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Detecting Vacant Parking Spaces using Matlab

Erukulla Eshwar[1], Thumu Anvesh[2], Teja M[3], Mrs. S Latha[4]
[1, 2, 3]*U.G. Student,* [4]*Associate Professor Dept. of ECE, Sreenidhi Institute of Science and Technology, Hyderabad, Telangana-501301 India*

Abstract: *One of the primary stressful conditions in town facilities is looking for a parking place. In this study, we come up with a completely unique approach for parking slot identification based mostly on an image processing method that would capture and device the image to discover empty parking regions. After that, the output can be supplied on a console. This system will lessen down the time it takes to find available parking spots and reduce beneficial aid waste. The proposed system aids withinside the counting of parked motors and identifying the extensive style of available parking regions. Instead of the usage of electronic sensors buried withinside the floors, the era uses photographs to stumble on autos. In the automobile parking zone, a virtual digital camera is installed in a high, steady location. As a reference, a photo of an empty parking lot is taken, followed with the resource of the usage of an image of a parking lot with cars. To calculate the extensive style of parking regions available, dispose of every photograph. Software and hardware systems have been used to grow the cautioned system.*

Keywords: Image processing, parking space, electronic sensors, technology, photographs.

I. INTRODUCTION

Cars have become a necessity rather than a luxury, especially for working people. People even buy cars every month. When it comes to metropolitan areas, traffic bottlenecks have become increasingly typical in recent years due to a significant number of automobiles. We also cannot ignore the presence of automobiles in our daily lives. We have difficulty finding a parking space whenever we go out by automobile. When a car enters a parking lot, the first thing he looks for is a sign that indicates whether the lot is fully occupied, partially occupied, or unoccupied. He also has no idea how many parking spaces are available or where he may find a parking division for his vehicle. Even when the total occupancy is high, some parking divisions may stay vacant. This results in inefficient utilization of parking divisions as well as traffic congestion near the parking lot's entrance. When a result, vehicles in the parking lot and provides an image for processing. Image processing techniques are then applied to the image using the software, and the result is obtained. providing drivers with essential parking lot information as they enter the parking lot becomes a critical issue. When a motorist enters a parking lot, it takes a long time for a parking space to be located by the driver. Using Image Processing to count available parking spaces reduces the cost of solving the driver's problem. The system detects the presence of the car using image processing and offers information such as the number of available parking spaces. The technology uses CCTV cameras to gather images, which it then processes to determine how many parking spaces are available. The system employs MATLAB software to find whether a car is present or not. The MATLAB receives its input from a camera that monitors the movement.

II. LITERATURE SURVEY

A. Eight-Class multi-SVM Classifier

It is a widely used approach for detecting automatic parking. In this method, we first extract features from input video frames by producing detection patches and developing a Gaussian ground model. Then, using this model, an eight-class multi-SVM classifier is trained. Finally, using a Markov Random Field, the categorization is optimized globally.

B. Using Ultrasonic Sensors

Embedded sensors are a common solution to this issue, but they necessitate substantial parking lot construction at a significant cost. In (Lee, Yoon, &Ghosh, 2008), for example, a wireless sensor network with motion sensors under the spaces is used. Park et al. (Park, Kim, Seo, Kim, & Lee, 2008) produce their images with installed ultrasonic sensors and an echo feature. The most widely used instruments for parking space detection are ultrasonic sensors, cameras, motion sensors. Ultrasonic devices, as the name implies, use ultrasonic waves to measure distance. The sensor head sends out an ultrasonic wave, which is reflected by the target. Ultrasonic sensors use the time between emission and reception to calculate the distance to the target. A transmitter and receiver are used in an optical sensor, while an ultrasonic sensor uses a single ultrasonic element for both emission and reception.

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III. WORKING

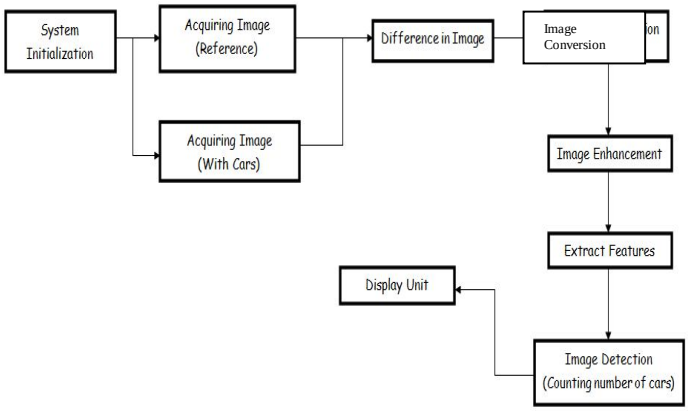

Fig.1 System Block Diagram

Five tiny processing units make up our project. The program that is displayed in Fig.1 is used to create these blocks. The camera and system are set up in the first section, followed by a technique for automatically identifying every parking space that is available in the image. An image with no parked cars is considered to be a reference image when the system first starts up, and this image will be used as the reference image for the rest of the system. After a given interval, the image of parked cars is refreshed or altered. The next phase is image acquisition, which involves the camera capturing images and connecting this module to the system processing unit, which is a MATLAB application.

