

FINDING FREE SPACE IN PARKING LOT USING SUPERVISED LEARNING

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Abstract : This paper aims at finding free parking slots in parking area for incoming cars using digital image processing. Due to increase in car usage, it becomes difficult for parking supervisors to maintain track of free slots and occupied slots. Using this technique, the problem of heavy traffic in parking area and delay in searching parking slot is reduced. Ultimately, much fuel consumption is minimized.

I. INTRODUCTION

In Olden days individuals utilized general society transportation method as train and bus for moving starting with one area then onto the next [8]. Yet, because of Globalization the general population moved from country territory to non-rural regions for work and different needs therefore, the solitary transportation have been enhanced a considerable measure for their simplicity. Attributable to these expansion in vehicle, the parking turned out to be exceptionally confounded and the general population can park their on the either sides of the streets giving rise to heavy traffic. Presently, there are no systematical approaches in parking system. The manual control can be actualized in a few regions however it is not so stable to satisfy the present count of vehicles. These days the quantity of vehicles is expanding quick with the goal that searching for an empty parking spot turned out to be increasingly troublesome particularly in huge parking areas, for example, air terminals, railway stations, and malls. In such substantial zones, a few areas of the parking might be intensely utilized while others may have numerous empty spaces. [7] Building an advanced parking system has become must in developing nations like India because of increase in population and automobiles. Utilization of the cars is expanding quickly, in any case, the effective parking spaces are not accessible to station a car, which constrain the driver to stop a vehicle on the streets, which is the purpose behind overwhelming blockage on the streets and moderate motion of traffic. A past report has demonstrated that 30-50% of total traffic can be accounted by traffic because of car park searching in downtowns of major cities. Despite the fact that, plenty of moment is squandered in looking for parking space and while looking unknowingly it impacts surroundings by the discharge of dangerous and horrendous gases from vehicles. This discharge contaminates the atmosphere by CO₂ and different gases by burning of petrol or diesel. Additionally, movement of traffic becomes slow while seeking parking slots. To beat every one of the issues specified above, we require a productive system for parking which would decrease congestion and enhance quality of air at imperative areas where jam surge is more. This project includes automated car parking system using digital image processing in MATLAB. To save driver's time in finding an empty slot, we display the empty slot list in displayer from which the driver can be guided directly to the slot to park the car instead of wasting time and fuel. The image of parking lot is extracted periodically and processed so that empty slots can be found and displayed in the monitor.

II. LITERATURE REVIEW

In this section, we will go through various papers that talk about parking solutions.

Halal Al-Kharusi and Ibrahim Al-Bahadly [3] proposed a system that uses image processing of parking area images to find free slot. It is assumed that camera direction can be moved to capture whole parking area. The images acquired are processed and information is used to guide the driver to find the available nearest parking place.

Methodology:-

This includes five modules:-

1. **Image Identification:-** The image of empty parking area is obtained to note the position of all car parks. RGB values could be used to find the green dots that shows vacant car park. To get the position of green dots, the image is changed to HSV image. This HSV image is the converted to binary image to get clear image of the dots. To do this the HSV image is first converted to gray scale and then to binary. Finally the noise in image is removed using erode operator.
2. **Image Acquisition:-** camera is fixed above the cars in such position where it can capture all car parks clearly and is used to acquire image that helps in finding the free vacant park.
3. **Image Separation :-** This can be done by using clustering which identifies and separates different objects.

4. Image Development:- The noise is removed from the image with the help of morphological operations like dilation and erosion. Dilation enhances the object's periphery and also merges objects together which is hard to distinguish. This problem is removed using erosion. Erosion diminishes the limit of the items so they can be effortlessly recognized from each other.
5. Image Determination:- There were specifically three techniques used to decide if car parks were occupied or not. Parameters such as height, width or size determined if there is a car or not. This could be done by deciding if the size is too enormous or too little for a car.

Advantages:-

1. It successfully identifies the empty park slots.
2. Less complex.
3. Power supply is assured.

Disadvantages:-

1. This system depends on weather conditions.

R. Yusnita, Fariza Norbaya, and Norazwinawati Basharuddin [11] proposed a keen framework for parking spot recognition in light of picture preparing strategy that catch and process the darker adjusted picture plotted at parking area and deliver the data of the non-occupied car parking spots. It is then shown at the monitor that comprises of seven portions progressively. The seven portions show demonstrates the quantity of current accessible parking areas in the stopping zone.

Methodology :-

This includes five modules:-

1.System initialization:- This module runs once for first time. The picture of stopping zone with round dark colored imprints is taken at first. The reason for this module is to consequently distinguish stopping area in picture. It is ensured that the stopping lines are clear and unhampered in the picture.

