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Car Parking Slot Detection Using Image Processing

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ABSTRACT - Parking space limitations and traffic congestion stand out as the two main problems that drivers in big cities throughout the world are currently experiencing. Population growth is driving up demand for autos, which is rising daily. Heavy traffic in crowded cities is evidently caused by the same lack of parking places or improper management of those that are available. We can either strive to add more parking places or to effectively use and manage the ones that are already there, and the latter is obviously more effective. We must devise a clever and effective strategy to make the most use of the resources at hand in order to avoid wasting money, time, or fuel. A secure and intelligent parking system is essential, particularly with regard to parking .

KEYWORDS- Car Parking Slot Detection, Image processing based algorithms

I.INTRODUCTION

Finding open parking spaces in parking lots is a common challenge for drivers. This study describes an image-processing-based smart parking lot management system. From aerial photos of the parking spot, an image processing technique is utilized to find unoccupied spaces. The program analyses the image and extracts information on spot occupancy and their locations. The technology also provides information on whether or not specific parking spaces are occupied. Newly arriving drivers are provided with occupancy information by projecting it onto sizable displays placed at strategic locations nearby. The smart parking lot management system makes managing these spaces less expensive and lowers the stress and time waste associated with car parking.

II.RELATED WORKS

Following an extensive research of the literature , we have selected a few noteworthy works and have listed them below:

Benjamin Kommey et al, [1] This study describes an image-processing-based smart parking lot management system. From aerial photos of the parking spot, an image processing technique is utilized to find unoccupied spaces. The system analyzes the image and extracts information about spots' occupancy, including their locations.

Fazel Mohammadi et al, [2] In this study, integrated on-site data collecting is effective for creating a secure and dependable cloud-based intelligent auto parking system. It utilizes wireless sensors.

Md.Omar Hasan et al, [3] The suggested system deploys zoom-lens cameras that use motorized heads to detect vehicles as they enter or exit a parking lot and then take pictures of license plate numbers from those plates. Wide-angle fish-eye lens cameras are utilized specifically to monitor the huge parking lot using a custom-designed deep neural network which aids in the development of a more flexible and cheap parking system.

Md. Motaharul Islam et al, [4] This model uses a dataset of tagged parking spaces to train the model. uses region-based convolutional neural networks (R-CNN) to locate parking spaces accurately.

Pavlo Radiuk et al, [5] This system trains a group of convolutional neural networks (CNNs) using a substantial dataset of parking slots. uses a sliding window method with non-maximum suppression to find parking spaces.

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Wenhao Zong ID et al, [6] This model uses the Vibe algorithm to separate foreground items from the background. Applies. Parking spaces are identified using color-based segmentation, which uses their color features. uses contour analysis to determine the parking space borders.

III.PROBLEM STATEMENT

To create an automobile parking spot detecting image processing system. The system should be able to precisely locate open parking spaces in a certain parking location. Identifying parking slot boundaries, allowing diverse slot kinds, and offering real-time processing capabilities are among the problems. The ultimate objective is to develop an effective and dependable system that can function in various settings and provide accurate information regarding parking space availability.

IV.DESIGN AND IMPLIMENTATION

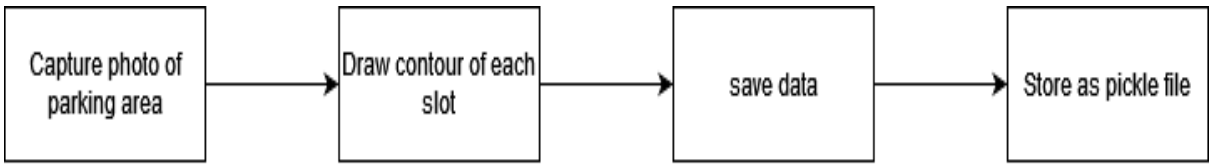

Fig 1: Block Diagram Of Mapping

Capture photo of parking area: The occupancy status of each parking space can be ascertained by taking a picture of the parking area and analyzing the image. Drivers can easily and quickly find parking places by using this information.

Draw contour of each slot: By taking a picture of the parking lot and looking at the image, it is possible to determine the state of each parking space's occupancy. Using this information, drivers may locate parking spaces quickly and easily.

Save data: Saving information about the parking area normally requires gathering and storing pertinent data about the status of each parking slot's occupancy in automobile parking slot monitoring systems.

Store as pickle file: The trained model or any other pertinent data connected to the detection system is saved using Python's pickle module when an object is "stored as a pickle file" for automobile parking space detection. The Pickle serialization package makes it simple to save and retrieve complicated data structures by converting objects into byte stream representations and vice versa.

