Parking Slot Detection Using Computer Vision

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***Abstract*—** The paper of Parking Slot Display is in the domain of Smart Cities and therefore needed software to design the functioning of the system and some hardware to let the users know about the situation. To detect the object we have included pixel which in count will judge the presence and absence of car as an object. The detection technic is therefore pixel conversion. It includes various steps which is further explained in the paper.

Keywords —Image Processing, Libraries, Machine Learning, Modules, Python.

DOI Number: 10.14704/nq.2022.20.7.NQ33062 **Neuro Quantology 2022; 20(7):490-495**

I. INTRODUCTION

Analogy for information display near parking lot is must nowadays. Driver should get the information about everything in the parking lot, where to park, how many places are vacant, how is the facility and how big it is. As we know when we have to wait out of the parking lot, vehicle is turned on for quite a long time, thus wasting the fuel and also polluting the environment.

As pollution is becoming a big issue currently. Also this paper helps in reducing the problems of traffic jam in the parking space. For example whenever we enter a parking lot we roam around checking for free parking and then there is also a car behind us and if we don't find a parking space we have to then take a U-turn and thus making car behind us also move back and if there is a car behind the car then it will result in traffic jam.

Management is the real issue here. Sometimes either there are very few cars or there could be numerous resulting great traffic jams. The total display must be simple and not waste the time of driver so that he could move on soon if places are not vacant. In this paper we have proposed a system or a software which would automatically detect the existence of the vehicle and will detect total number of available parking.

We don't have to install or make changes like making new underground basement in order to install the system. So, this is the plus point of the proposed system.

Status of display is so mobile and live that it only depends on frame rate of camera and the work is done by software analyzing the entrance and exist of car from the slot. Infrastructure is not distributed while installing the equipment or we neither have to create any special arrangements for the same.

II. LITERATURE REVIEW

Currently, smart new technology parking system has changed the existing parking method and improved user accessibility.

In [2] it presents a visual-based algorithm for the Searching for available parking spaces in images using AVM system. It is shown that parking spaces are identified using RANSAC technique and the corner-based recognition of slot marking and the slot occupancy is classified in effective way by analyzing the pavement and non-pavement features of slots.

[5] This cannot be implemented in Client service systems that send current traffic conditions to vehicle driver. In this paper, a WSN-based traffic monitoring and control system is proposed. This network of surveillance systems is depends on a web of wireless sensor placed at every junction in the road network.

[3] shows an intelligent parking system using RFID IoT module and cloud server or mobile application. Commercial parking lots could also use this automation to streamline monitoring and provide transaction flexibility.

[1] describes an efficient algorithm for using intelligent parking systems. Another problem that may be faced when working with intelligent parking systems and solutions that provide a better platform for all users has been expressed.

The work [6] describes a monocular vision system capable of identifying the markings of parking spaces. An important contribution is the identification of lane segments and structural models of parking lot lanes using peak pair detection in Hough space. We have to mark the parking slot in the system itself. If slot is not marked in real, it doesn't affect the working of the system as in this paper's system does.

[7] Smart Parking Management System (SPMS) is introduced which supply drivers the latest information regarding to the parking spaces and helps drivers to find their parking lots easily, especially in the big parking lots.

In [9] using stationary camera in various environmental conditions they proposed real time object tracking system. They identified and tracked moving objects in an environment made up of objects of various sizes, shapes, and colors.

III. METHODOLOGY

a. Theory

[8] And all, Object Recognition and Tracking in Video The detection and tracking of moving objects is an important fundamental task of computer vision technology. Tracking is the identification of the position of an object in successive frames of an image. This is an early step in many advanced applications that can be useful for long-term tracking. Some of them are listed in Table 1.