2.Image Acquisition:- This module includes catching and putting away computerized pictures from the camcorders. The superior quality camera used to procure advanced pictures is then associated with a preparing unit. The product is running continuously. The stature of the camera must be sufficient to acquire an unmistakable, unhampered best perspective of the parking garages.

3.Image Segementation:- RGB Picture obtained from the camera is then changed over to dim scale picture and make the double pictures in picture division module. It is anything but difficult to distinguish question of enthusiasm from double picture.

4.Image enhancement:- In the wake of changing over pictures into parallel, the picture needs to evacuate the commotion and follow the limit of distinguished question. This procedure is done in picture improvement module. Pictures, taken by advanced camera, will get the commotion from assortment of sources. Subsequently, to evacuate the clamor, a morphology work is utilized. It evacuates the blemish included amid division.

5.Image Detection:- When following the limits of question in pictures, the picture identification module is executed. This module will figure out which objects are round by evaluate each protest's zone and border.

Advantages:-

1. Identifying the rounded image in the parking lot makes more efficient to decide whether the lot is vacant or not.
2. Reduces cost of sensor and wireless hassle.

Nithinya G and Suresh Kumar R [12] proposed a smart system that automatically detects the type of vehicle, directs it, counts the number of vehicles and identify the empty plot number at the parking area. This system uses image processing technique. At whatever point a vehicle approaches the stopping passage, the picture of the vehicle is caught. In light of the picture gained, the framework identifies the vehicle type. The kinds of vehicle utilized as a part of this framework are Bus, Car and Two-wheeler. Likewise, the picture of the parking area is caught and the framework checks the quantity of vehicles, the plot number and shows the parking status. On the off chance that Bus is recognized at the passageway, it is coordinated towards west and if Car is identified, it is coordinated towards the east and if Two-Wheeler is distinguished, it is coordinated towards north side of the stopping region in light of the accessibility of stopping status.

Methodology:-

The proposed system involves 2 modules: Simulation part and the Hardware module. Simulation process involves the Vehicle detection and direction module and Slot number identification module. The vehicle detection and direction module is used for the detection and the direction of the vehicles. This involves the Image Acquisition, Binary Image Processing, Area Calculation and Vehicle direction. The Slot Number Identification module is used to get the count of vehicles and identifying the individual empty slot number in the area of parking. This involves the Feature extraction, Classification using ANN and the Output. The Hardware module includes PIC controller which is a 8-bit first RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor).

Advantages:-

1. This project can be applied to any type of vehicle.

Disadvantages:-

1. Since controller is used, it can wear out anytime.

K Kaarthik, A Sridevi and C Vivek [8] proposed a systematic approach in which the stopping zone can be set apart with certain particular numbers and sensors, with the assistance of these sensors the empty space can be found in stopping zone. Alongside Show a sound framework is interfaced to give oral data. The Vehicle is detected by the Sensor and the accessibility of Stopping territory and suitable Stopping opening can be educated to the driver through sound declaration. The show utilizes seven section show to recognize stopping opening with the assistance of particular number which are shown on displayer. This is actualized in programming stage with the assistance of picture handling and equipment stage with Arduino Uno.

Methodology:-

This system contains five modules,

1. System Initialization :- This includes manual drawing of parking area which is visible, clear, easy to understand and sufficient enough to provide parking area number information.
2. Image Acquisition:- The images of parking area are captured through stationary cameras from top view and side view. This images are further processed.
3. Image Segmentation:- This includes conversion of acquired RGB image to grey scale image and then thresholding technique is applied to form final binary output image. Clustering process is used to form number of clusters.
4. Image Enhancement:- This involves image noise removal which is done using Morphology operation.
5. Image Detection:- This is the final module which can be done only image correct edges and outline boundaries are obtained in previous module. This helps in correct detection of shape which is helpful for the drivers.

Advantages:-

1. No manual interruption is required.
2. It is highly efficient.
3. Accuracy is also high.
4. Audio system is boon to this system.
5. This avoids distortion.
6. Parking area and time consumed is reduced.

Disadvantages:-

1. Image detection cannot be done if appropriate results are not obtained in image enhancement module.
2. Sensors may fail sometimes to detect moving car.

III. METHODOLOGY

This paper proposes a method in which free car parking slot is identified using CCTV cameras installed in parking lot. The count of free parking slots can be found using digital image processing. The following methodology is employed:-

1. Image Acquisition:-
CCTV cameras are attached to base station computer and digital images are obtained.
2. Image Preprocessing:-
This includes two steps:-
 - a. Gray scale conversion:- The image acquired is converted to gray scale for suitable processing.
 - b. Noise removal:- After capturing the image from CCTV camera, it contains noise. For further process to be done, it has to be eliminated.
3. Image Processing:-
Morphological operations are done before converting the image to binary image.

