

ANPR Camera Based Smart Parking Management System

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Abstract— There are more than one billion cars being used for moving from one place to another but there is a scarcity for parking those vehicles, parking has become a major problem. In some metropolitan areas, finding a parking space for the vehicles during the rush hours is difficult for drivers. The difficulty arises from not knowing where the available spaces may be at that time. Another difficulty that is often faced by the people is to locate their cars when they forget where they last parked there car. The cameras that are used in the existing parking areas are only meant for video surveillance and cannot help in such situations as there is a lack of proper car parking management and guidance system. This paper discusses an innovative car parking management system based on Automatic Number Plate Recognition (ANPR) camera where the system will allow only the authorized cars to enter the parking lot, denying access to unauthorized cars. This system is also designed to guide the car to the nearest parking slot which is available

Keywords — ANPR camera, parking, car, management system, locating vehicles.

1. INTRODUCTION

Vehicle parking management has become a challenging problem due to the growing number of vehicles. Improper parking of the vehicles may lead to blocking the path for other vehicles, an issue that is faced by most of the vehicle owners. Finding out the responsible person is hard due to very limited or no information available to contact the person who parked the vehicle in an improper way. Additional problem is not knowing where the vacant parking slot is available, this makes the driver to search the entire parking lot which is both time and energy consuming.

In this paper we have proposed a smart vehicle parking monitoring and Management system where the entire process is done through image processing without using any sensors. In ANPR system, a camera is used to capture the vehicle's number plate images and a computer processes them by using various image processing algorithms and recognizes the information on the number plate. The system is also designed to guide the vehicles to the nearest available parking slot. The proposed system aims to provide solution to all the problems faced in previous systems which used unreliable sensors.

The objectives of the system are-

- To implement a vehicle parking monitoring and management system that will automate the existing parking management system by keeping the entry and exit time information as well as where the vehicle was parked.

- To find out the number of available parking slots.
- To guide the entered vehicle to the nearest available parking slot to avoid wastage of time and energy.

2. LITERATURE SURVEY

Many researchers in their various works elaborated significantly the problem of implementing reliable parking guidance and information systems (PGIS), by locating the vacant space in parking lots as well as conveying such information to the car owners. There are mainly two types of systems, Wireless sensor network- based systems and Camera-based systems.

Ankur kr Aggarwal, Aman Kr Aggarwal “Vehicle Registration Plate Recognition System Based on Edge Transition by Row and Column Profile on Still Images” [1]. The system works by using the digital images acquired from the camera and can be easily applied to commercial areas based on a simple yet smart algorithm for vehicles registration plate recognition system. The accuracy of the system goes up to 95%.

Christos Nikolaos E. Anagnostopoulos, Ioannis E. Anagnostopoulos, Vassili Loumos, and Eleftherios Kayafas, “A Number Plate-Recognition Algorithm for Intelligent Transportation System Applications” [2]. In this paper an algorithm is created for vehicle number plate identification on the basis of adaptive image segmentation technique and connected component analysis using neural network for character recognition.

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Choudhury A. Rahman, Ahmad Radmanesh, describes “A Real Time Vehicle’s License Plate Recognition System” [3] in 2003. Here, C++ is used for developing the project. The system is used to find the number plate region from the entire picture obtained from the camera and the characters on the number plate is identified by using horizontal and vertical projection and color concentration.

3. PROPOSED SYSTEM

The block diagram for the proposed system design is as shown below.

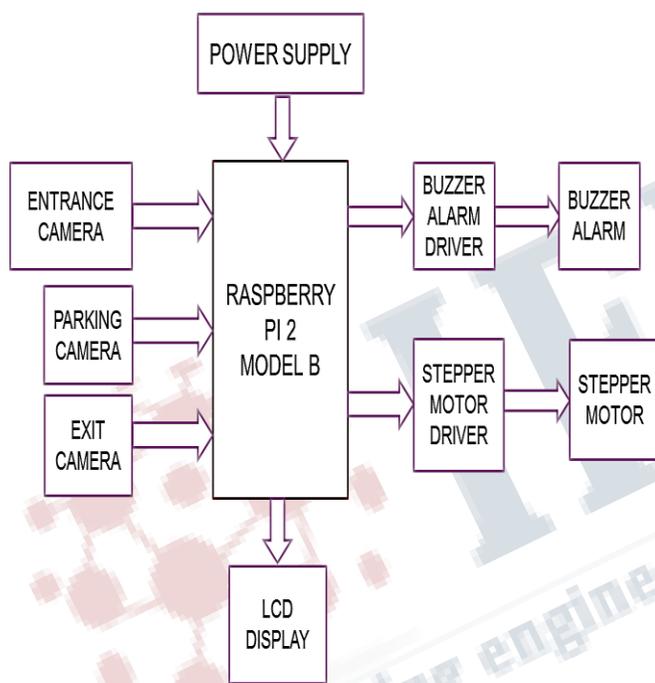


Fig.1. Block diagram of parking management system.