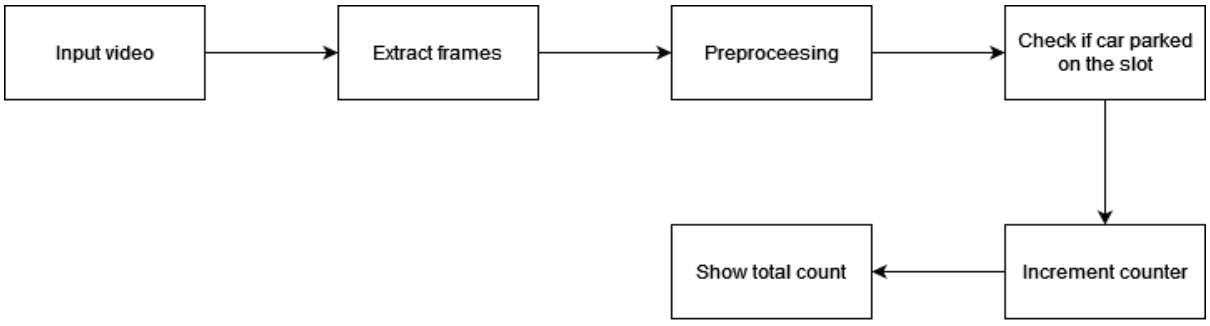

Fig 2: Block Diagram Of The Proposed Methodology

The system is given video input. The frames are taken from the video and pre-processed. The user will define the predetermined car parking slots for the video. The system checks to see if there is or is not an automobile in the slots. The slot counter is increased based on this.

Input video: When a camera or other imaging device is used to monitor a parking area, it is referred to as input video. The video usually consists of a number of frames, each of which captures the parking lot at a particular moment in time.

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Extract frames: The practice of recording individual frames or images from a video stream or a sequence of images for additional analysis and processing is referred to as "extracting frames" in the context of automobile parking slot detection. In the context of car parking slot detection, it entails isolating and extracting frames from a video or picture sequence that contain parking slots.

Pre-processing: The set of processes and methods used on input data (usually pictures or video frames) before the detection algorithm is actually used are referred to as pre-processing in the context of automobile parking space detection. Pre-processing aims to improve the data's quality and identify pertinent elements that help with precise and effective parking place recognition.

Check if car parked on slot: The technique of determining whether an automobile is parked in an allocated parking space or not is known as car parking slot detection. Computer vision techniques are frequently utilized for this detection, and photos or videos of the parking lot are captured using cameras or other sensors.

Show total count: The technique of determining whether an automobile is parked in an allocated parking space or not is known as car parking slot detection. Computer vision techniques are frequently utilized for this detection, and photos or videos of the parking lot are captured using cameras or other sensors.

Increment counter: An algorithm or technique called an increment counter is used to keep track of how many parking spaces are available in a parking lot. Based on the detection of cars entering or departing the parking spaces, the counter is increased or decreased.

V.RESULT ANALYSIS

The method of recognizing and evaluating parking spaces in pictures or movies is known as car parking slot detection. Evaluation of the detection algorithm's or system's precision and effectiveness normally occurs during the result analysis of car parking space detection. This model is a accurate model which analyse the actual number of slots available in green colour and the slots which are filled in red colour. In this model Image processing based algorithms are used.

VI.RESULT AND DISCUSSION

In the fields of computer vision and autonomous driving, the recognition of car parking slots is a crucial problem. In order to help drivers or autonomous cars locate adequate parking spaces, it involves the detection and recognition of available parking spaces. This technology has the potential to significantly increase productivity, lessen traffic, and improve the parking experience as a whole.

The following steps are commonly involved in the car parking slot detection process:

Image Acquisition: Cameras mounted on cars or in parking lots are used to take pictures or video frames of the parking area.

Preprocessing: By transforming the image to a binary code, this technique in image processing may distinguish between certain objects or regions and their surrounding background

There are few techniques performed under the term preprocessing:

Grey Level: The intensity or brightness of a pixel in a grayscale image is referred to as the grey level in image processing. In a grayscale image, each pixel represents a distinct shade of grey, from black (the lowest intensity) to white (the highest intensity), spanning from the image.

Adaptive Thresholding: Adaptive thresholding determines various threshold values for various regions of the image as opposed to global thresholding, which applies a single threshold value to the entire image. When dealing with photographs that have different lighting or contrast, this method is quite helpful.

Blur Technique: The blur technique, also known as image blurring, is a popular image processing method that lowers an image's sharpness in order to minimize noise, conceal delicate features, or provide aesthetic effects. To produce a smoother appearance, it includes averaging or blending the pixel values in the vicinity of each individual pixel.

