

SMART CAR PARKING SYSTEM USING DIGITAL IMAGE PROCESSING

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ABSTRACT

This paper presents the process of smart car parking system using image processing. As the use of private vehicles are increasing, the problem of parking of four wheelers has become a major problem especially in multi-national companies, malls, metros etc. In addition to this, the security of vehicles has also become a major problem in present stage. The motive of this paper is to use the available parking space in right manner and to provide security to the vehicles. It also provides reservation based parking. The reservation system is provided through GSM. Optical character recognition[OCR] technique is used for converting the acquired image into text format.

Keywords: Camera module, GSM, image processing technique, Optical Character Recognition.

I. INTRODUCTION

As the standard of living of people is increasing, the problem of traffic congestion and insufficient parking space has risen. Implementing this system will help to resolve the growing problem of traffic congestion, wastage of time and money, and help provide better public service, reduce car emissions and pollution, increase parking utilization, and prevent unnecessary capital investments. A smart parking system can be implemented through sensors at the entrance of the parking area, a computer system that manages the whole process and display panel and buzzer that help the driver in parking the car on the specified slot.

The technique of image processing is used in this paper. At the entrance there will be camera module which will take the picture of the number plate of the incoming cars. The image will be converted into text by using optical character recognition[OCR] technique. There are various methods for identifying vehicle plate such as Radial Basis Function(RBF), Probabilistic Neural Network (PNN), optical character recognition[OCR] and Fuzzy system. However, OCR is used in this paper due to its high accuracy compared to other techniques. OCR processing is done through MATLAB software. The display panel will continuously display the empty slots in sequence which will guide the driver to park the vehicle in particular slot which is done by IR sensors, placed on each slot. The cost of parking will be decided on the basis of difference between the parked and unparked time.

This paper provides two facilities, one is security and other is reservation based parking. The user will be asked to enter the phone number through the keypad and an alert message will be sent to that number at the parking and unparking time. By this way, the misuse of vehicle is avoided and thus security is provided.

A fixed phone number will be allocated for parking system to which user can send the message for reserving the parking slot. Both the above processes are done through GSM.

II. BLOCK DIAGRAM

The following figure shows the overall system block diagram:

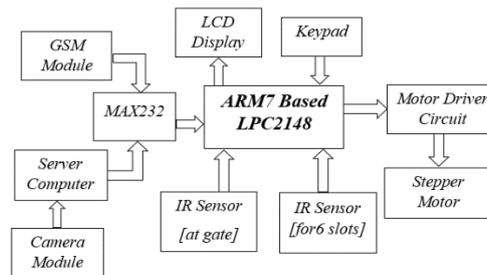


Fig. 1 Block Diagram of the system

III. METHODOLOGY

An OCR technique consists of several steps. The block diagram of OCR technique is as shown in the figure1. It is called as optical character recognition, because it uses optical properties of text to identify the characters. The first step is to use an optical scanner to convert the analog data into digital data. Each character is then located and segmented, and the resulting character image is fed into a preprocessor for noise reduction and normalization. The extracted features are then compared with the standard templates which is already computed. Thus, the original alphabets and numbers are reconstructed.

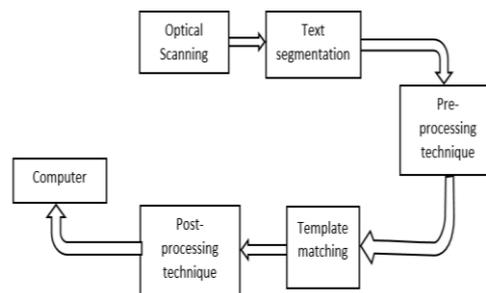


Fig. 2 Block diagram of OCR technique

A. Optical scanner: First the original document is captured as a digital image. Optical scanners are used to acquire the image. These optical scanners consist of a sensing device to convert the intensity of light into gray levels and also consist of transport mechanism. The vehicle number plates usually consist of black document on white background. It is thus necessary to convert the input image into binary image i.e, only of black and white. To convert the RGB image into binary image, the process of thresholding is used. In this process, a fixed threshold value is allocated, where the pixel value above the threshold value is considered to be white and below is considered to be black. A prechosen fixed threshold can be assigned to an image with uniform background.



Fig. 3 Original input image



Fig. 4 Binarized Image

B. Text segmentation: Segmentation is the process of isolation of alphabets and characters. The isolated characters are individually recognized. It is mainly used to determine the elements of the image. The segmentation process is usually performed by separating each of the connected components from each other.

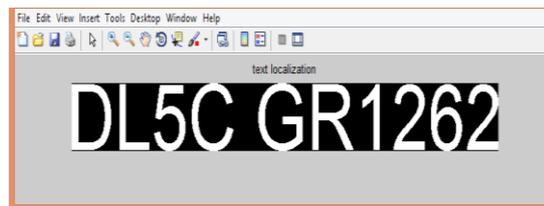


Fig. 5 Text Segmented Image

C. Preprocessing technique: The resulting image from the optical scanner may consist of noise. To remove the noise present, techniques such as thinning and filling are used. Filling technique usually eliminates gaps, small breaks and holes in the characters, whereas thinning technique reduces the width of the line. In addition to smoothing, normalization is also performed. The normalization is used to obtain the characters of uniform size, without any slant and rotation.

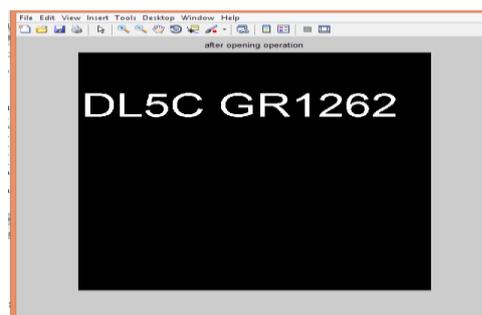


Fig. 6 Pre-processed Image

D. Template matching: The image of the input character is stored in the form of matrix which is matched directly with a set of template characters. It uses the correlation property. The distance between each template and input character is computed, and the one giving the maximum correlation or best match is assigned.

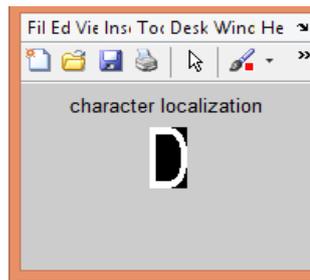


Fig. 7 Character Segmented Image

E. Post Processing: It includes grouping, error detection and correction techniques. The result of template matching is a set of individual symbols on a document. However, the enough information is not contained in these symbols itself. Instead, the individual symbols that belong to the same string are associated with each other, thereby making up with the alphabets and numbers. This process of associating the symbols into strings is called as grouping.



Fig. 8 Grouping Process

IV. CONCLUSION

The availability of car park based on digital image processing was modelled and tested with different scenarios of vehicle parks. It consists of acquiring an image of the number plate of car, converting the image to black and white for analysis purpose, removing the noise if any and determining whether car parks are vacant or filled. We have developed a new prototype of SMS-parking system to optimize parking management. In this system, we implement parking reservation policy to balance the benefit of service providers and requirements from the users.

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