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## PARKING LOT SPACE DETECTION BASED ON IMAGE PROCESSING

<sup>1</sup>DR.T. SREELATHA , <sup>2</sup>P. SWATHI, <sup>3</sup>S. SAYED PEER,

<sup>4</sup>G. SUNIL, <sup>5</sup>R. SAI KUMAR, <sup>6</sup>R. SUMANTH KUMAR

<sup>1,2,3,4,5,6</sup>Department of Electronics & Communication Engineering

Siddharth Institute of Engineering & Technology (Autonomous), Puttur-517583, Andhra Pradesh.

### ABSTRACT:

The number of people who drive their cars every day has increased dramatically in recent years. However, because road and parking garage capacity has historically lagged behind the rise of automobiles, finding a parking place is becoming a far more difficult challenge in practically in every country. In this work, implementation of predicting parking lots is performed using image processing techniques. The techniques involved in this work are image subtraction, image conversions, morphological operations, blob detection, finding image region properties, vehicle and parking lot detection. Our proposed model will provide better results compared to existing works

**Keywords:** image conversions, morphological operations, blob detection, region properties, vehicle detection, parking lot detection

### I. INTRODUCTION:

Parking problems in cities and urban areas are becoming increasingly important and have been one of the most discussed topics by both the general public and professionals. The imbalance between parking supply and parking demand has been considered as the main reason for metropolis parking problems. Moreover, the parking system plays a key role in the metropolitan traffic system, and lacking of it shows closed relation with traffic congestion, traffic accident, and environmental pollution. Although efficient parking system can improve urban transportation and city environment besides raising the quality of life for citizens, parking problem is an often-overlooked aspect of urban planning and transportation. Urban planners should seek more efficient and innovative solutions for parking problem on the level of management, planning, and designs.

Car parking can be provided in three forms; on-street parking (curb parking), off-street parking (parking lot), and parking structures which may be in two types; either as a single or double floors constituting the building basement (if underground) or podium (if above ground), or as an individual structure (multi-story garage). Every form of parking provision has several types in car circulation and arrangement to maximize the number of cars that can be parked in it. Every parking system in any of the three previous forms, has three key parts; quantity, quality, and management. Conventional parking planning tends to focus

primarily on quantity. It assumes that more is always better, and there can never be too much. This type of planning relies primarily on minimum parking requirements and providing abundant parking supply. Parking planning also considers the quality of parking areas such as the convenience and safety of walking from a parking space to destinations, the attractiveness and security of parking facilities, and the environmental requirements of parking areas. Parking management aims at achieving the best economic performance of parking spaces, especially in parking lots or in curb parking. It focuses on adopting special operating and pricing policies appropriate for each case. The combination of planning and management solutions ensures that parking demand is precisely sized according to development actual needs and its working circumstances, and not according to fixed general standards. It also preserves the financial cost, user's time and convenience, and the green infrastructure needed for the environmental balance.

### II. RELATED WORKS

[1] Hossam El-Din I. S. Ahmed: Car parking is a major problem in urban areas in both developed and developing countries. Following the rapid incense of car ownership, many cities are suffering from lacking of car parking areas with imbalance between parking supply and demand which can be considered the initial reason for metropolis parking problems. This imbalance is partially due to ineffective land use planning and miscalculations of space requirements during first stages of planning. Shortage of parking space, high parking tariffs, and traffic congestion due to visitors in search for a parking place are only a few examples of everyday parking problems. The paper examines car parking problem in the city; its different causes and conventional - yet non -successful- approaches. Modern technology has produced a variety of new solutions and techniques in this respect. The paper reviews new planning trends and creative technological solutions which can help alleviate the strain of the problem. Because car parking solutions are not an end in itself, but rather a means of achieving larger community goals in order to improve urban transportation and make cities more livable and efficient, the paper also discusses the environmental impacts which should be taken into considerations for solutions proposed. Summary: The paper reviews new planning trends and creative technological solutions of parking problem.

[2] Ruixuan Chen; Xingyan Hu; Wei Mu: The number of vehicles has increased dramatically, with the continuous expansion of vehicle production scale. This paper designs and implements a parking lot management system, which solves the problems of parking difficulty and complex vehicle management. Compared with the previous system, the administrator can check the parking space and vehicle information at any time, which greatly reduces the workload. The driver can not only check the parking information of the nearby parking lot, but also book the parking space by selecting key words. At the same time, this paper analyzes the complexity of different path guidance algorithms, considering the different real-time requirements of the map in the parking lot and off-site path guidance, and finally uses Dijkstra algorithm based on heap optimization and Floyd algorithm to realize the parking space navigation, which greatly reduces the time for the driver to find the parking space.

