Proceedings of the 2nd Indian International Conference on Industrial Engineering and Operations Management
Warangal, Telangana, India, August 16-18, 2022

Smart Parking System Using Object detection

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Abstract

Nowadays parking of a car has become a great issue in these metropolitan cities. Smart parking systems, when implemented correctly, can significantly alleviate many of the difficulties associated with traffic congestion in urban areas. Many modern parking systems will have a fundamental section of Empty Parking Slot Detection. This paper mainly concentrates on smart parking system based on image processing which is developed for open parking plots and many more. It is proposed as an acquisition to new evolving technology by using python programming and OpenCV tools library such as HAAR Classifier. Using edge detention and coordinate constrained pixel portions, it is possible to detect unoccupied parking spaces using photos of the parking lot. Edge detection helps in many ways in processing the image by noise reduction, locating the intensity gradient in the image, non-maximum suppression and hysteresis threshold. In the other section, a digital image consists of columns and rows of pixels. A pixel in a particular image can be identified by determining which column and row it belongs to. The graphic system would then transform the image coordinates into pixel coordinates.

Keywords
Smart Parking, Edge detection, threshold, Open CV, and HAAR Classifier.

1.Introduction

Anggi Sahfutri et al. (2018) developed Smart Parking Using Wireless Sensor Network System With the successful application of modern parking using wireless sensor networking parking spots are spotted and imparted to a database. The sole non-theoretical aspect of the smart parking tenancy tracking and perception system for smart cities is that it allows cars to determine open parking places rather than their actual location. As it can't be possible to find the exact location in replacement of this technique, Image processing technique is followed to know the image of the parking area to find out empty space. Paul Melnyk et al. (2019) presented Towards a smart parking management system for smart cities which makes parking easier, faster and it also reduces drivers search time for empty parking. This technique used only in large car parks by rapidly decreasing battery life with the increasing precision requirements. This smart parking system platform is supported by mobile app. Wiedjaja Atmadja et al. (2014) developed Parking Guidance System Based on Real Time Operating System,which measures sensor measurement range determine the safe distance and also update time. The cost of setting up a sound, operational parking management program is usually considerable due to the high cost of structure or installation. Bibi et al. (2017) proposed Automatic parking space detection. By simple video the empty parking space is identified by Automatic parking space detection system and drivers could go to that particular area. If they are any small objects which blocks the view though it is not fully blocked it shows that space is full. Here as replacement optical character recognition technique is used so that if only the number assigned is totally blocked then it shows that the parking lot is filled.Ibisch et al. (2013) developed Towards autonomous driving in a parking garage: Vehicle localization and tracking using environment-embedded LIDAR sensors where Vehicle locating and monitoring using environment-embedded lidar sensors minimizes drivers search time for empty parking. It reduces the drivers stress while driving. The usage of sensors is not cost effective and using it everywhere is not possible. In replacement of sensors Open Cv library is used. Das (2019) proposed a novel parking system which is outlined for smart cities can provide real-time data for motor vehicle owners with mitigation and attainability. Lots of data need to be collected to run this application. As there is involvement of cloud computing

process in the project, so the deletion of this process profits in cost cutting of the actual project. Family algorithm is not followed.
Aydin et al. (2017) implemented A Navigation and Reservation Based Smart Parking Platform Using Genetic Optimization for Smart Cities a avenue to a nearest free parking lot is observed and this lot can be privatized for this user. App should be advanced in order to use the procedure and everyone will not be aware of keys that are used in this apps. Porle et al. (2021) presented an android based smart parking system to lower the traffic congestion and helps to identify the amount of time the vehicle is parked and calculates the charge to be paid. There will be no need of a person to calculate the amount and collect it. It involves a different software to be developed to design an app. It also compels every person to have an android based mobile phone which is not possible.so as a replacement, in further development IOS platform is also being focused and also own mobile banking system is being developed to avoid the need of other banking system or cash. Athira et al. (2019) developed Smart Parking System based on Optical Character Recognition is a time saving process because it doesn't need to be manually managed. This helps in recognizing the vacant spaces in parking lot without circling in the l ot. This method involves capturing and storing digital images with high quality camera. Misplaced camera even gives wrong information. So to avoid this OCR system is used. OCR System use pattern recognition to look at a printed image and generate a digital equivalent. It is easy to modify and store files because it consumes less data.