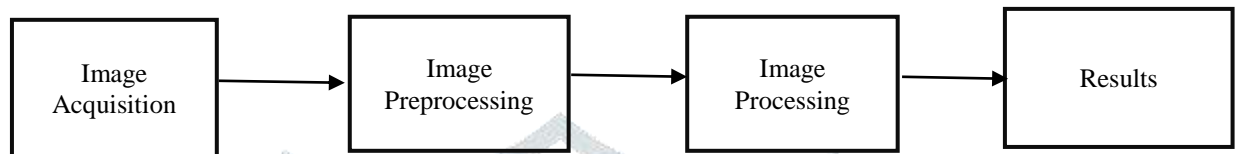


Figure a :- Block Diagram

Algorithm:-

- Step1:- Convert the input RGB image into gray scale image.
- Step2:- Remove the noise from the image by using 2-D median filter.
- Step3:- Convert filtered image to binary image.
- Step4:- Perform morphological operations like dilation and erosion to identify the objects in the image.
- Step5:- Mark the identified objects with some color to indicate number of cars.
- Step6:- Subtract total number of parking slots in the image with number of cars obtained. This will give number of vacant parking slots.

IV. RESULTS AND DISCUSSION

An automated car parking system is proposed in which free parking slot is found and then displayed for driver's reference. We use image processing as a tool to find the free parking space. The images taken from CCTV cameras are processed in such a way that number of free parking place available can be found.



Figure b :- Input image to find number of free slots.

If we give the above image as input, we get output as image showing number of cars parked and number of free slots. The output image is shown in Figure c.

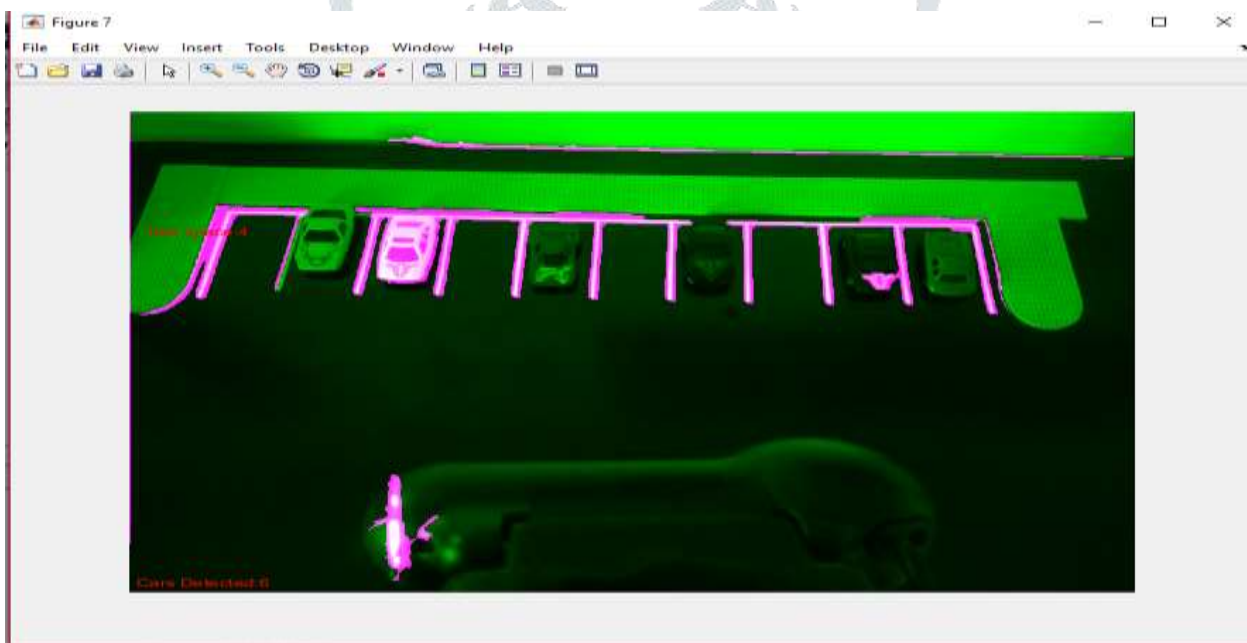


Figure c :- Output image showing number of cars parked and number of free slots

First, the images are converted to gray scale and then noise is removed. Morphological operations are used further to obtain the required result. In Figure c, the number of cars parked is 6 and number of free slots for further parking are 4. Hence, This system gives instant result and becomes convenient for the supervisors of parking area. But the images taken should be from top view of parking area so that it can easily recognize the parking limit lines.

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