

# A Comprehensive Study of Real-Time Vacant Parking Space Detection Towards the need of a Robust Model

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**Abstract**—Detection of vacant parking space is becoming a challenging task gradually. Space utilization and management of vehicle space is now a demandable field of research. Searching for an empty parking space in congested traffic is a time-consuming process. The existing vacant parking space detection methods are not robust or generalized for images captured from different camera viewpoints. Finding a proper parking space in a busy city is really a challenging issue and people are facing this problem on a daily basis. The main purpose of this research is to comprehensively discuss the previous researches of vacant parking space detection and compare them from different aspects. Methods used in previous researches are descriptively discussed along with their advantages and disadvantages. The frameworks of previous researches were compared on six generalized phases and the experimental results are compared in terms of dataset, accuracy, processing time and other performance measures. This research also focuses on the challenges of vision-based vacant parking space detection which will contribute to future researches and researchers can work to overcome these challenges.

**Index Terms**— Object Detection, Neural Networks, Parking space management, Segmentation

## I. INTRODUCTION

Worldwide, the number of people increasing day by day and the living style of people all over the world is also getting better. One of the big factors of the lifestyle of modern age people is transportation and that's the reason the number of people owning a motor vehicle is also increasing. As a result,

the number of vehicles is increasing. Along with this increasing number of vehicles, requirements of parking are becoming a problematic issue globally. So, searching for a parking area that is suitable for the motorist or the owner in a populated metropolitan city is becoming extremely difficult. Severe congestion of traffic can happen for not being able to find proper parking space in the desired area. But if the driver or user is able to get information about this unavailability or availability of parking spaces, he or she will be able to look for parking space somewhere else and would not need to enter parking area that does not have an available parking space.

Parking systems are manually handled by a human individual. For this reason, it is time-consuming and also inaccurate. People also feel frustrated to find parking space. But many of the parking areas may have parking space that nearby drivers are unaware of. So, the automatic parking system is an emerging and attracted field for researchers on computer vision to contribute to this technology [1]. The systems that are previously developed are mainly on the basis of image segmentation or machine learning mainly Support Vector Machines (SVM), Neural Networks (NN) over spot patches. But it is possible to use these algorithms for the proper detection of automatic parking management systems because of the evolution in the last years of object detection algorithms [2].

Providing enough parking for visitors is one of the main issues in many real-life scenarios. Safe and secure parking lots with a enough spaces can increase visitor's loyalty and attract visitors to visit in many places more frequently. This research aims to set milestones that need to be achieved to develop a model for real-time vacant parking space detection for efficient and smart parking.

The main purpose of this research is to find existing methods and frameworks and evaluate them so that in future researches a more robust model can be developed for general purpose use, which can help the motorist in efficiently finding vacant parking space. In addition, a reservation feature can be provided to reserve the space if the vehicle is in a certain range of the parking area. The model should be able to find a total number of parking spots in a parking area and how many of them are occupied and how many of them are unoccupied and this information needs to visually represent for the targeted users in real-time.

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