After the photo is captured then the tool operates making the photo smooth thru filtering the noise and then dealing with the photo for similar processing, withinside the following module photo conversion is performed which separates the preferred object from the records and differentiates the pixels having nearby values for reinforcing the contrast.

If there can be a difference withinside the image, it is subtracted from the reference image, and if the difference is detected, further processing is finished to determine the changes withinside the auto parking area numbers. The image is transformed to grayscale (black and white). Image enhancement is the final module. The generated noise is removed using morphology functions in this module, which take away pixels that do not belong to the object of interest. The image's border devices are tracing, this is targeted on the outside limits. The final module is image detection, this is used to end up aware of the automobiles in a picture. Fig.1 depicts the complete module.

IV. SYSTEM MODULE DESCRIPTION

A. System Initialization

The module is only activated the first time the system is turned on, which is illustrated in Fig.2, the initial image, also known as the reference image is obtained. When there are no automobiles in the parking lot. This is done to identify every parking spot in the image. If the reference image to be considered, the lines dividing each slot must be clear, visible, and unimpeded. All of the time, the location and the direction of the camera should be in such a way that it covers the optimum area. This image is then analyzed to determine which parking lots are available.

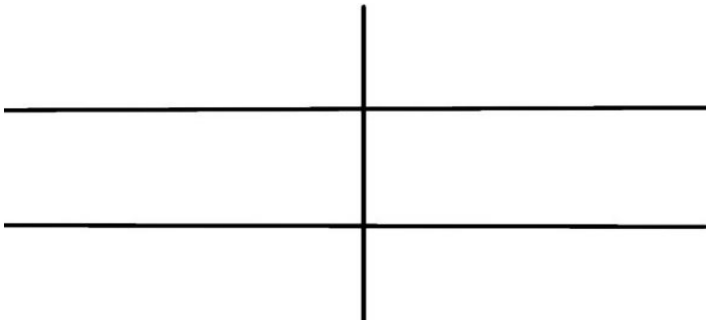

Fig.2 System Initialization

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B. Image Acquisition

The image is processed in the image acquisition module after the first step. Image capture and storage of digital images from video cameras are the steps involved in this process. This is accomplished with the help of a high-definition camera which provides real-time information or images to the MATLAB software with the help of intermediate processors. The camera should be aligned with extreme caution. For the image to be clear and process-able the camera should be placed in the appropriate position. The image obtained by the camera in Fig.3 depicts the cars parked in the vicinity.

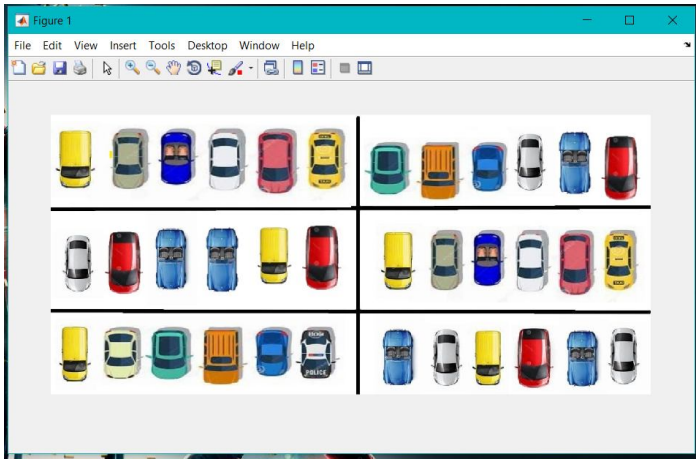

Fig.3 The cars parked in the area

C. Image Conversion

The image which was acquired in the above module is in the form a coloured image or RGB(Red, Green, and, Blue), then the image is divided into RGB channels and turned into a greyscale image. The binary image is then created in the conversion module.

A greyscale image is obtained from RGB using the below equation.

Grey Image= 0.2291R + 0.5872G + 0.1141B

After obtaining the gray level image, the binary picture can be retrieved using the Thresholding technique. The information regarding the shape and position of the cars is available in the binary image. The threshold level is set so that the objects of interest i.e the cars become white and the remaining of the image becomes black. This strategy not only reduces the complexity of the procedure but also simplifies it.