The extension in population leads to an extension additionally to human mobility. This will impact in the expansion of number of vehicles which influences the parking circumstance. Now a days, the taste of few people in purchasing vehicles is regardless of whether they have no place to park, that leads to heavy traffic on the streets. Normal parking regions have simply vacant spaces, and individuals have to search for an empty parking space manually. The proposed system uses OpenCV library for making the parking system easy and accessible.

2.Algorithm

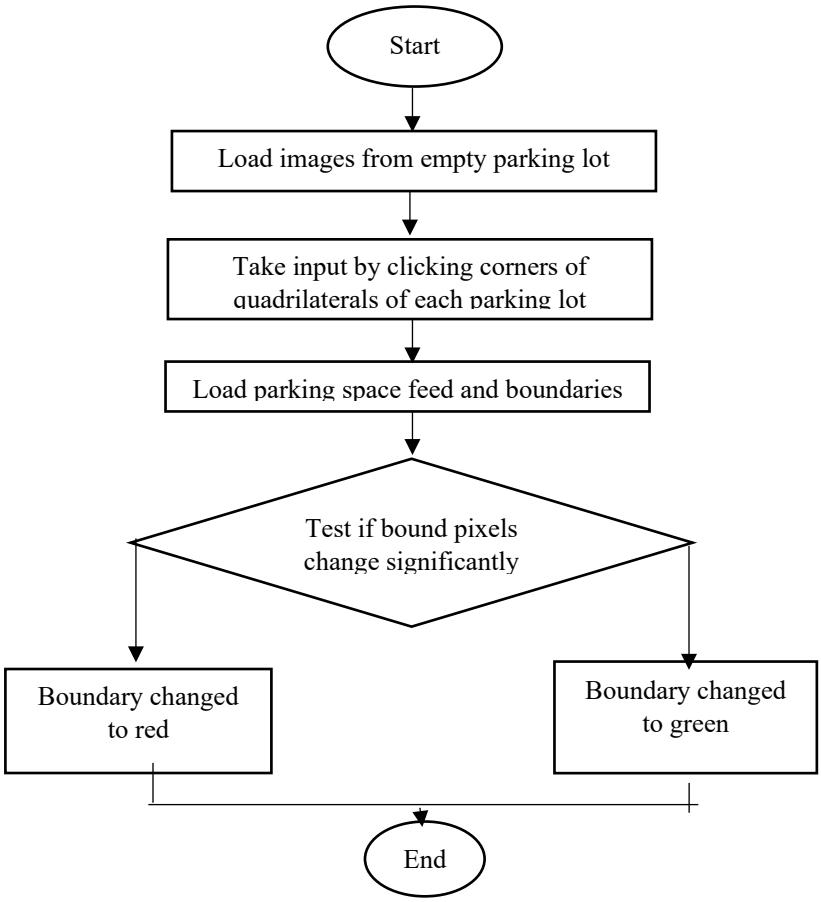

Figure 1. Flowchart of proposed algorithm

Whenever the code is run, the still picture appears, and the mouse is used to construct a quadrilateral from the three input points. The coordinates of such input points are stored in a YAML file, and the video stream is exhibited by inputting the letter 'q'. Each parking place is split into 4 quadrilaterals, which are either red or green in colour. The colour red signifies that a vehicle is parked in the quadrilateral, whereas the colour green shows that it is accessible for parking. The following figure 1 depicts the algorithm such that the images of parking lot are taken and the inputs are quadrilaterals and output is determined by the colour of the quadrilateral as in the proposed system.

