International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Parking Slot Detection

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Abstract:
Due to the escaltion in the number of vehicles on the road, traffic problems are bound to exist. This is because the current transportation infrastructure and developed car park facility cannot cope with the influx of vehicles on the road. Parking shortages, excessive parking fees, and traffic congestion caused by people looking for a spot are just a few common parking issues. The study investigates the city's car parking problem, its various origins, and tried-and-true solutions. People face a lot of difficulties in finding a parking space for their vehicle at a location that is highly populated with continuous parking and departing vehicles which in turn consumes a lot of time and effort, to solve this problem we came up with an idea and titled it as "Parking Slot Detection". In this project, we are going to create a Parking Slot Detector which finds how many total cars are present and how many spaces are vacant to park, with this it is easy for people to park their vehicles directly at the vacant space creating a better visualization which is shown by our project, our project is at initial stages of development. Many components actively work to show the vacant spaces, our project is mainly based on the primary image processing techniques and some of the widely used modules in python such as "Opencv", "cv zone", and "CV2". Our project can also be considered a smart parking system which saves lots of time and effort..

Keywords: OpenCV, CVzone, Escalation, Influx, CV2, Image Processing

I. INTRODUCTION

With the increase in population, the proliferation of Vehicles on roads has also increased. Every house has at least two to three vehicles used for individual benefits and transportation. With this, the traffic on roads increased, especially near shopping malls, cinema halls, schools, and colleges. When researching the reasons for traffic near those areas most common answer was people facing difficulty in parking, and difficulty finding parking locations. At times there is no proper navigation and clear visualization of the entire parking system. This in turn results in the consumption of time and effort.
The increase in Vehicles is outnumbering available parking places, jamming highways. Violence over occupancy, distorted cars due to a lack of space, and overcharging for parking are some issues that arise. To solve this issue we must have one efficient visualizing parking system, that navigates users to desired parking locations in no time. Our project "Parking Slot Detection" shows how many vehicles are parked, vacant spaces to park and the number of vehicles arriving and departing..

II. PROPOSED ALGORITHM

2.1 Mathematics of Gaussian Blur–

Applying a Gaussian blur to an image is mathematically equivalent to convolving the image with a

Gaussian function. A two-dimensional Weierstrass transform is another name for this. Convoluting by a circle, on the other hand, would more accurately duplicate the bokeh effect (i.e., a circular box blur). Because a Gaussian's Fourier transform is another Gaussian, adding a Gaussian blur reduces the image's high- frequency components; consequently, a Gaussian blur is a low-pass filter.

Using Gaussian blur, a halftone print is smoothed out. The Gaussian blur is a type of picture-blurring filter that calculates the change to apply to each pixel in the image using a Gaussian function (which also describes the normal distribution in statistics).

The formula of a Gaussian function in one dimension is

$$G(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{x^2}{2\sigma^2}}$$

Figure 1. Gaussian Blur

In the two dimensions, it is coined as the product of two such Gaussian functions, one in each dimension:

$$G(x,y) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}}$$

Figure 2. Gaussian Blur one dimension

After that we select the ordered coefficient from 1 to N to get N coefficient. the formulae of watermark embeddingare as follows.

$C_w(i) = Y_o(i)+\alpha_1 w(i)$ (1)

Where the parameter α is called embedding intensity and their effect of validity of the algorithm directly is apply after this process, after that apply the inverse wavelet transform to the image for find out watermark image.

2.2. Linear Gaussian Filter–

The filter is applied using the surface data and discrete values collected from the weight function in a discrete convolution.

III. EXPERIMENT AND RESULT

The first test case involves the checking of the camera and taking of the footage properly. The details regarding the test case, its description, and the expected and actual output all are summarized in the above table. The output of the test case is the proper functioning of the camera and video footage perfectly taken.

The second test case deals with the vacant and occupied spaces are being properly detected. We will test whether the slots are properly detected and localized or not. The details regarding the test case, its description, and the expected and actual output all are summarized in the above table. The output of the test case is the proper picking of parking slots.

The third test case is about vacant and occupied slot detection by using pixel count. In this, we will be checking whether the slot is properly extracted or not. The details regarding the test case, its description, and the expected and actual output all are summarized in the above table. The output of the test case is the vacant and occupied parking slot detection.