ANPR cameras are used for capturing the license number plates of the vehicles instead of Sensor or RFID based existing vehicle parking management systems. These ANPR cameras are more advantageous than other technologies. This system makes use of three cameras. Two cameras are used at entrance and exit respectively. One more camera is used inside the parking lot for detecting number of vacant spaces and for finding where the available vacant spaces are. The LCD display is used at the entrance to indicate the driver where the available parking slots are and guides the vehicle to the nearest parking slot.

The buzzer is used at the entrance to indicate the unauthorized vehicles that they have been not given access to enter.

A motor is used both at entrance as well as at the exit to control the barricade.

The authorized vehicles will be registered in the parking management system along with their owner information. The information about the parking zones and parking lots will already be stored in the system with other related information. The software could lead to a cheaper and faster way of enhancing and determined the performance of the recognition system. The system will be based on a personal computer which will generate a report on the vehicle license plate that has been captured. The algorithm should be created in a way that the system should be able to detect the vehicle registration plate at a faster speed and also should be accurate.

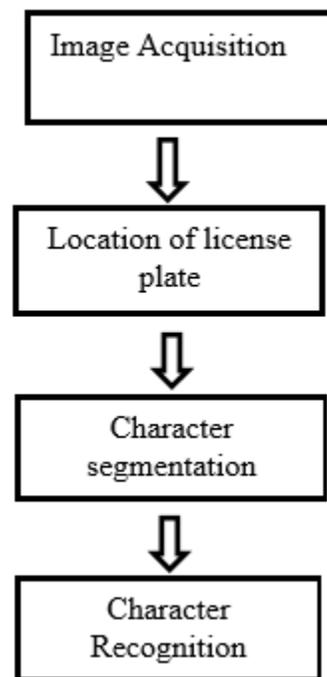


Fig.2. Structure of an ANPR system.

3.1 Image Acquisition

The image of the car is obtained by the color camera. For better detection, the color image is converted to a standard grey scale image.



Fig.3.Gray Scale image

3.2 Location of License Plate

For finding out the number of the vehicle, only the region containing the number plate is of importance. That region is called as the region of interest. In this step, the system recognizes the approximate region of interest from the acquired image using an algorithm so that it's easier for determining the content of the number plate by further processing only that part of the entire captured image.

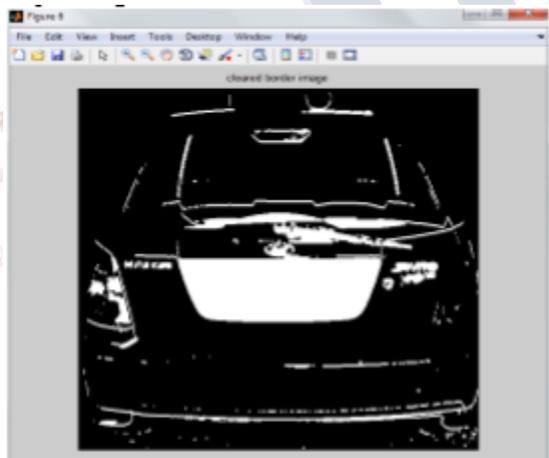


Fig.4. Extraction of number plate area

3.3 Character segmentation

Character segmentation is the process of separating all individual characters from each other so that recognition of that character becomes easier. The ROI is stretched over the grey levels available (0-255). Then, the plate image is threshold. A search algorithm to find all the pixels which are connected together is applied and a special label is assigned so that different connected components in the image can be distinguished.



Fig.5. Number Plate with bounding box image



Fig.6. Image of each character

3.4 Character Recognition

In this process, low-resolution template matching is adopted. Once the characters are obtained, they are now compared with the complete alphanumeric database by adopting template matching. This process involves the moving the template image to all possible position and a numerical index is computed to indicate how accurately the image matches with that position.. Compared with the high-resolution matching algorithm, correct identification rate of the letters and numbers is greatly enhanced.

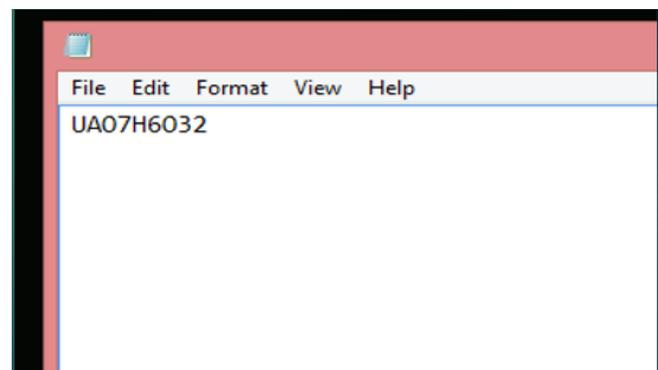


Fig.7. Image of Result

The reason is that if the resolution rate goes through a moderate reduction, the error generated by the image

distortion and the noise will be decreased. The recognition errors of letters and numbers mainly occur in some of the characters with the very similar main structures but some detailed differences, such as B and 8, O and 0, S and 5.