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Dilation: Dilation is a fundamental morphological technique used in image processing to improve or change the size and form of objects in an image. It is a member of a class of operations known as mathematical morphology, which focuses on the evaluation and manipulation of shape information in visual representation .These methods helps in better detection of the effective parking slots.

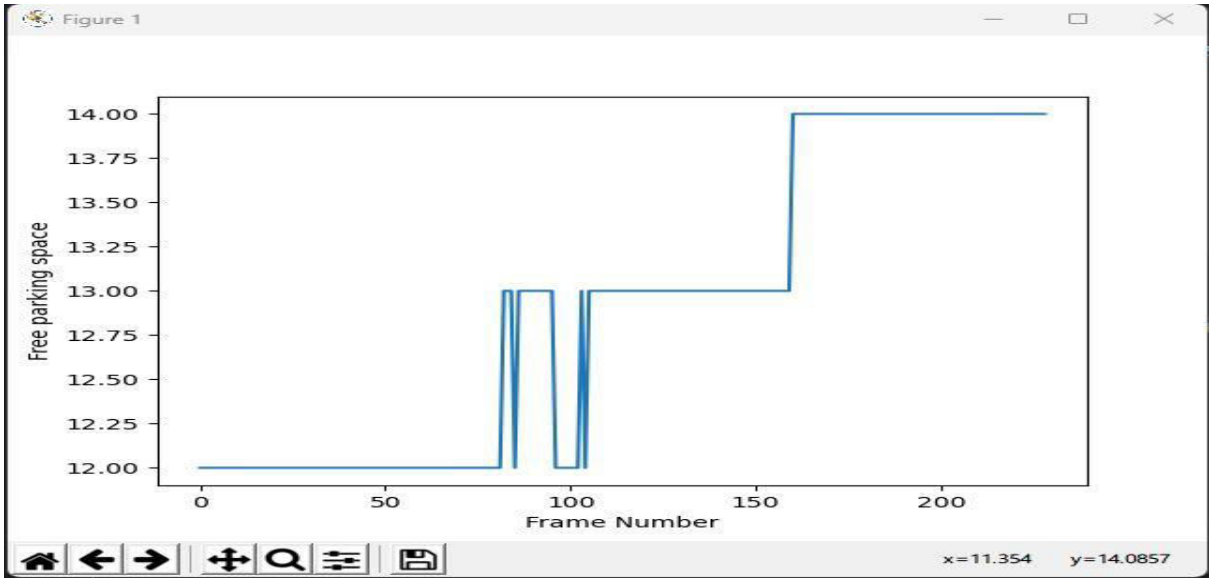

Fig 3:Graphical Representation of Parking Space

In the above graph the X axis represents frame number and Y axis represents the free parking space available.This models' accuracy rates can vary, but they are typically pretty high. Detection accuracy rates exceeding 95% are frequently possible in well-managed locations with distinct parking markings and excellent lighting conditions. The accuracy may decline in more difficult situations, such as congested or inadequately marked parking lots.

VII.SNAPSHOTS OF USER INTERFACE

Figure 4 : Random Image Of a Parking Lot Where The Availability Is Analysed

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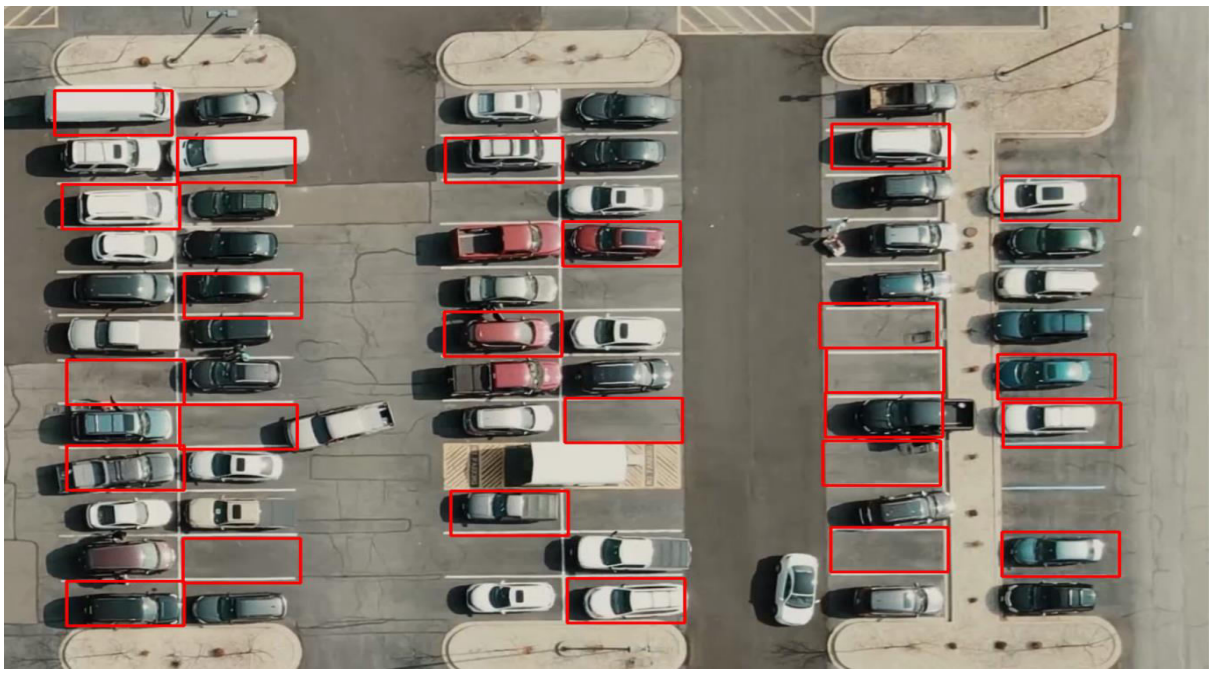

