahadly, “An Intelligent Parking Management Based on Image Processing Technique”.
[2] Ms. Priyanka Kolhar - Management Plan of street parking for the city of Dharwad, Karnataka, India, 2012.
[3] Marcello Marinho Barenger Vianna intelligent transport systems and parking management, 2004.
[4] F. Zhou, and Q. Li, “Parking guidance system based on ZigBee and geomagnetic sensor technology,” 13th International Symposium on Distributed Computing and Applications to Business Engineering and Science (DCABES) 2014, pp. 268-271.
[5] Shoup, Donald, “The Trouble With Minimum Parking Requirements”, 9 December 1999.
[6] Jihoon Yang , Jorge Portilla, Teresa Riesgo “Smart Parking Service based on Wireless Sensor Networks.”, IEEE 2012
[7] P.Dharma Reddy, A. RajeshwarRao, Dr. Syed Musthak Ahmed, “An Intelligent Parking Guidance and Information System by using image processing technique”, IJARCCE, Vol. 2, Issue 10, October 2013.
[8] A. Khanna, and R. Anand, “IoT based smart parking system,” 2016 International Conference on Internet-of-Things and Applications (IOTA), Pune, 2016, pp. 266-270.



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