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Car parking Space Detection Using Image Processing

Ashu Yadav[1], Kirti Bhatia[2], Rohini Sharma[3]

[1]P.G. Student, Sat Kabir Institute of Technology and Management, Bahadurgarh, Haryana, India
[2]Assistant Professor, Sat Kabir Institute of Technology and Management, Bahadurgarh, Haryana, India
[3]Assistant Professor, Government College for Women, Rohtak, India3

Abstract : The major goal of the project is to develop a fully automated parking system that requires little human interaction. Look for a suitable parking area for automobiles in the well-known metropolitan metropolis. These parking lots are necessary to solve the challenges of rising urban congestion and, as a result, a scarcity of space. The goal of this article is to determine the number of automobiles and the location where they can be found.

Key words : This study uses terminology like parking space, image processing, system initialization, image acquisition, image segmentation, image enhancement, and image detection.

Introduction

Finding a free parking spot in Slot is a widespread difficulty in the twenty-first century, particularly for people who commute for business or on a regular basis and frequently find it difficult or impossible to obtain a parking spot for their vehicles. The rise in the number of cars on the road around the world is a result of global economic growth, which has resulted in a host of parking challenges.

Finding a parking spot in today's heavily populated cities is tough. Drivers waste time and gas going back and forth hunting for parking spots.

VARIOUS ALGORITHMS

A. Parking Spot Detection Identification of parking spots is done in a scenario where each parking spot is vacant (figure1).

1. Parking divisions are identified through the use of eight phases of parking lines, which are used to segment the image.

HSV Thresholding:

The HSV values filter for the yellow parking line dividers has been completed.

- Vertical coordination of the centroid: portions in the upper half of the image are deleted.
- Solidity: regions with a solidity threshold are deleted.
- Area: Both small and large regions have been deleted.
- Excentricity: Those locations with an eccentricity threshold are deleted
- Accounts are created for regions along the same line that have a threshold value in their centres.
- Vertical coordination of the centroid: any outlier regions
- Major axis length: regions with bigger axis lengths below a certain threshold are deleted.

2. Identification of the parking space co-ordinates : once the dividers between parking lines have been identified The four vertices of a quadrilateral represent the vehicle park's four ends. By subtracting a height value from the base vertex, four extra vertices are calculated that correspond to the vertices with a 3-d volume occupied by the automobile. This results in an 8-coordinate bounding box that roughly represents the zone in the image where a car is located. Five of these coorders are used to create a bounding box that allows for occlusion by nearby vehicles that may enter the bounding box of adjacent boundaries.

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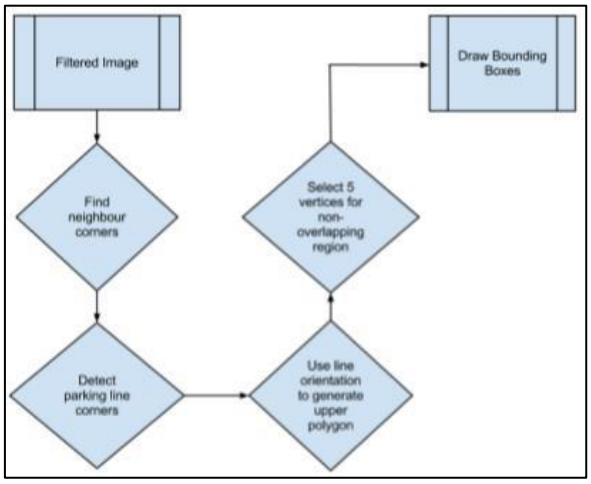

Fig1. Algorithm for parking space detection

B. Vehicle Detection This refers both to the picture of the empty car park used to produce the bounding boxes and to the coordinates of the bounding boxes themselves.

SIFT Detection: The Transform Invariant Scale Feature created in 1999 by Dr. David Lowe. They may be utilized in different images to detect and characterize local characteristics.

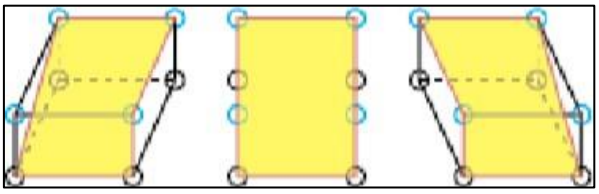

Fig2. 5-coordinate bounding box (shaded region).