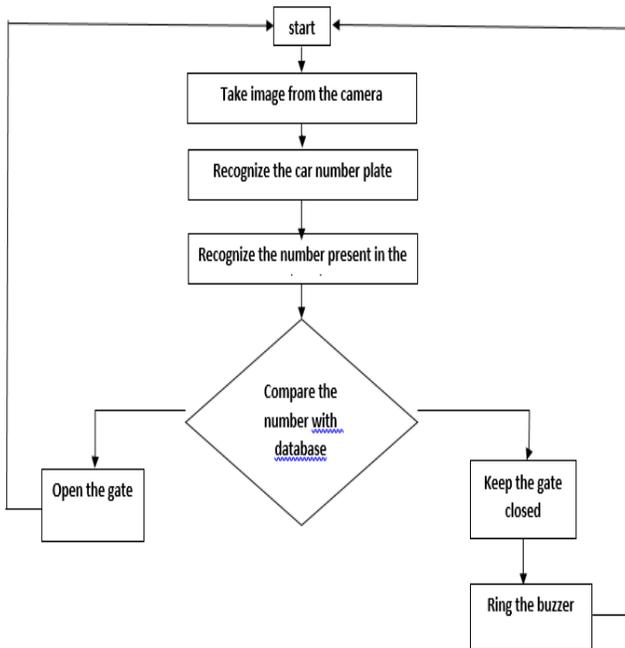


Fig.8. Flow Chart for the working of ANPR Cameras integrated with parking management system.

4. VACANT PARKING SLOT DETECTION

Our project consists of five modules as shown in the fig

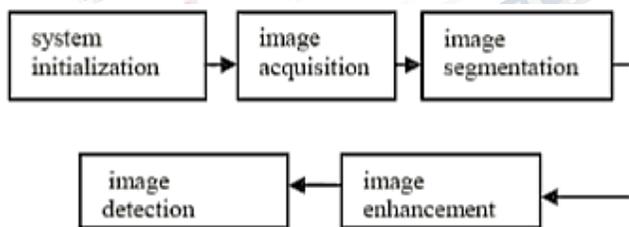


Fig. 9. System module

The system detects the vacant parking slot through processing the image obtained from the parking camera which would be installed in such a way that the camera eye would cover as much area as possible. Initially, when no cars are present, a round image is drawn on each and every parking slot.

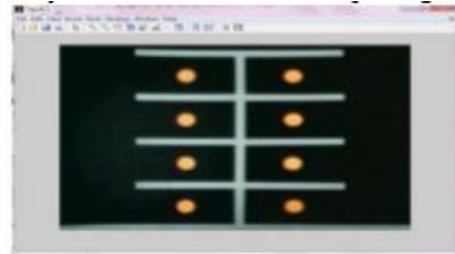


Fig. 10. Empty parking lot

The purpose of this procedure is to automatically identify location of every parking slot in the image by the system. The initialization process will begin with the system searching for the round image by using the algorithm meant for detecting the shape of the image. Detected image are then analysis to determined available parking lot. Coming to the analyzing part, everything from acquiring the image of the parking area till the detection of round images is almost same as the image processing steps carried out to find the license plate number.

The only difference is that while tracing the boundaries of object in images, the image detection module is implemented.

The image detection module makes use of the formula shown below for identifying the round image by considering its area and perimeter.

$$\text{Shape} = 4 \times \pi \times \text{area} / \text{perimeter}^2$$

The discrimination process can be controlled by setting an appropriate threshold. In this project, the system makes use of a threshold value of 0.9. The available parking lot will be counted and displayed in display unit. Fig. 14 shows there are five detected rounded image with the threshold value above than 0.9. This means there are five empty parking slots and this information will be displayed in the display panel near the entrance.



Fig. 11. Detected parking lot

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5. CONCLUSIONS

In this system, an application software is designed to recognize the number plate of vehicles. At first, by making use of morphological operation, the plate region is extracted. After getting the region where the number plate is present, the plate characters are individually separated by segmentation. Finally, low-level template matching adopted with the use of correlation for recognition of plate characters. Some of possible difficulties that may arise are:

1. Broken number plate.
2. Low resolution of the characters.
3. Number plate not within the legal specification.
4. Blurry images.
5. Poor maintenance of the vehicle plate.
6. Similarity between certain characters, namely, O and D; 5 and S; 8 and B, E; O and 0, etc.

This intelligent parking space detection system based on image processing was designed and tested. The conceptualization of this project is to discover the parking system by using image processing instead of using sensor base. Intelligent parking system is developed using an integrated image processing approach to reduce cost of sensor and wiring hassle.

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