3.Proposed System

A system that labels parking spaces as occupied or vacant is proposed. In situations where a camera is mounted at a lamp post view and parking spaces are visible, such a device is extremely useful. To discriminate between parked and vacant spaces, the system employs a mix of the Laplacian operator for edge detection, the HAAR classifier for object acknowledgement, and motion tracing. Background subtraction techniques, contours, and morphological processes are utilized to track motion.

The HAAR classifier was compared to the SVM and HOG classifiers. Although HOG paired with SVM provides better prediction than HAAR alone, the processing required for HAAR is much less than for HOG. As a result, HAAR was completed and is now ready to be implemented. HOG's pedestrian detection inherent opencv2 function is used, however you can see how it reduces the pace of execution by turning it on.

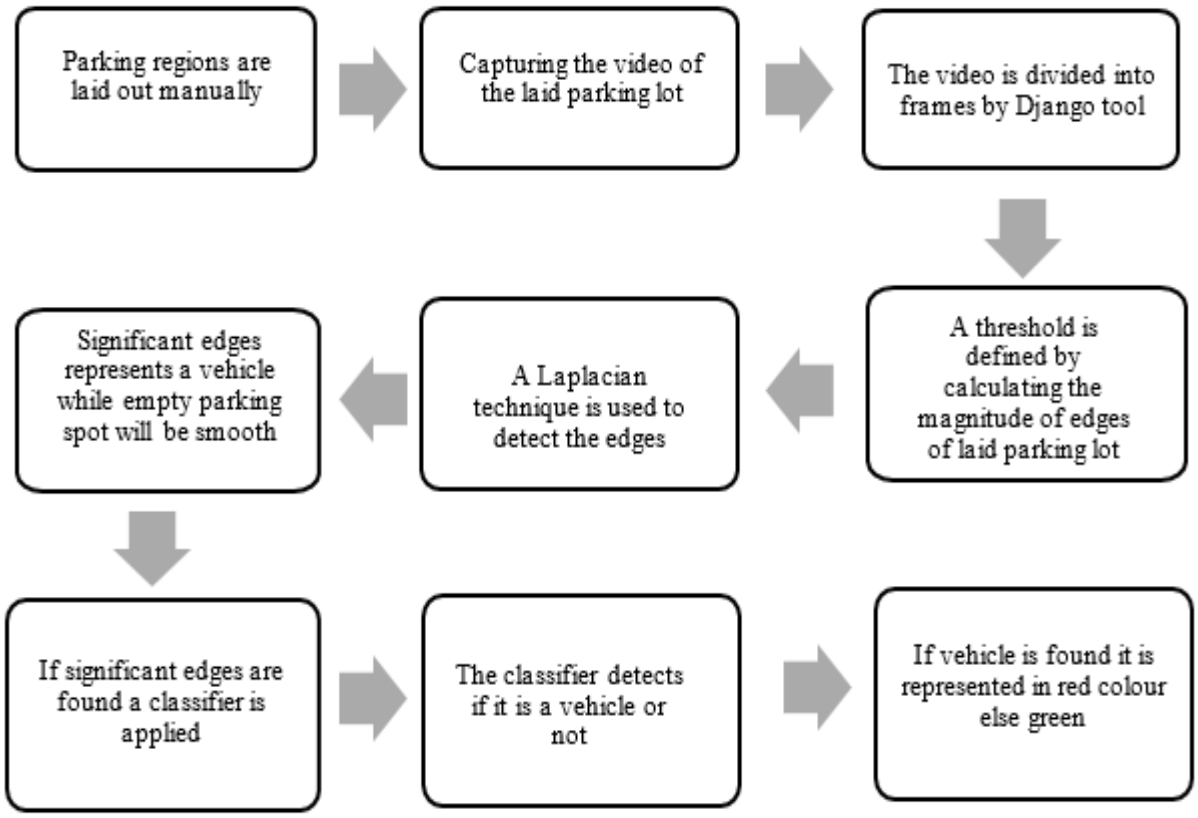

Figure 2. Block diagram representation of Proposed Methodology

The Laplacian operator is used to improve the accuracy of classification as an unoccupied or occupied space. A threshold is determined where the likelihood of a vehicle's presence is at its highest. Essentially, parking zones are drawn by hand, and a threshold is established by estimating the magnitude of the edges within them (Figure 2).