Summary: Solves the problems of parking difficulty and complex vehicle management.

[3] Arunabha Tarafdar; Sukanya Roy; Anurup Mondal; Rupsa Sen; Arpan Adhikari: This paper on object detection by image processing to ensure the people suffering from various vision disorders to detect and to perceive the real image before them. The image perceived by the patients are rendered and developed so that the closest similar object is detected. The input to the program is a image which is fed to the set of processes which in turn gives a image that can be compared to the set of data to give the accuracy in (percentage) to which extend the image is similar to an object or animal.

Summary:

[4] Shagun Gupta; Shubham Mahajan; Amit Kant Pandit: In current circumstance image processing is one of interesting field. It is methodology which is normally used to improve picture which are gotten since many resources. This work gives outline of image processing techniques. Fundamental apprehension of this work is characterizing different methods utilized in various periods of image processing. Gathering of pixels dependent on specific sort of similitude or brokenness among the pixel called Segmentation. Segmentation of ROI from the given info picture decides the accomplishment of investigation. Legitimacy measurements assists with estimating the similitude of the sectioned picture result. Most significant and required for human endurance is food. In that situation Agriculture industry plays an indispensable job and the business faces lose in light of specific reasons. One of the motivations to yield lose is unconscious of infection conclusion and more often than not rancher can foresee malady finally second. By actualizing innovative improvement in agribusiness industry attempt to improve the harvests lose and that outcome expanding rancher salary. Files based power histogram segmentation strategy

used to portion the sickness influenced part from undesirable leaf with better exactness rate. Segmentation is significant stage in picture handling procedure and it assists with diagnosing the sick locale.

Summary: About image processing techniques

[5] Oge Marques: Mathematical morphology is a branch of image processing that has been successfully used to provide tools for representing, describing, and analyzing shapes in images. It was initially developed by Jean Serra in the early 1980s [SC82] and—because of its emphasis on studying the geometrical structure of the components of an image—named after the branch of biology that deals with the form and structure of animals and plants. In addition to providing

useful tools for extracting image components, morphological algorithms have been used for pre- or postprocessing the images containing shapes of interest.

Summary: About morphological operations in image processing

[6] Seelam Shanmukha Kalyan; Voruganti Pratyusha; Nandikonda Nishitha; T.K. Ramesh: Nowadays, detection of the vehicles and their classification is very essential and also it has a lot of importance because of its use in many applications. One of the main applications is controlling and managing traffic. Vehicle detection and tracking plays a major role in the project of preventing road accidents using image processing. Tracking of moving objects is important in monitoring surveillance videos and capturing human motion. Taking its importance into consideration, an efficient algorithm is proposed to detect vehicles in an image using image processing. The image is captured from the front view of the vehicles. So, this algorithm detects vehicles using the front view. Each vehicle is detected based on its size. The two major techniques used in this algorithm are edge detection and morphological processing. Edge detection as well as morphological processing are important applications in image processing because of their wide range of uses. Edge detection is used to enhance the objects in image. Morphological operations are used to remove noise and as well as to adjust image in such a way to detect objects in an image. The simulation work of this algorithm is done in MATLAB which is a very strong scientific tool.

Summary: Vehicle detection using image processing and Matlab

### III. MATERIALS AND METHODS

#### Requirements:

The proposed prototype requires the following

#### Hardware:

Arduino Uno, GSM Module, 16\*2 LCD..The specifications of these hardware is presented in table 1:

S.No	Hardware Names	Specifications
1	Arduino UNO	Is an open source micro controller based on the microchip ATmega328P
2	16*2 LCD display	The outline size of 80.0*36.0 mm and VA size of 66.0*16.0 mm and the maximum thickness is 13.2mm.
3	GSM Module	Used to transmitting mobile voice and data service operators at the 800MHz, 900MHz, 1800MHz and 1900MHz
4	Power	5v power supply

Table 1:Hardware Specifications

The algorithm of the proposed model is developed in Embedded C and simulated on Arduino IDE. Arduino IDE is an open source platform which is used to program the microcontroller to perform some specific task. In this work, we are using Arduino IDE software version 1.0.6.