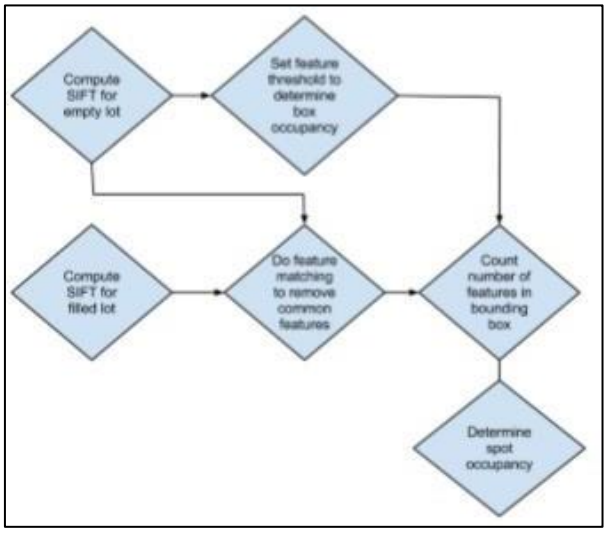

Fig3. Car detection algorithm

SIFT was created to ensure that image translations and rotations are invariant.

In the current scope of the project, the photos are not translated or rotated. SIFT would be a useful tool in this case.

1) FLANN: Approximate Nearest Neighbors Fast Library) is a library that contains a collection of algorithms that are optimized for the fastest neighbor searches in large data sets and features. This was also designed by David Lowe. We matched traits not only on the basis of descriptors, but also on the basis of location (x, y). Because the camera did not move between the two images, the relevant features should be quite close in pixels.

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2) Characteristic thresholds: After we've matched the attributes of each image to the vacant lot image, we'll set the thresholds. We used the binding box to compute the number of features within each location calculated in the first phase of our technique.

(I) SYSTEM MODULE

The suggested image processing module is implemented in MATLAB. This project module is made up of five phase modules that work together to make it work. A block diagram can be used to depict the processing phase.

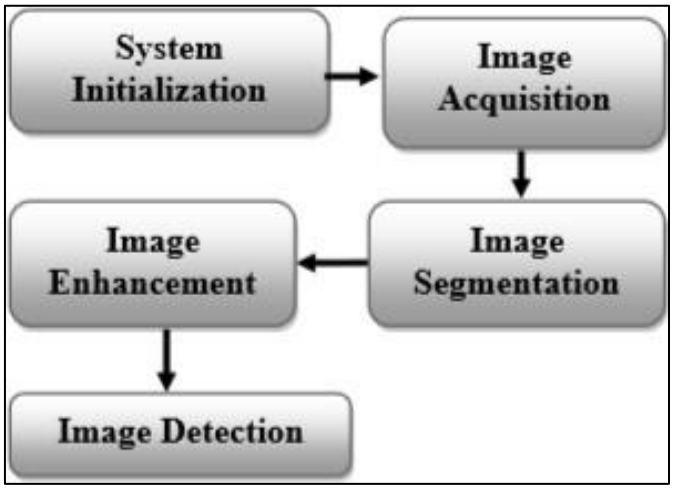

Fig 4: block diagram of system module

A. System Initialization:-

The hand drawing technique will be employed during the system's initialization. The artwork might be made with the park slot number in the hand drawing style, which would aid identify the empty parking lot. The purpose of this strategy is to locate an empty parking spot without involving humans. The graphic generated should be visible, clear, and easy to understand during the start-upperiod, and provide complete and sufficient information on the parking space. The sensor and camera should be stationary at the start of the system design plan. As a result, multiple image processing techniques can be used to the recognised image from the camera.

Fig 5:- System Initialization

B. Image Acquisition:-

The image acquisition module is the next processing module in the Image Processing techniques after the system initialization module. Images from the parking area can be captured using the camera in the Image Acquisition module. In the parking lot, high definition cameras can be employed to capture the images needed for processing. The camera may snap images from the top and side perspectives of the parking lot to provide a sense of the entry picture.