The edges of a vehicle will be sharp, whereas the edges of an empty parking structure will be smooth. This fact underpins the use of the Laplacian methodology. The classifier is used to identify even if there isn't a vehicle present if the likelihood of its presence exceeds the threshold. The classifier is invoked when a change in threshold is detected to evaluate if the object is an automobile or not. It is identified and watched for movements if it is confirmed to be a vehicle. The classifier is called again when there is motion at the spot to identify whether or not a vehicle is there. To accomplish effective parking, the system recommends a mix of identification, tracing, and classification

4. Implementation

The following figure 3 shows a normal image of the parking lot without any processing on the image where white boundaries are drawn such that we can differentiate among one parking lot to another parking lot.

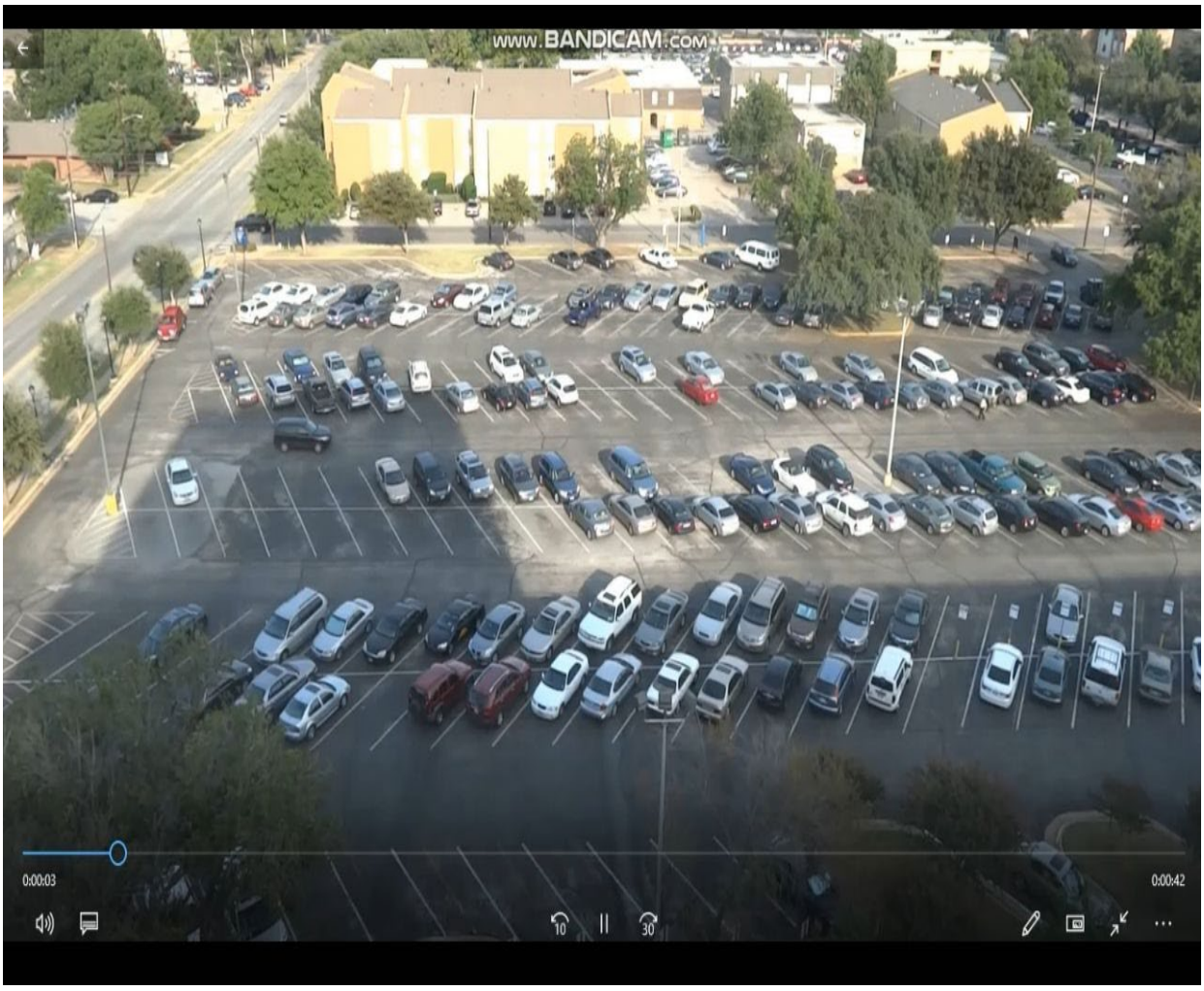