Figure 5: Manual Mapping of The Slots Done By User

As mentioned in the above Figure 4, every slot in a particular parking unit can only be checked for availability when the user manually selects them to check their availability. In the above figure the slots which are marked in red are marked by the user to check availability, the system will not consider the unmapped slots

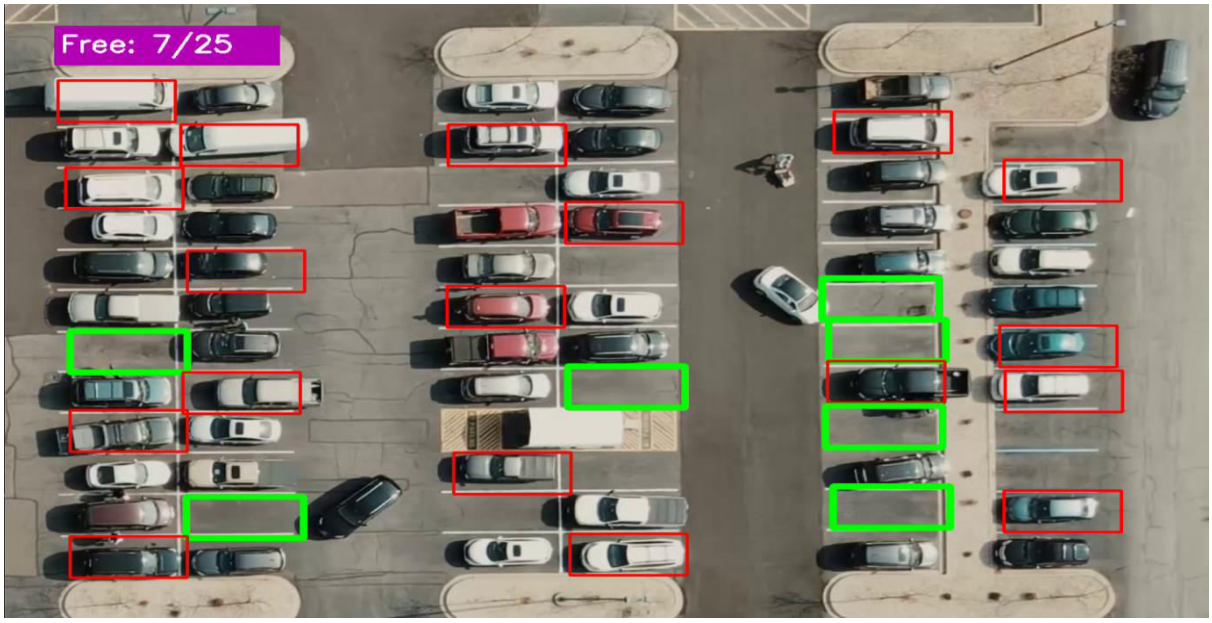

Figure 6 : Result of Available Free Parking Slots

In the Figure 5, the result is provided for the slots which are mapped by the user .Here we have selected a total of 25 slots in which the system detects 7 of 25 slots are free. The free slots are represented in green colour and the slots which are not available are represented in red colour.

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VII.CONCLUSION AND FUTURE WORK

Slot detection for automobiles is a crucial technology that has several advantages and the potential to transform the parking sector. Parking slot detection systems can precisely identify and categorize available parking spaces in real time by using cutting-edge computer vision techniques and machine learning algorithms. Improved efficiency and convenience for drivers, lessened traffic congestion, more safety, and higher income collection for parking lot operators are all advantages of automobile parking slot detection. Drivers can save time and energy by not having to spend as much time looking for parking, which improves traffic flow and lowers emissions.

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