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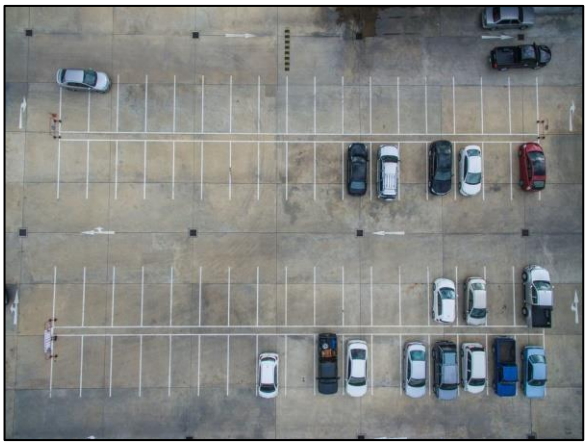

Fig 6: Image Taken form camera

C. Image Segmentation:-

Image segmentation could be the next module type in the Image Processing Steps. Image segmentation is a component of image processing technology that can be used to quickly identify and analyse images[4]. The picture segmentation technique can be represented in the block diagram displayed in the image. 4,

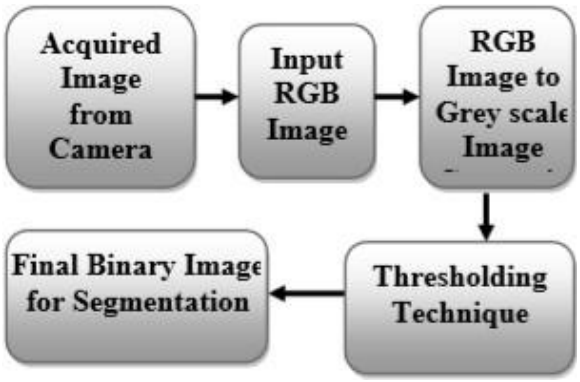

Fig 7:- Flow chart of Image Segmentation Process

The process of image segmentation separates an image into pieces. The number of pixels in the captured image is used to compute the visual qualities. As a result, the image produced by segmentation is a superior output result. When the pixels are added together, they might be able to create the whole image. An empty parking spot in a slot, as well as an Edge, Boundary, Object, and so on, can all be detected using this method. Clustering is used to segment the image, dividing it into many groups. Clustering can be done manually or using the assortment source's Random Selection technique.

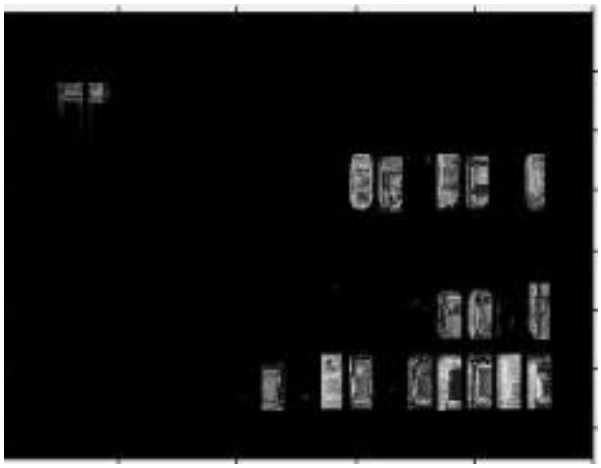

Fig 8:- Binary Image for Segmentation

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D. Image Enhancement:-

The binary image module of the image segmentation module is taken into account. We've cleaned up the image by removing the noise that was introduced during the binary image conversion. It is possible to utilise them to trace the outline of a newly-discovered image. While making a little noise, the digital camera takes pictures at various sites across the world. [9] To remove the noise generated, a morphological technique might be utilised. While segmenting an image, morphology can be utilised to smooth out imperfections[1,7]. Processes that have an impact on morphological mechanisms include: dilatation, erosion, reopening, reclosing, reopening, reclosing, reclosing. To remove noise, the morphological method has been around the longest. Opening techniques in the segmentation process remove small elements from the segmented image, whereas closure techniques eliminate undesired and small gaps from the segmented image. The major purpose of the morphological process is to ensure that edges and pictures are correctly formed without distortion. What are the exact parameters of the proposed system?