Figure 3. Manually laid Parking regions

The video of the parking lot is processed using python with OpenCv tool. The empty parking slot is shown in the green colour and the slot where car is parked is shown in the red colour. By using colour we can identify the empty parking slot (figure 4).

Figure 4. Representation vacant parking and filled parking spaces

The following figure 5 is the parking lot image of VR Siddhartha Engineering College without processing of the image. Here we have taken a parking lot and adjusted the camera in such a way that cars are visible accurately.

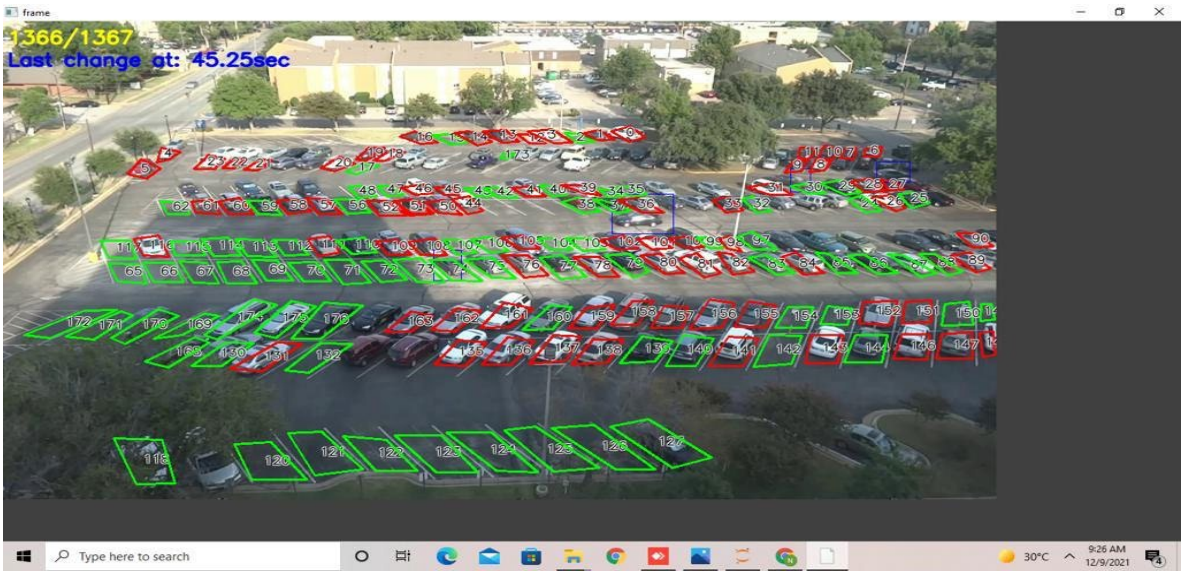

Figure 5. Parking lot image of VR Siddhartha Engineering College before processing

The following figure 6 shows the image of parking lot after processing we can see that there are red boxes and green box where the green colour box represents the parking space is empty and the red colour box indicates the parking is full.