We have considered the basic Thresholding technique in this paper.

Thresholding is defined as: g (x,y) = 1 if x > Threshold_value and 0 if x ≤ Threshold_value…. [2]

The threshold value, given by T in equation [2], is chosen. Since the RGB is retrieved, it is converted to binary and then separated into the proper channel. The Thresholding technique works as explained here: any value less than or equal to T is classed as black (0), while any value more than or equal to T is categorized as white (1). The diagram Fig.4 shows the R, G, and B channels of the converted binary image.

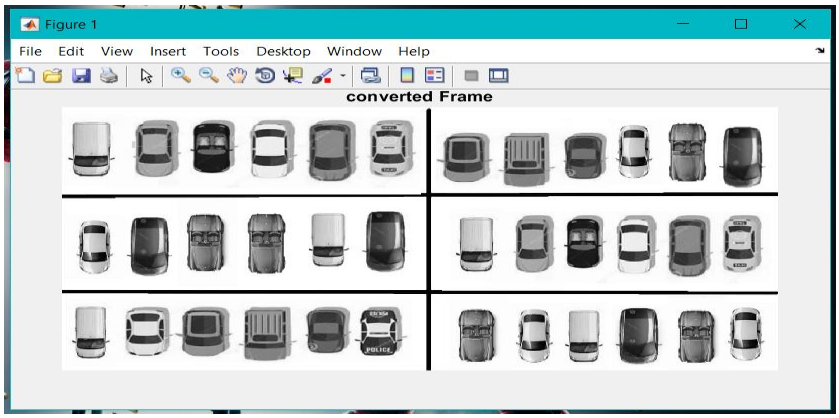

Fig.4 RGB image to greyscale image(Converted Frame)

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D. Image Enhancement

The binary image will have some noise due to transmission and will trace the object's boundaries. To remove the noise that the image has picked up from several sources, morphological operations such as dilation, erosion, and so on will be used. On the binary image, we employed an open area in the study. The majority of image processing operations rely on this operation.

The image after noise removal at the detected object is shown in Fig. 5. (white color). We just trace the car's outside boundaries while tracing its bounds. If any pixel value of a binary picture is 0, the output is 0. The image is upgraded by adding pixels to fill in the gaps and removing pixels to remove undesired things.

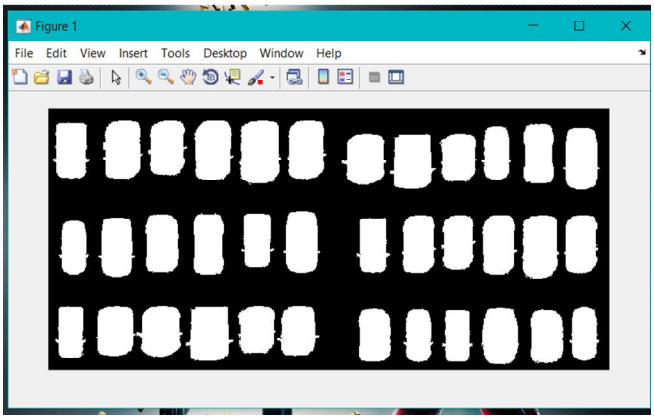

Fig.5 Enhanced Image

E. Image Detection

After the enhancement of the image and filtration of external noise, the blobs which are shown, are cars from the original image. This is the final section and the objective is to count the total number of cars present. Since it is a binary image, using an inbuilt Matlab method each blob is labeled with a sequence of numbers starting with one. The image itself acts as a matrix filled with zeros where there are no cars and in the area where cars are present, the matrix is filled with the blobs sequence number. Finding the maximum value of the matrix would result in the total number of vehicles present in the parking lot.

V. ALGORITHM

The following are the main steps in the suggested parking space detection algorithm:

A. With the help of a high-resolution camera the reference image of the parking lot with no cars and the main input image consisting of cars is considered as system initialization and image acquisition.
B. Grayscale images are created by converting RGB photos to grayscale images.
C. Perform calibration, which entails determining the parking coordinates. Then, select the coordinates of the single parking slot. The parking lot is divided into equal parts because of this.
D. Each block is converted from grayscale to binary, then inverse binary, resulting in a white car and a black parking lot.
E. In each block, a threshold value is determined to determine if the block contains an automobile or not.
F. If the value is less than the threshold value, the block is free and open for parking cars; if the value is larger than the threshold value, the block is occupied.

