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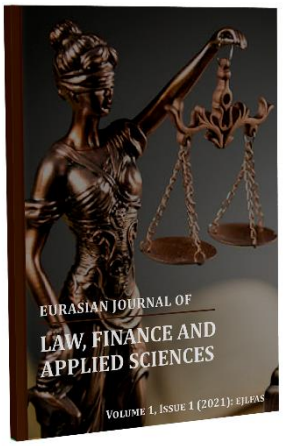


# PARKING SPACE DETECTION SYSTEM

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**ABSTRACT**

*Searching a suitable parking space in populated metropolitan city is extremely difficult for drivers. Serious traffic congestion may occur due to unavailable parking space. Automatic smart parking system is emerging field and attracted computer vision researchers to contribute in this arena of technology.*

## Introduction

Now a day's most of the parking areas are manually managed by human manpower and there is no automatic system to manage the parking area in an efficient way. There is great analogy that when a driver enters any of the parking lot he must look for some kind of information board that tells him about the status of the parking lot that whether it is fully occupied, partly occupied or vacant. Most of the times the drivers have to circle around the parking area in search of the free parking space. This kind of problem mostly occur in cities near the shopping malls, hospitals etc., where the number of vehicles is greater as compared to the parking spaces.

The process for searching the free parking space is time consuming and also wastage of fuel. Most of the times the parking spaces remain unoccupied, however the total occupancy is low because of bad management of parking lot. This causes ineffective use of the parking area and also results in traffic jams and congestion near the parking lots.

To properly manage the parking lot and display each parking division's information to the drivers before entering the parking lot have become an important issue to be resolved. In this paper, a system is proposed that will detect the total number of available parking spaces and displays the information to the drivers so that they can easily parked their cars. A web camera

is used to get the images of the parking area and image processing techniques are used to detect the presence or absence of cars to count and locate the available parking spaces.The status of the parking lot is updated whenever a car enters or leaves the parking lot.

**Literature Survey**

Various methods and techniques have been proposed to overcome the problem of parking in the congested areas. Ming-Yee Chiu et al. proposed a method for counting the vehicles at the checkpoint from which the number of available parking spaces can be counted. The counting is performed by installation of the induction loop sensors under the road surface. Although the usage of sensors was less costly, not easily affected by environmental conditions and it detects accurately however, it installation was difficult and cause damage to roads. It was also difficult to maintain it in case of malfunction. Moreover, the exact locations of free parking area cannot be determined because the counting method is not able to give the detail information, it just records the number of vehicles passing the checkpoints. The other detection methods were based on use of sensors like ultrasonic, infrared and microwave for the detection of vehicles. These sensors are placed beneath every parking space. The total number of cars in the parking area can be determined by the difference of incoming and outgoing cars.

The other kinds of detection methods are presented based on vision based methods. Through vision based methods, the whole parking area available for parking can be examined though the camera, the data is than processed and the result generated will determine the exact number and location of the free parking spaces. Zhang Bin et al. proposed that vision based parking space detection methods are very easy to install, low in cost and the detector can be easily adjusted according to requirements. Moreover, the data obtained from images is very rich. However, the defects in the vision method are that the accuracy is highly dependent upon the position of the camera.

Thomas Fabian proposed an unsupervised vision based system for parking space occupancy detection. The proposed system has low complexity in computation and needs less image frames per minutes. He claims that the major problem in images detection is the occlusions and shadows. For unsupervised learning more advanced clustering algorithms An image processing technique was presented that captures the brown circle drawn on the parking area and process it to detect whether that parking division is free or reserved. In an image of car is saved as reference and the other images are matched with the reference image by edge detection technique and information about free and reserved slots are displayed. In this paper, we have designed and implemented a framework for automatic parking system. The experimental results have shown the remarkable accuracy, achieved by proposed system as compared to state-of-the-art methodologies. The proposed parking lot model is discussed in detail in Section 3. In Section 4 the proposed algorithm of the parking system is discussed in detail.Section 5 deals with experimental results. Conclusion is given in section 6.

**PROPOSED PARKING MODEL AND METHODOLOGY**

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The main flow of framework is shown is Fig. 1. Videos were acquired from the top view of parking arena, from ten feet heighted camera. To strengthen the recognition capacity of system video data was captured at different environmental conditions and temporal shifts.

V ideo is segmented into frames. Then from each segment a key frame is extracted and further processing is applied on this key frame, to reduce computational complexity. When radio controlled toy car enter or leave the parking lot from parking arena, motion of car is estimated by key frame subtraction.

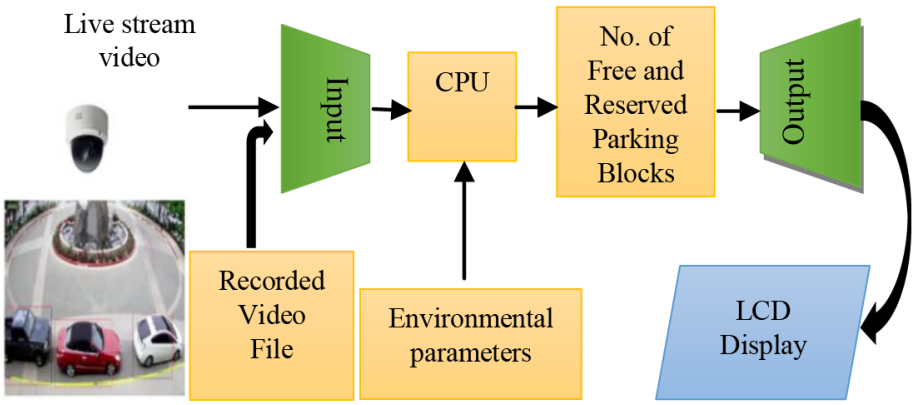


*Figure 1. Block diagram of proposed system.*

Initially, the parking arena have no parking lines. User will manually input the coordinates of parking area and vehicle intended to be parked. The system automatically generates virtual parking lines keeping in view the size of vehicle. The maximum capacity of parking slots in our training model is fourteen.

