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Automatic Payment System in Tollgate Using Number Plate Recognition

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***Abstract*—** Human beings are capable of identifying and recognizing patterns in an image but if these tasks are done in repetitive manner they are subjected to errors. The same happens in vehicle license plate recognition, especially because the number of vehicles is very large. That is why automated systems are required for this job. The objective is to extract and recognize vehicle registration numbers from vehicle images, process the image data finally utilize for access record and then use it for further necessity. Monitoring the vehicle traffic and the management of parking areas are most labor-intensive job. In this paper we propose a new technique for automatic payment method in tollgate

***Keywords*—**Numberplate, Vehicle, Detection

I. INTRODUCTION

The vehicle license plate recognition identification is an important application in the field of Intelligent Transport System (ITS) and Electronic toll collection (ETC). The objective is to extract and recognize vehicle registration numbers from vehicle images, process the image data finally utilize for access record and prepare electronic bill. Electronic toll collection (ETC) or Electronic Vehicle parking payment is one of the major research topics in intelligent transportation system (ITS) In the recent years, License Plate Recognition (LPR) are having a wide impact in people's life as their scope is to improve transportation safety and mobility and to enhance productivity through the use of advanced technologies. Productivity through the use of advanced technologies .This system is useful in many fields and places such as parking lots, private and public entrances, border control, theft and vandalism control. For the past two decades, there have been various studies for number plate recognition in images.

II. RELATED WORK

In recent years, the great progress of technology in many areas such as sensors, embedded systems, control systems, communications, and signal processing has prepared a solid ground for deployment of ITS in reality. Although there are many types of ITS, they can be grouped into two classes including intelligent infrastructure systems and intelligent ve-hicle systems [1]. In intelligent infrastructure systems, the license plate numbers must be in machine-encoded text for easier store and processing, so OCR plays the important role in extracting data from license plate image. Because the complexity of OCR algorithms, the traditional methods usually use a combination of high resolution camera and powerful computer to perform recognition.Since the mobile devices have been equipped strong hard-ware and installed mobile operating system, many complex applications for daily activity, entertainment, etc. have been transferred successfully from computers to them. The authors in [2] built a tagging application runs on Android devices. They used OpenCV libraries and image processing techniques like morphological and contour finding in object detection. An application runs on a smartphone sends the captured image to a computer via fourth generation (4G) mobile network for im- plementation of vehicle retrieval and recognition and receives the results was introduced in [3]. Although this application exploits the mobility of mobile phone, its disadvantage is the need of 4G network and computer. The authors in [4] developed a software runs on mobile device to recognize speech and synthesize voice for helping visually impaired people in Azerbaijani reading. A. Mutholid used two different methods template matching [5] and neural network [6] in OCR step for automatic number plate recognition (ANPR) systems based on smartphone.

In this paper, we develop an application runs on Android mobile device which can extract license plate number in machine-encoded text type from image captured by available camera of that device. Some image processing techniques are used to crop the license plate from image including noise reduction, adaptive binarization, and skew correction. Based

on the properties of letters/numbers in the plate, we can separate each of them for recognition. We considered two OCR methods: Tesseract engine [7] and neural network. In order to evaluate the performance of the program, we created a database and used three measuring parameters including correct localization rate, OCR rate, and processing duration.

Android is a Linux-kernelled open source mobile phone operating system, middleware and key applications. Android applications are primarily written in Java and compiled into Dalvik executable (DEX) format, a custom byte code. The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language. Developers have full access to all the frameworks and APIs that the core applications use and to Google-developed software libraries. In 2005, Google merged the mobile phone OS developer Android, and Google continued to develop it after the mergence. Until November 5th 2007, Open Handset Alliance which is composed of Google and other 33 mobile device manufacturers announces this operating system [5] [6].Android's software architecture is designed to simplify component reuse. Any application can publish its capabilities, and any other application can then use those capabilities, subject to security constraints en- forced by the framework. The detail of the android architecture is shown in figure 1.The Android software development kit (SDK) supports authoring applications with rich functionality. Like the iPhone, it can handle touch screens, accelerometers, 3D graphics, and GPS as well as collaboration among applications like email, messaging, calendars, social networking, and location-based services [6].

III. METHODOLOGY

The overall ANPR system can be subdivided into the software design and hardware design. In this section will discuss the both designs in detail.

A. Software Design

The most important part of this system is the software design. The software design uses series of image processing techniques which are implemented in Android mobile platform which is supported minimum API 5 or android 2.0 (cupcake). The ANPR algorithm designed in this paper is roughly divided into four parts:

1. Capture vehicle number plate image
2. Image filtering
3. Segmentation of the number plate image
4. Recognize the numbers plate image using OCR algorithm.

The first step is the capturing of an image using the camera provided by the mobile phone. The images are captured in RGB format so it can be further process easily for the number plate segmentation.

The following step is image filtering of the number plate image. The filtering process is using two different filtering techniques. The first technique involves removing of all white patches that are connected to any border and set their pixel value to 0. The second filtering technique use pixel count method to remove the small regions in an image other than the plate region. The number of consecutive white pixels is inspected and regions that contain number of white pixels less than the predefined threshold are set to 0.