Table 1 Applications of object tracking

Areas	*Specific applications*
Surveillance	Monitoring a scene to detect suspicious activities or unlikely events
Motion-based recognition	Human identification based on gait, automatic object detection
Traffic monitoring	Real-time gathering of traffic statistics to direct traffic flow
Human-computer interaction	Gesture recognition, eye gaze tracking for data input to computers
Vehicle navigation	Video-based path planning and obstacle avoidance capabilities
Video indexing	Automatic annotation and retrieval of videos in multimedia databases

The first step in this method is to split the video from the database into various shots and frames. The next step is feature extraction. The proposed method extracts some features, such as color features and pixel extraction features, from the segmented image.

i.*Image Initialization*

In this first section of processing we are going to initialize a basic image on any of the python IDE (we have used pycharm). This include help from cv2 library of python and loops of python which helps to put or generate an image that we already have saved in a folder to get its access in our IDE. Here we are able to see any kind of image that is saved if it is in '.jpg' form.

ii.*Image Detection*

Image recognition/detection is a computing technology related to image processing, computer vision and deep learning that handles the detection of instances of objects in videos and images. Here object are detected in a moving video of changing frames but its initialization is done on image corresponding to various coordinates that we select on the image. This is the most important part of detecting an object, a car etc.

iii.Video Acquisition

Video Acquisition is the act of returning to an external source for further processing. It is consistently the fundamental step in the workflow since we can't get access to any attributes unless and until we display the actual video or footage from live cam.

iv.*Video frames Enhancement*

Frame enhancement is the process of highlighting specific information of the image and also weakening or removing any unwanted information according to our needs. We can enhance the quality of output we want.

v.*Each Slot Segmentation*

In the Image segmentation part a digital image is broken down into the different subgroups called as Image segments which is helpful in the reducing the difficulty of the image to make further analysis or processing of the image simpler. Segmentation in simple language is assigning labels to the pixels.

Here we will be assigning pixel to each segment of the car slot and set a limit.

vi.*Synchronizing the topics*

This is the last segment where all the data which is there and newly created by various image processing methods shall me merged and create a full-fledge working program.

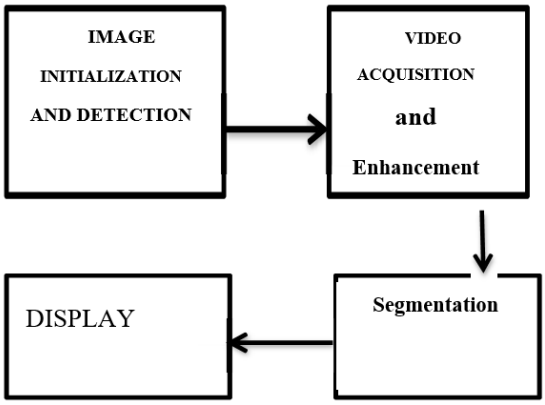


Fig. 1. Block diagram of Software Process

This is the basic flow chart on how the system is going to work for detecting car in each parking slot and display it in on the screen. This diagram shows the seriality of each task and how the earlier task is going to help the followed one.

vii.Various Equipment and there Positioning

A P.C. is needed in order to code for a programme and therefore could give a signal further. A display screen is needed in order to display the live condition of parking lot so that driver could get the idea of present condition and availability of spot. A camera is needed so that program could work on live frames.

A. P.C.

A p.c. could be setup anywhere possible as it is only useful to run the program

B. Display Screen

A display screen could be set up at the entrance of parking lot. So that driver could get a clear idea whether parking is available or not.

C. Cameras

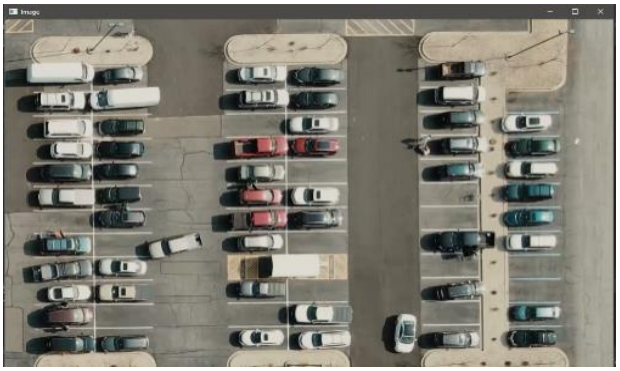
CCTV cams are required in order to keep a watch on parking slot 24/7 so that the program keeps detecting frames and gives output a result of vacancy. The cctv cam should be set up in birds eye view of the parking lot. The reason is, we need a perfect birds eye view in order to detect all spot simultaneously. If the area is big then there could be 2 possibilities, either camera could be a little upwards or more such cameras are required.