## Hardware block diagram

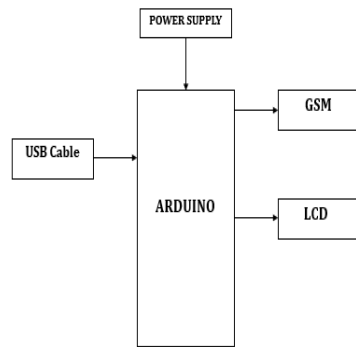


Figure :1 hardware block diagram

### Software Details:

#### Matlab;

This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features. It allows both "programming in the small" to rapidly create quick and dirty throw-away programs, and "programming in the large" to create complete large and complex application programs.

After logging into your account, you can enter MATLAB by double-clicking on the MATLAB shortcut icon (MATLAB 7.0.4) on your Windows desktop. When you start MATLAB, a special window called the MATLAB desktop appears. The desktop is a window that contains other windows. The major tools within or accessible from the desktop are:

- The Command Window
- The Command History
- The Workspace
- The Current Directory
- The Help Browser

#### Features of MATLAB:

Following are the basic features of MATLAB.

- It is a high-level language for numerical computation, visualization and application development.
- It also provides an interactive environment for iterative exploration, design and problem solving.
- It provides vast library of mathematical functions for linear algebra, statistics, Fourier analysis, filtering, optimization, numerical integration and solving ordinary differential equations.
- It provides built-in graphics for visualizing data and tools for creating custom plots.
- MATLAB's programming interface gives development tools for improving code quality maintainability and maximizing performance.
- It provides tools for building applications with custom graphical interfaces.
- It provides functions for integrating MATLAB based algorithms with external applications and languages such as C, Java, .NET and Microsoft Excel.

### Arduino IDE software:

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS and Linux. The environment is written in C and based on Processing and other open-source software. This software can be used with any Arduino board.

- Embedded C:

Embedded C is a set of language extensions of C programming language. It includes a number of features not available in normal C, such as fixed point arithmetic, named address spaces, and basics I/O hardware addressing. Embedded C uses most of the syntax and semantics of standard C.

### Proposed model:

To overcome the disadvantage of existing system, our system aims to reduce the human intervention to the minimal by automating the process of car parking. This in turn would prove to be useful in reducing the time required for search of free parking space by manually driving through multiple slots. The automation in the car parking is achieved by using Sensors. The system can then inform drivers about the number of available parking spaces and in which area should they be directed to.

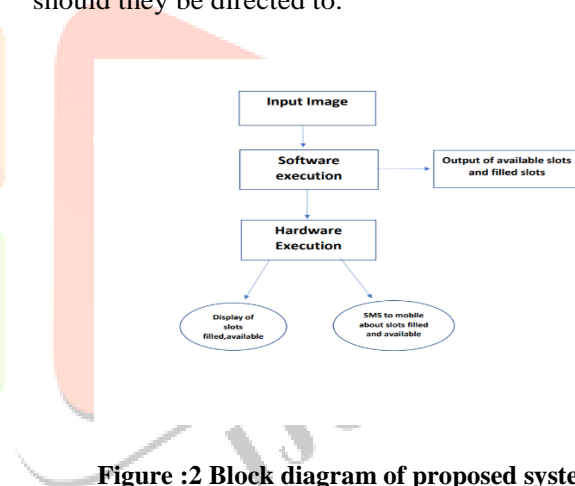
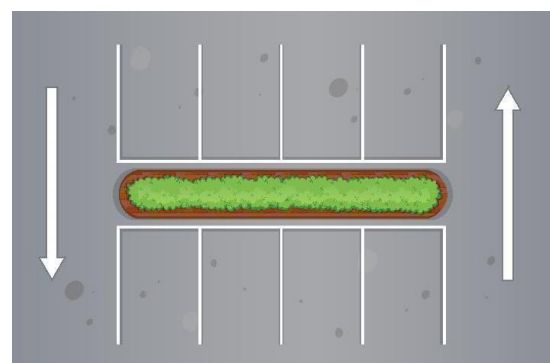


