

Dynamic Traffic Rule Violation Monitoring System Using Automatic Number Plate Recognition with SMS Feedback

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Abstract— In the last couple of decades, number of vehicles has been increased drastically. Hence it has become very difficult to keep track of each and every vehicle for the purpose of traffic management and the law enforcement. Use of Automation number Plate Recognition is increasingly now days for maintaining traffic activities and as similar to the method of automatic electronic toll collection. In the past, from the survey many techniques and algorithms have been proposed for number plate detection and recognition, each technique having its own advantages and disadvantages. The fundamental step in number plate detection is localization of a number plate. The proposed Automatic Number Plate Recognition (ANPR) System is based on an image processing technology. The proposed system can be mainly used to monitor road traffic activities such as the identification of vehicle during traffic violations such as speed of vehicle and to detect at the street traffic signals lane violation. And thereby can be traced every vehicle for traffic rule violation and can provide the information to the concern authority to take further effective action, so we can have smooth traffic flow and also we can avoid accidents occurring on the traffic junction. This system can also be used to assist the authorities in identifying for any stolen vehicle. The proposed system first detects for any vehicle which violates traffic rule and then captures the vehicle image. From the captured image using image segmentation technique the vehicle number plate region will be extracted. And the technique used for the character recognition on number plate is Optical character recognition. The system is implemented and simulated using Matlab. Next we have feedback system i.e., the vehicle number which is extracted using the proposed ANPR algorithm from PC which is then given to GSM modem for further SMS feedback system to the user and concern authority. The system design also involves the design and development of GUI using Matlab, to ease the user in step by step recognizing the characters and numbers from the vehicle license plate and displaying on the desktop GUI screen.

Keywords— ANPR; License Plate Recognition; Matlab; GSM modem;

I. INTRODUCTION

With increasing number of vehicles on roads, it is getting difficult to manually enforce laws and traffic rules for smooth

traffic flow. Traffic Management systems are installed on traffic signals to check for vehicles breaking the traffic rules. In order to automate these processes and make them more effective, a system is required to easily identify a vehicle. The important question here is how to identify a particular vehicle? The obvious answer to this question is by using the vehicle's number plate as every vehicle has a unique number through which it is easily differentiated from other vehicles. Vehicles in each country have a unique license number, which is written on its license plate. This number distinguishes one vehicle from the other, which is useful especially when both are of same make and model. An automated system can be implemented to identify the license plate of a vehicle and extract the characters and numbers from the region containing a license plate. The license plate number can be used to retrieve more information about the vehicle and its owner, which can be used for further processing. Such an automated system should be small in size, portable and be able to process data at sufficient rate. Various license plate detection algorithms have been developed in past few years.

Each of these algorithms has their own advantages and disadvantages. The main objective of the proposed design is to detect a license plate number from an image which is captured from camera. An efficient algorithm is proposed to detect a license plate under various conditions. This algorithm extracts the license plate data from an image and provides it as an input to the stage of Car License number Plate Recognition.



Fig.1.ANPR Block diagram

This algorithm is downloaded to the processor and the number plate data is extracted and is further sent for identification of the vehicles owner. After recognizing the owner of the vehicle

it extracts his/her phone number and sends them a SMS informing them about the penalty.

II. PROPOSED SYSTEM

In this proposed work. The block diagram displays the process of the complete system, which includes the extraction of the vehicle number from the number plate and identifying its owner to alert him/her about their penalty by sending an SMS with the help of GSM module.

Global System for Mobile Communication is a facility through which SMS (Short Message Service) can be sent. GSM modems are easily available in market and can be operated with the use of AT commands. With the help of Attention commands, SMS can be sent to the to the concern authority. A computer is used for programming for the computation of arithmetic and logical operations and run many applications compatible with the application platform of MATLAB.

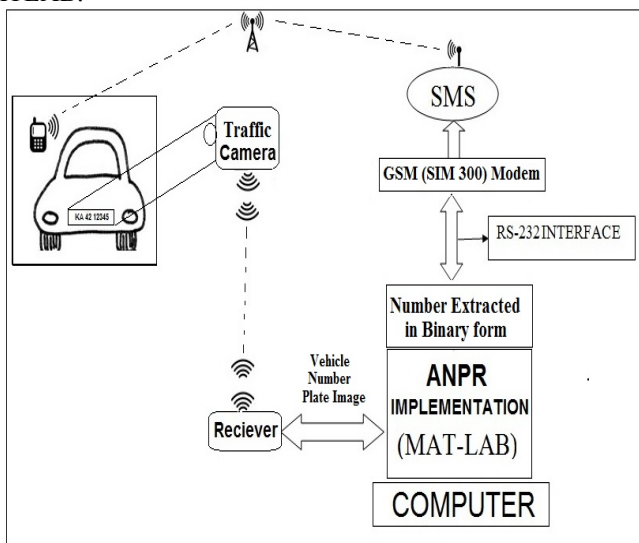


Fig.2. Proposed Block diagram

III. IMPLEMENTATION

A. Algorithm for Automatic Number Plate Recognition System- using OCR



Fig.3. Licence Plate Recognition

- 1) Input image from webcam.
- 2) Convert image into binary.
- 3) Detect number plate area.
- 4) Segmentation.
- 5) Number identification.
- 6) Save to file in given format.

- 1) Input Image from file.
 - Capture image from webcam.

- Store the captured image into an image file for further processing.

- 2) Convert image into binary.
 - Identify the intensity of the image.
 - If image intensity = high

Reduce intensity

Else if intensity = low

Increase intensity

Else, No change.

