

# Parking Space Detector

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**Abstract**—In today's era, the problem of parking is also increasing due to the increase in the number of vehicles. Over the last decade, there are various research took place intending to develop an ideal automatic parking slot occupancy detection. There is an auto mechanism that can park a vehicle automatically but it is required to detect which parking slot is vacant and which one is occupied. The systems which have been designed so far are intended to build parking slot detection using some sensors or mechanisms that can indicate whether the vehicle has been parked correctly or not. Various researches have been implemented using AVM (Around View Monitor) technology in which various fish cameras require to project the vehicle position at the time of parking. Around view monitor (AVM) image sequence makes it possible with 360-degree scene Bird's eye view camera. The AVM captures the image sequence and the empty slot is detected on the combination of each of the images. The ultrasonic sensor is useful for determining adjacent vehicles. The hierarchical tree structure-based parking slot marking method is used to identify parking slot marking. After the combination of sequentially detected parking slots, the empty parking slot is identified and the driver has to select one of the empty parking slots and park in it. These sensors are required to install on vehicles which increase the cost of vehicles. The system should be intended for one sensor that can target many vehicles in parking areas. Accuracy is often important for ideal outcomes in real time through which an intelligent parking slot or space detection can be implemented with a newly introduced technique.

**Index Terms**— Deep Learning, Convolutional Neural Networks, Image Classification, Car detection.

## I. INTRODUCTION

Growth in technology evaluates day-to-day life. By seeing growth in technology, human is going towards automation, but in many places, it is not affordable to their system. Coming to the point there should be an easy way to complete the work. Take an example of the car parking system. It is just the solution to help to detect no of cars present in the parking lot, to know how many empty slots are available for parking. The search for a parking space in urban areas is often time-consuming and nerve-racking. Efficient car park guidance systems could support drivers in their search for an available parking space. Image Processing based systems are a reasonably priced alternative to systems employing other sensor types and their camera input can be used for various tasks within the system. Current systems detecting vacant parking spaces are either very expensive due to their hardware requirements or do not provide a detailed occupancy map. Now a day, the parking system has increased rapidly.

It is required to develop an automatic parking slot detection system that helps to entertain useful and careful parking. The exploitation of an automatic and systematic parking system may reduce the human effort and be able to work efficiently to avoid any obstruction and wastage of time. There are different methods related to parking systems that have been employed till now such as the user interface-based approach, free space-based approach, parking slot marking-based approach, and infrastructure-based approach. And we are applying a neural network approach to detect parking space availability

## II. LITERATURE REVIEW

### A) Video-based parking space detection

- Author: Marc Tschentscher, Marcel Neuhausen
- Published on: January 2012

In this paper they have developed a promising video-based system for vacant parking space detection which can be adopted by a car-park routing system to navigate drivers to a comfortable parking space. They evaluated different combinations of image features and machine learning algorithms. The final system relies on color histograms and difference of Gaussian features, an SVM classifier, and exponential smoothing for temporal integration. Their system reached an accuracy of 99.8 % in classifying parking situations.

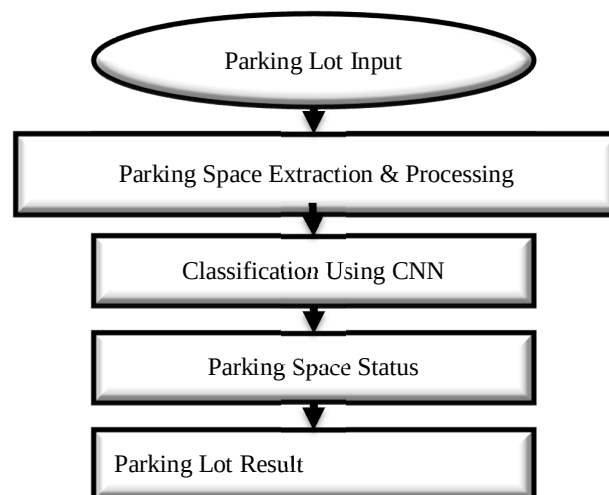
### B) Parking Space Detection Using Image Processing

- Author: Purva Hattale, Vikrant Jangam, Shrutika Khilare, Yash Ratnaparkhi, Pradnya Kasture.
- Date Added to IEEE Xplore: 3, March 2021.
- The counting is done by the installation of the induction loop sensors. Although the usage of sensors was less costly, not easily affected by environmental conditions, and detected objects accurately, its installation was difficult and cause damage to roads. It was also difficult to maintain
- The other methods were used for providing different sensors like ultrasonic, infrared, and microwave for the detection of vehicles
- These sensors are placed in every parking area. Wan-Joo Park et al. proposed the method used of ultrasonic sensors mounted on cars to search for a free parking space. The disadvantage of this method was that the sensors are easily affected by natural environmental problems or weather conditions like rain, high temperature, snow, and fast air breeze.

## III. PROBLEM DEFINITION:

To detect whether the parking space is occupied by the vehicle or not and provide the total number of vacant spaces available in the entire parking lot.

## IV. METHODOLOGY



- Initially in our project we will extract the video from parking lot. After taking the video from the parking lot we will be feeding this video into our project for further processing.
- In this step we will be identifying the different parking spaces that are available in the parking lot by taking a single frame from the input video.
- After detecting all the spaces from parking lot input, we will extract each parking space frames which will be fed into our model for classification.
- Then we will be feeding the frames that we have extracted from the parking lot to CNN Model. The CNN model will be already trained with datasets to detect the free space and occupied space, by which it will classify the given input image as free space or occupied space.
- After combining the result of the all frames which is classified from the CNN model, we will be highlighting the free parking space in green colour and the occupied space by red colour. By this, driver can easily identify the free spaces available in parking lot.
- The final step in our project is to display the output to the driver in real time on some screen in the entrance of the parking lot. And it will also redirect the driver to the shortest parking space available in the parking lot. By seeing this, the driver will be able to find the free space to park his vehicle very quickly without wasting time in searching. .
- And if in case if there is no parking space available in the parking lot it will be displaying that “No Parking space available”

## V. RESULTS



## VI. CONCLUSION

The proposed system accurately detected the presence of cars in parking slots. The filled image approach performed better than the use of dilated edge images to determine the vacancy of parking spots. The two approaches could be fused into one system. The camera position could be adjusted to improve the performance. From the above set of test results, it has been shown that the proposed image processing-based system is a viable option for parking space vacancy management. Other technologies such as automatic number plate recognition and traffic light control could be conjoined with this system to form holistic intelligent transport systems. As per the survey of many approaches; most of the systems are using sensors like ultrasonic, AVM, proximity, and fish cameras which increase the cost of the system since these components need to install in every vehicle to execute the system. AVM itself indicates whether the vehicle has been parked correctly or not along with occupancy detection but vehicles can be parked manually. Instead of using AVM or other monitoring sensors, a visual-based approach that can be installed at parking lots at particular elevations is useful that can intelligently monitor several slots along with vehicle transition. It would be best for vehicle security views that indicate vehicle transitions and pedestrian occurrence. Real-time parking slot detection can be used for automatic parking management. But accuracy is often important which is required for developing an ideal system. OpenCV-based approaches can build a cost-effective system.

## REFERENCES

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