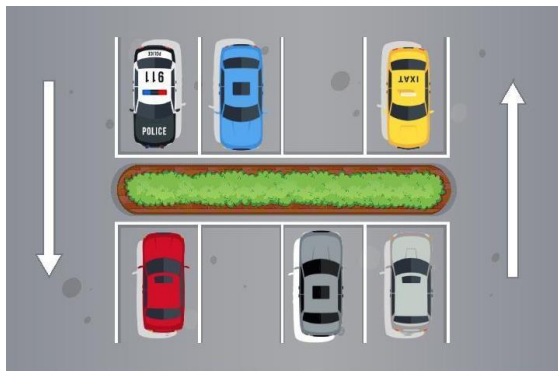
Figure :2 Block diagram of proposed system

## IV. Experimental Results

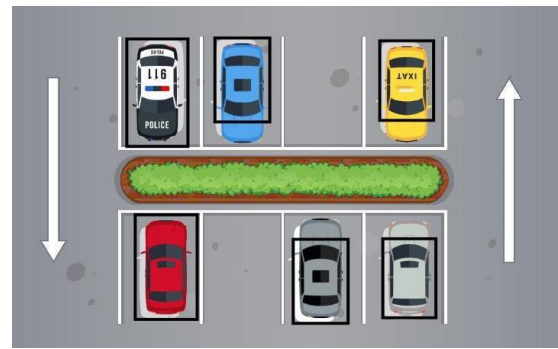
- This study will tell you how many parking lots are available and how many are filled.
- The available lots and filled lots will be display on LCD ,which is connected to Arduino.
- The LCD display result will be send as SMS to phone using GSM.



Background Image



Foreground Image



Detection of vehicles

Figure 3 Steps for processing parking lot details



Subtracted Image

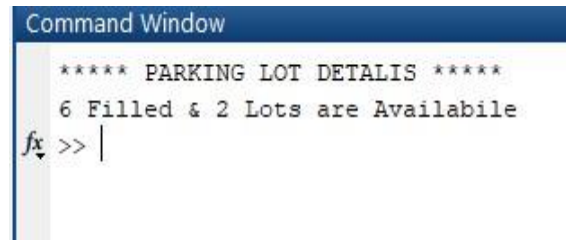
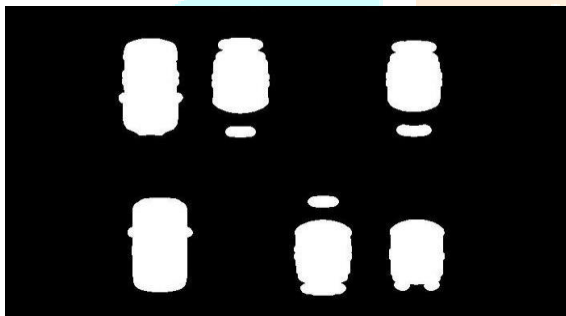


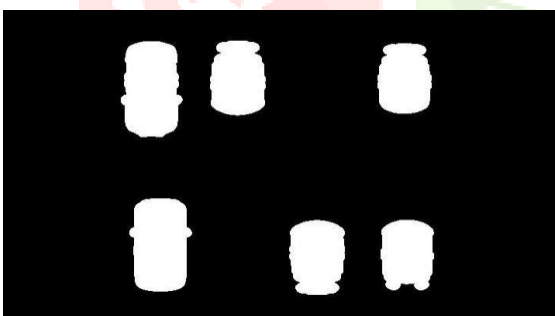
Figure :4 Parking space lot details in command window



Binary form of subtracted image



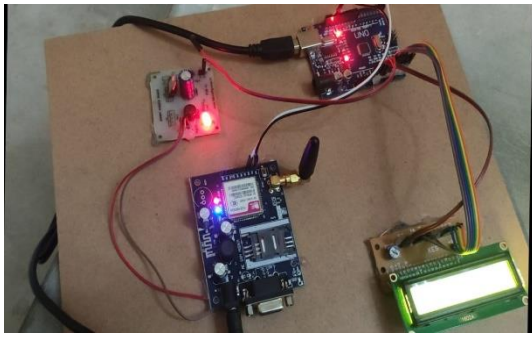
Figure :5 Count displayed on LCD



Removing small objects



Figure 6: count of the vehicle will be sent as SMS to mobile number



**Figure :7 Hard Ware proto type Output**

### FUTURE SCOPE

In future, this work is carried out on hardware devices like sending parking lot details to respective customer/person.

We are working on enhancing and improving the algorithm and the fully documenting its performance. Moreover, we intend to automate all the steps in the process, including to identification of parking lots, and rotating and preprocessing the images as needed. We will also seek to automate the use of the algorithm over large areas. A fully automated algorithm will be useful in various urban, business, and emergency planning applications.

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