VI. FUTURE SCOPE

The guidance information display on this device can provide drivers with a vital real-time parking lot information. Researchers can concentrate their efforts in the future on allocating specific locations to clients who have previously registered with an online parking management system. Many automated car parking systems currently exist, utilizing technologies such as GSM, wireless transmitters, and other similar technologies. This project was chosen with care. Several CCTV cameras may be put to use to oversee a vast region. Because it uses genuine car photos, it is constant in recognizing impending cars. Because of the simple technology, it is inexpensive and straightforward to install. The guidance information display on this device can provide drivers with a vital real-time parking lot information.

Researchers can concentrate their efforts in the future on allocating specific locations to clients who have previously registered with an online parking management system.

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VII. CONCLUSION

The parking spot detection system was created and tested in MATLAB using image processing. Using multiple cameras, it is feasible to oversee a big region. Because it uses genuine car photos, it is constant in recognized impending cars. Because of the simple technology, it is inexpensive and straightforward to install.

The parking spot detection system was created and tested in MATLAB using image processing.

VIII. ACKNOWLEDGEMENT

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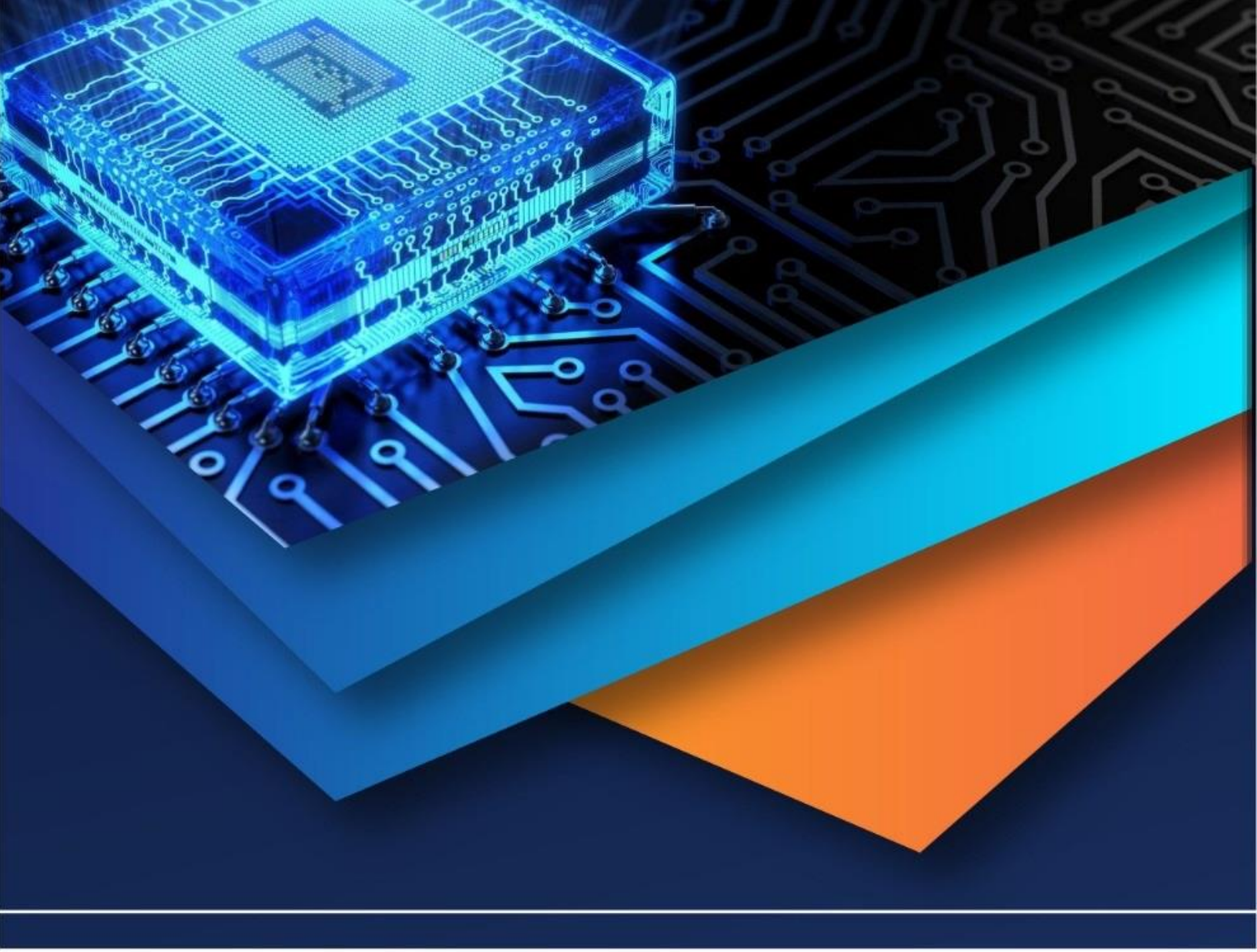

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