D. Cost

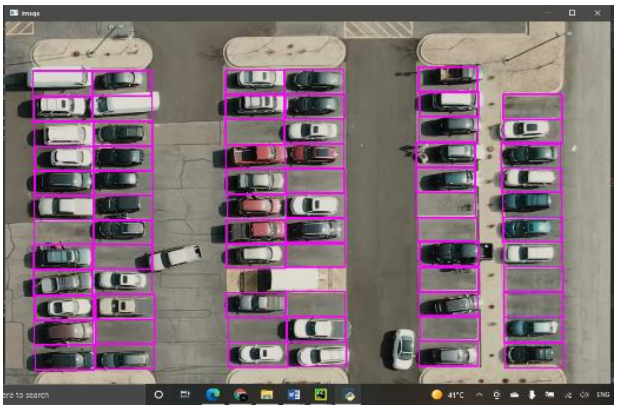
Total cost could be a high but this is one time investment for an organization. We are eliminating the workers who work inside the slot giving directions to the cars. Therefore, employment cost could be deducted. Calculating cost for each instrument required, it could go upto 55,000-60,000 Rs.

b) Algorithm

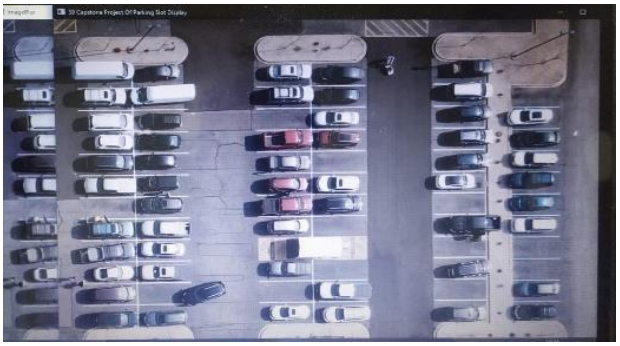
c) Testing



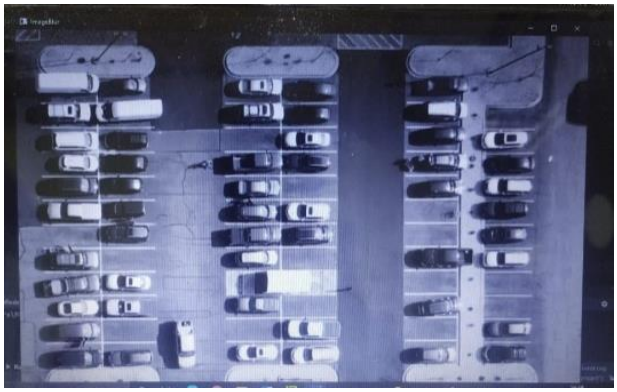
The picture shows the part of image initialization. Due to unavailability of parking slot and cctv camera we have taken a image and a video from internet where it shows car exiting and parking in the lot.



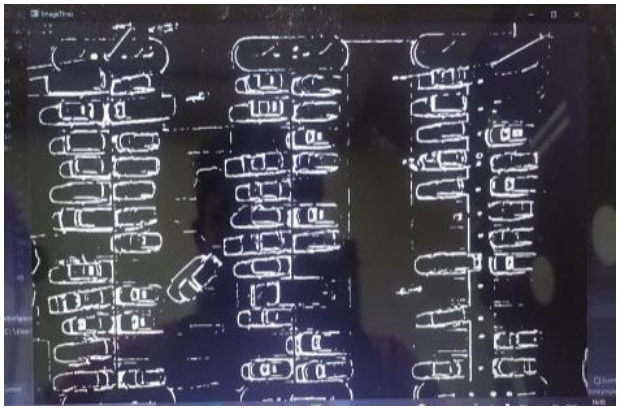
This picture shows the image detection part successfully performed where area is selected by purple rectangles and its coordinates are saved in a file in the form of object list. We can select and delete any rectangle anytime.