The next step of the ANPR algorithm is the segmentation of number plate in an image. It is one of the most important processes in the automatic number plate recognition, because the following step relies on it. If the segmentation fails, a character can be improperly divided into two pieces or two characters can be improperly merged together. In this process, we split up the number plate image character by character until we have each character separated [7].

The algorithm of segmentation basically finds the maximum peak in the graph of vertical projection iteratively. The peak is treated as a space between characters, if it meets some additional conditions, such as height of peak. The algorithm then zeroizes the peak and this process will repeat until no next space is found. This principle can be illustrated by the following steps [7]:

Target for the ANN are 26 elements for ANN's letter and 10 elements for ANN's number. For ANN's number, there will be 10 neurons for hidden layer and output layer. For ANN's letter, there will be 20 and 26 neurons for hidden layer and output layer respectively. The value of element of each targets are all zero except one element on specific position which represent the number or letter. The output from the network will be two dimensional matrixes with size 26 x *n* and 10 x *n* for ANN's letter and ANN's number, respectively. The value of output will be in range 0 and 1. To be recognize, output should be processed first by converted the highest value to be 1 and other will be 0. Then, the location of element which has value 1 will be founded and the result will represent number or letter. For example, output from ANN's letter which has value 1 at first element will represent the letter A.

Correlation method is used by the OCR to counterpart individual character and as a final point the number is identified and stored a variable as a string format. The string will be compared against the stored database for the vehicle authorization. The detail of the proposed software design is shown in Figure 2.

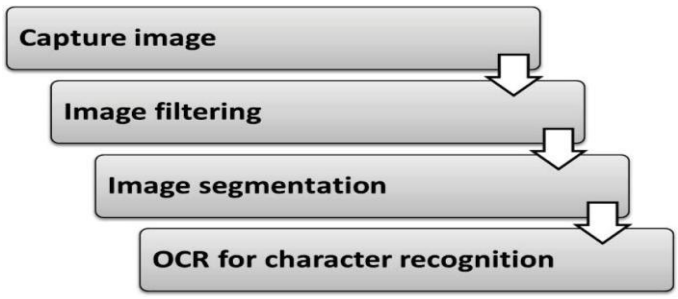

Figure 1. Steps of automatic number plate recognition.

The final step is recognizing the character using Optical Character Recognition (OCR) algorithm by compared the image character that we have in second step against the alphanumerical database that we trained using artificial neural network (ANN) algorithm approach.

IV. RESULTS AND DISCUSSION

Fig2: Number plate recognition

Fig2 shows capturing of vehicle number plate. We take tab infront of vehicle number plate and we capture Fig3 shows captured vehicle details. The details are vehicle number,owner name,vehicle class,manufacture year,fuel type ,date of registration.etc. Fig4 shows payment information.It will ask for payment and money is debited from payment wallet

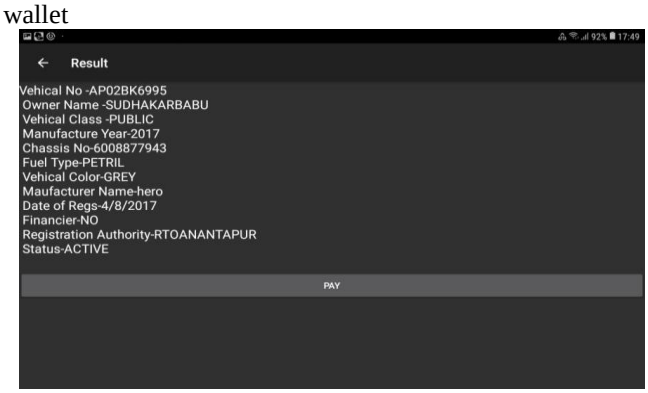

Fig3: captured details

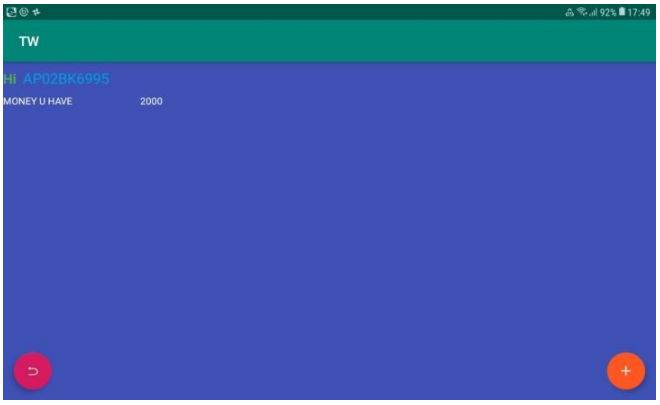

Fig4: paymentdetails

V. CONCLUSION AND FUTURE SCOPE

This paper has generally discussed on design and implementation of automatic number plate recognition (ANPR) on android mobile phone platform. In conclusion, we have proposed the design of ANPR that can be implemented on android mobile phone platform. This system is designed for the identification Andhra Pradesh state vehicle number plates and the system is tested over a large number of images.

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