The fourth test case deals with finding the count of vacant and occupied slots. Here, we will test whether

the count of slots vehicles incoming and outgoing are detected in a correct way or not. The details regarding the test case, its description, and the expected and actual output all are summarized in the above table. The output of the test case is finding the count of vacant and occupied slots.

Here, we have taken a pixel image from the live stream of video for image picking, counting and to find vacant spaces. The single pixel image is supplied as input feed to the program for further process. The output image is given as vacant and filled slots in the parking area as shown in the below pictures along with the count of vehicles.

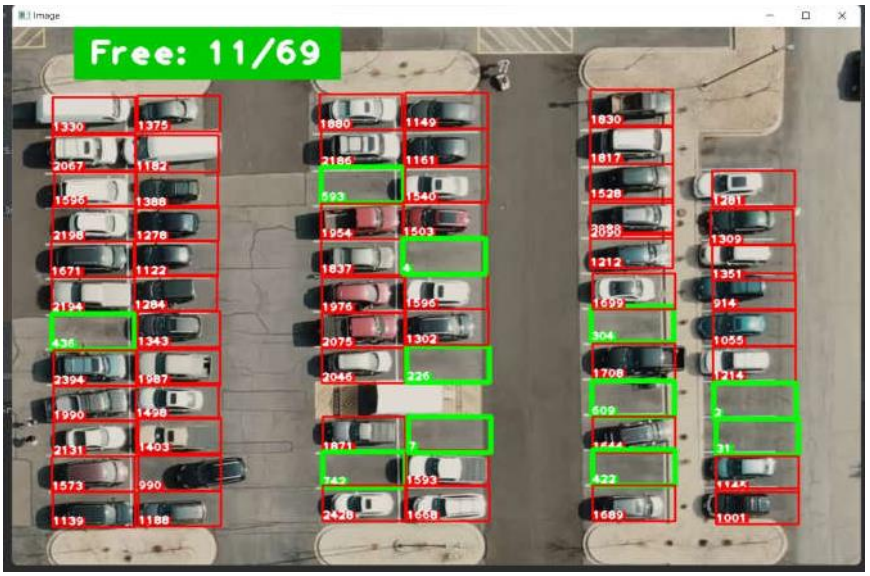

Figure 3. Output of Parking Availability Checker using Open CV

Table -1 Experiment Result

Test Case Id	'est Case Name	Test Case Description	Test Case step	Step Expected output	Actual Output	Test Case statu
01	Video footage	Switch on the camera for taking stream of live video as input	If we do not have live video. It is difficult to capture vehicles.	We will not have any images of the parking slot.	The camera works fine and the input video is taken properly	High
02	lanual slots picking	Check whether the slot is properly driven and picked.	If we cannot have the properly detected slot.	We will not be able to know the empty or occupied slot	The parking slots are successfully picked	High
03	Vacant or occupied space detection	Check whether the slots are empty or filled	If we cannot determine the empty slots	We will not be able to know the	The vacant and occupied spaces are	High

		with vehicles		**parking slot condition either empty or filled**	**highlighted separately.**	
04	**Finding number of available and filled slots in parking area**	**Check whether the count of vacant and occupied slots is displayed or not**	**If we cannot generate the count.**	**We will not be able to proceed with allotting slots.**	**The count of empty and occupied slots is clearly defined to allot slots.**	**High**

Table 1 shows the different test cases performed, the result and the test case status. This result states how a parking slot is picked, how many empty slots are available and how many are occupied.

CONCLUSION

The world's industrialization, population growth, delayed city development, and mismanagement of available parking spaces have all contributed to parking issues. There is an urgent need for a safe, intelligent, efficient, and dependable system that may be used for searching for unoccupied parking spaces, directing people to parking spaces, negotiating parking fees, and managing parking spaces. Intelligent Parking is a component of Intelligent Transportation Systems (ITS). Our project continuously processes the incoming video feed with minimal power requirements and hardware requirements which precisely detects the number of free parking spaces or the vacancies in that particular parking lot helps in a hassle-free way of handling the parking spaces. It also displays the number of free parking spaces that helps drivers whether that particular parking space has less or more traffic based on the displayed number of free parking spaces.

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