You'll need to utilise the photographs to find the vacant parking spot. As a result of dilation and erosion, the output image's pixel range can be increased or decreased at this point. The dilation improves the image contour's pixel range. Unwanted pixels can be removed via erosion. "0" is equal to "0" in a binary picture, and "0" is also equal to "0."

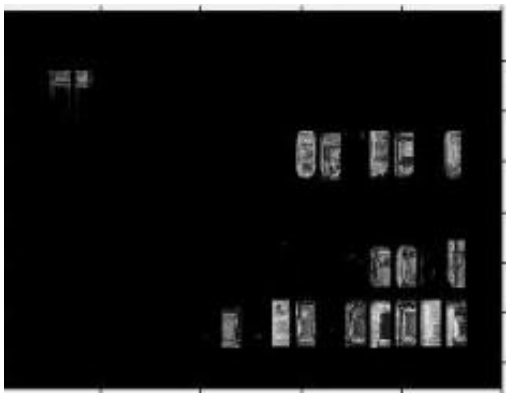

Fig 9:- Image after Noise Reduction

E. Image Detection Module:-

The image detection module is engaged when the image enhancement module receives the exact edge and outline boundaries of an imagen. These characteristics must be considered in order to acquire the correct form of an image using this method. Cars need accurate information about parking in a vacant parking space, which can be provided by a picture of a specific shape. It is possible to build an image form by using the following code.

Shape = (4×pi×area) / (perimeter^2)

Without the need for an operator, image processing may be used to park a car effectively and precisely. An eight-spot parking lot is part of the design plan. With the use of a camera preview display device, an empty parking space can be presented based on a predetermined threshold value. Information can be displayed on the LED display. Additionally, the audio system was integrated into the overall system architecture, in addition to the LED panel. Accordingly, a parking spot can be indicated to the driver by aural notice when a sensor alerts the car that a parking space is available. A automobile may be parked without deformation thanks to the proposed construction, potentially saving time and space.

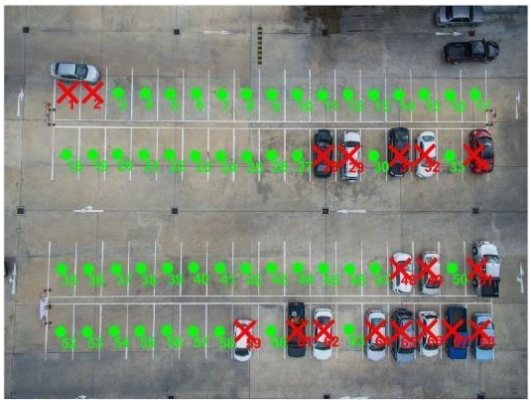

Fig 10:- Detected Parking Slot

RESULT AND DISCUSSION

In tests, it was determined that the suggested vacancy parking space management system extracted accurate vacancy data from recorded car park photos. A test photograph was taken using an 8MP camera mounted in the air. The image was greyed, stretched, smoothed, and binarized using previously reported image processing algorithms.

Without the need for an operator, image processing may be used to park a car effectively and precisely. 68 parking spaces will be included in the planned design. With the help of a camera preview unit, an empty parking space can be presented based on the threshold value.

FUTURE WORK

This software is the first step toward a more practical daily solution. This project can be expanded in a number of ways:

- To establish a central management system that ensures that only authorised information, such as security concerns, is transmitted to the customer.
- More analysis of parking history data may be possible, allowing users to receive recommendations or ideas about parking spots and their availability patterns.
- In addition, when a User parking spot is booked or a space is rented, this research could be used to calculate the price of a parking space
- We could also develop a smartphone application that allows drivers to check parking availability.
- From a faraway location, users can reserve a parking spot for a future job. In the future, GPS, booking capabilities, and licence plate scanning may be included.

CONCLUSION

The provided method correctly detected the presence of autos in parking places. To determine the empty of parking spaces, the picture method was superior to using dilated edge pictures. Both strategies can be combined into a single system. To improve performance, the camera's placement can be modified. The recommended image processing method has been shown to be a viable solution for vacant parking management based on the aforementioned test outcomes. To construct comprehensive and intelligent transportation systems, this might be combined with other technologies like automated number plate recognition and traffic signal control.

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