After the parking arena is divided in the virtual blocks, our system will check the existence of car in each block. Binary filter is applied on image and then inverse binary to extract car as region of interest ROI. Computing the value of connected region in ROI and setting the threshold value greater then eighty as reserved parking slot. The number of the free blocks will be indicated to the divers in green and the reserved blocks will be indicated in red color.

**ALGORITHM OF PROPOSED SYSTEM**

The main steps of the proposed algorithm for parking space detection are shown in Fig. 2 1. System will get Livestream video of the parking lot from camera.

2. Images are captured when a car enters or leaves the parking lot.

3. RGB Images are converted to grayscale images.

4. Do calibration

- First select the coordinates of the parking lot.

This will crop the extra space other than parking lot from the image.

- Secondly select the coordinates of the single parking slot.

This will divide the parking lot into equal size slots.

5. Each block is converted from grayscale to binary and then inverse binary to get the car in white color and parking area into black color.

6. Threshold value is calculated in every block to detect whether that block contain car or not.

7. If value is less than threshold value than that block is free and available for parking car and if value is greater than block is occupied.

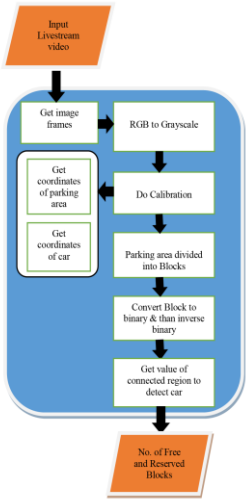


*Figure 2. Algorithm of proposed system*.

**RESULTS AND DISCUSSION**

The proposed method is implemented in MATLAB. The online system is getting images from the camera while offline system is getting images from a video file. The result of the online system shows that the proposed algorithms has efficiently detected the available parking slots and notify the drivers. The proposed algorithm is implemented on the model parking lot having space for 14 cars. The Slots having no car are shown as free while the Slots having car in it are shown as reserved to drivers as shown in Fig. 3.

To test the performance of our proposed algorithm, the accuracy of the system is measured with images taken at different time intervals. The performance is calculated by comparing the results of occupancy to the ground truth after every 5 sec.

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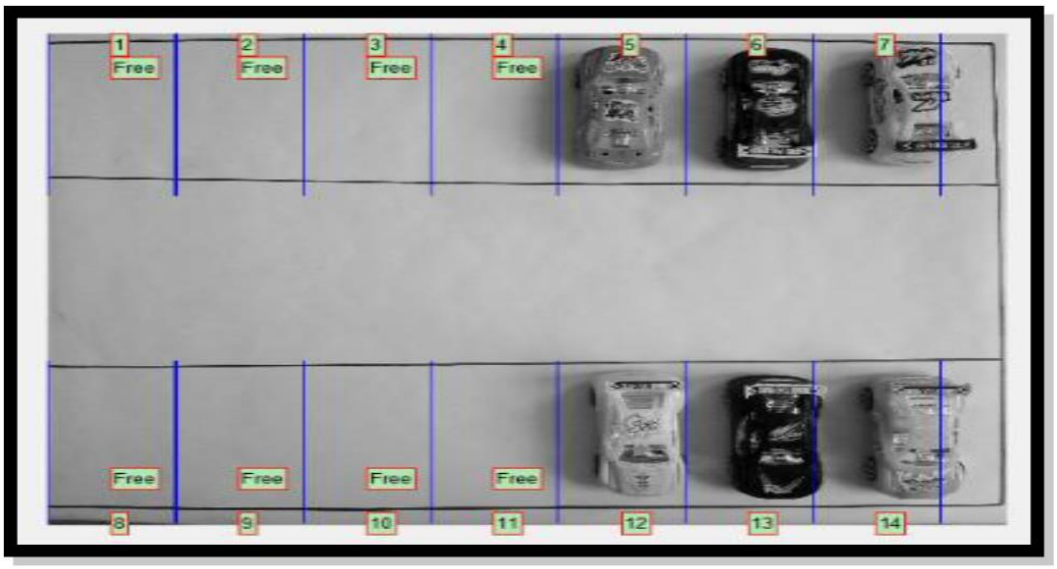


*Figure 3. Free slots detection*.

The performance of the proposed system is measured by the using the equation (1)
TPS = Total Parking slots
ANC = Actual Number of Cars
PNC = Predicted Number of Cars
Performance= 1 - ((| ANC - PNC|)/TPS) *100 (1)
The percentage of error in the proposed system will be find by using the equation (2) Percentage Error = ((| ANC - PNC|)/TPS) *100 (2)

CONCLUSION

The main contribution of this study is to optimize the identification of available parking slots to possibly reduce the congestion in parking arena. Due to advancement in machine learning and vision base technology cost effective automatic parking systems facilitate the drivers to locate available spaces at parking arena. Future researchers can focus on allocation specific location to customers already registered from online parking management system.

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