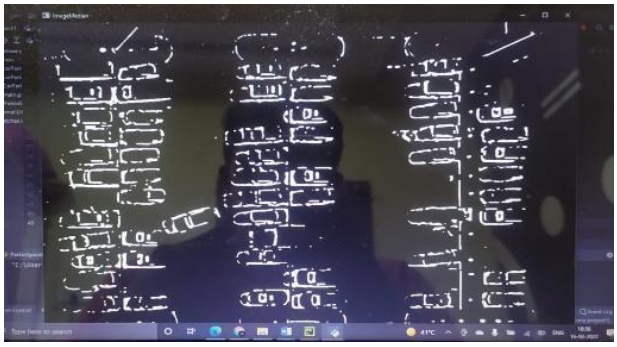
This is the picture from the video running on IDE. This shows acquisition of video and now we can make changes in this video to get pixels. Further steps are enhancing part



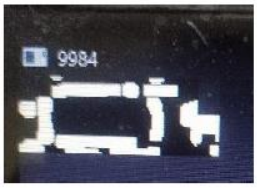
Now the video is more blurred and gray compared to the original video. As we only deal with black and white color in pixel , so we have made it gray. Now the video is ready for converting into pixel form.



This is the pixel conversion of video by threshold function in cvzone. The video still has some unwanted pixel away from parking slot which need to be removed. This would increase the accuracy of the pixel count.



Here unwanted pixel is removed and now the video is ready for counting pixel on each slot.



These are the pictures of three out of 69 parking slot in the video. 2 of the images has clear pixels in it and we can count that by loops in python and one has very few pixels. Therefore by if-else's condition we can se a limit that if its higher than predicted pixels then show red colored slot as car is assumed to be there and if it has less show green colored slot.

This are the final picture of the model. Here with a final touch of displaying vacancy on the display screen itself has been done. 2 pictures are given one has 12 vacancies before a car left and other has 13 vacancies after the car left. Therefore, the system has been performing successfully.

IV. Results and Discussions

This paper provides the society more efficient and simple way for automatic parking slot detection. The system is developed using simple image detection methods. When there is no noise (e.g. trees, huge objects) accuracy of this software is very high. Due to this proposed system many problems like traffic jams outside of parking space, pollution, wastage of time and fuel, drivers frustration etc. problems can be reduce. Usage of manpower can be reduced using this technology. In addition, it improves the quality of life.

V. Limitations

The important thing required in our system is the bird's eye view set up of camera. Without that we couldn't find similar distanced slot for parking and selecting area would be randomized. There should not be any noise (e.g. trees, huge objects) rather than car. If it does software would count its pixel and if it is greater than set limit then it would show parking space is acquired.

VI. Future Scope

We could add a programme and connect it to a billing and ticket machine which would independently allow the driver to select there parking slot. Also, driver could be given a ticket to his/her parking slot number and charged for the same. Continuing with this system user could include a second file and code with the help of Computer vision itself such that it could detect the car's registration plate and therefore not a single man could be required for any kind of transaction or information transfer.

VII. Conclusion

This research paper presents the overview of the proposed system where we are dealing with parking space and how to manage it using technology and various machine learning algorithms. Now, driver could enter the slot and by seeing the screen he could get the idea whether parking is possible or not by seeing vacancy. After leaving the parking lot it turns green and vacancy no has been incremented by one. This includes help from libraries so we could get access to various functions and methods of different classes in the stored library. Packages such as Numpy, Cv-zone, Pickle and opencv are required to run the system. Cv-zone is considered to be the eye of Machine learning. We have used 5 concepts of image processing in this paper where we are dealing with image and video. This paper had a specific aim of management of parking slot and therefore we had continued with this.

Acknowledgment

We are very grateful to our guide Ms. Shailaja Uke for her useful guidance. She guided us on how we could make our system better and what could go wrong so that we could be prepared for it

beforehand. Things such as design thinking, algorithm building was the key idea and was done successfully.

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