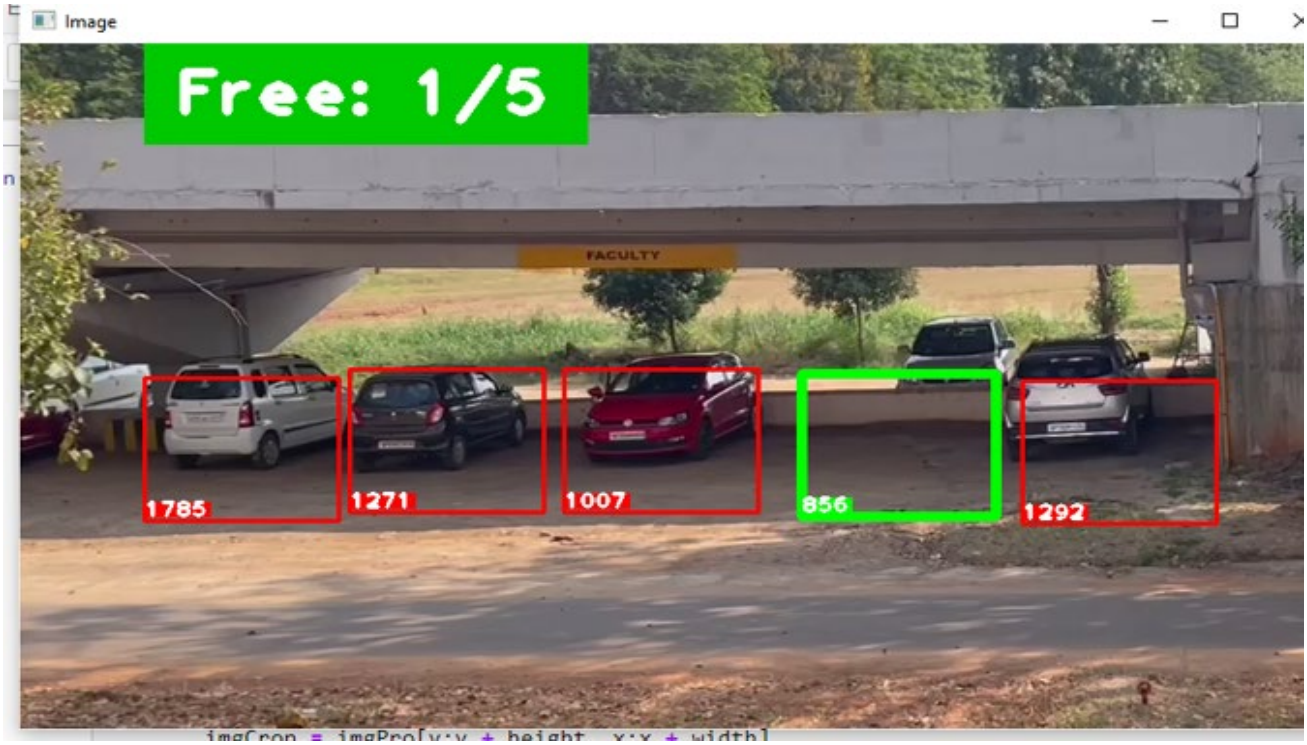

Figure 6. Parking lot of VR Siddhartha Engineering College after processing

5. Conclusion

The parking spot identification is the primary section of the smart parking system. This can be accomplished by placing sensors throughout the parking lot. However, this is an extremely expensive system with numerous flaws. The technology is simple and inexpensive thanks to image processing-based vacant parking lot recognition. For empty slot recognition, all that can be done now is use the photographs from the parking lot CCTV camera. An OpenCV-based solution will power future smart parking systems. The accuracy of detection can be increased by using appropriate image processing methods.

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