- Convert image into gray scale.
- Calculate appropriate threshold value for the image.
- Convert the image into binary image using the calculated threshold.

- 3) Detecting Number plate area

- Fill small holes including numbers of Number plate so that number plate area will be large to isolate from figure.
- Determine width and height of the image.
- Scan each pixel of line counting number of white pixels in the following system, If number of 'white' pixels < x; pixels become 'black' Else; no change If number of 'white' pixels > y; pixels become 'black' Else; no change the value of x and y may be changed according the image intensity and plate area.
- Use the step no. 3 for both horizontal and vertical direction.
- Check number of possible areas. If number of areas > 1 Select suitable area
- Logically AND with binary image obtained at "Convert image into binary" algorithm.
- Crop the required area.

- 4) Segmentation

- Filter the noise level present in the image.
- Clip the plate area in such a way that only numbers of plate area extracted.
- Separate each character from the plate.

- 5) Number identification

- Create the template file from the stored template images.
- Resize image obtained from segmentation to the size of template.
- Compare each character with the templates.
- Store the best matched character.

- 6) Save to file in given format

- Open a text file in write mode.
- Store the character obtained from the number identification process to text file in given format.
- Close the file.

B. Interfacing GSM modem to the Serial Port with MATLAB

SIM300 is a Tri-band GSM/GPRS modem that works on frequency of EGSM 900 MHz. One of the most commonly used methods to communicate between a Host like PC and devices like GSM Modem are the serial Communication port. Even interfacing with USB is gaining importance, but still these serial ports serves to be the easiest and cheapest. First important parameter to establish serial link connection between PC and GSM using Com port, for example the command serial ('COM1') is used. Other important parameters for GSM connection may be set according to requirements. In MATLAB fprintf is used for sending commands via serial port to GSM device. The recognized vehicle number from PC given to GSM modem which is interfaced using UART RS232 protocol which sends SMS to the vehicle owner and RTO office using following MATLAB code.

C. Matlab code to send SMS using GSM Modem

```
function sendsmsGSM(mobilenum,messagek)
global BytesAvail;
global A;
global B;
s = serial('COM1');
s.baudrate=9600;
fopen(s);
s.Terminator = 'CR';
pause(1.5);
tx='ATI';
tx1=char(13);
tx2=char(26);
tx3=strcat('AT+CMGS="'+91',mobilenum,'"');
tx4=messagek;
tx5='AT+CMGF=1';
fprintf(s,'%s', tx);
pause(1.5);
fprintf(s,'%s', tx1);
pause(1.5);
BytesAvail=s.BytesAvailable;
if(BytesAvail > 0)
    A=fread(s,BytesAvail,'char');
end
sprintf('%c', A)
fprintf(s,'%s', tx5);
fprintf(s,'%s', tx1);
pause(1.5);
fprintf(s,'%s', tx3);
pause(1.5);
fprintf(s,'%s', tx1);
pause(1.5);
fprintf(s,'%s', tx4);
pause(8);
fprintf(s,'%s', tx2);
pause(1.5);
disp('Done');
BytesAvail=s.BytesAvailable;
if(BytesAvail > 0)
    B=fread(s,BytesAvail,'char');
```

end
fclose(s)

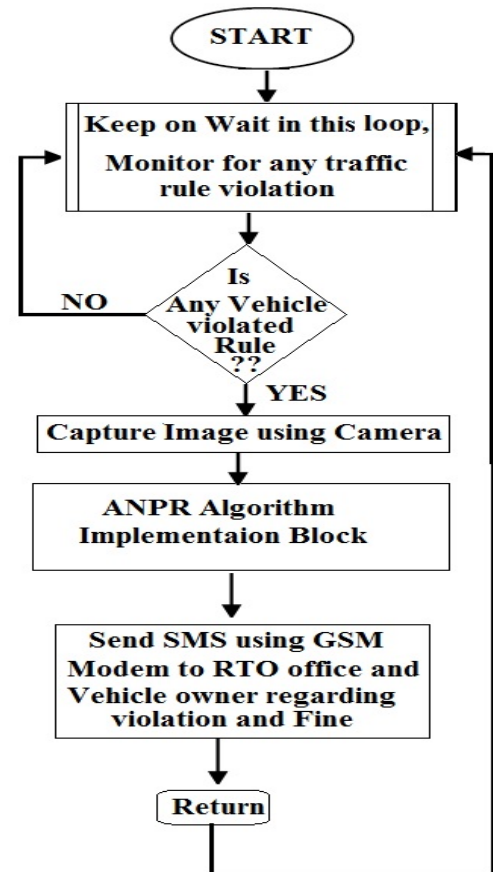


Fig.4.Flow chart to send SMS

IV. RESULTS AND DISCUSSIONS

This section presents the simulation results of the proposed system. The images which are captured are in RGB format with the resolution of image is 800 x 600 pixels.

Once the vehicle number is extracted from the plate and then it is converted to the binary text form. Fig.5. shows Step-by-Step process in recognition of Number Plate. The system is programmed using Matlab, and is tested on real time images. From the results it is observed that, the proposed system successfully recognizes the vehicle number plate on the real time images. Next we can send the warning SMS to the automobile owner and the RTO office using GSM modem which is connected through serial communication from MATLAB. This system also developed with Graphical User Interface for which the captured vehicle images are processed and will display the result on desktop GUI screen.

The algorithm has been tested using different number plate and the result of the some number plates shown below. In this Fig.5, axis 1 shows captured image, axis 2 shows gray image, axis 3 shows dilated image, axis 4 shows eroded image, axis 5 shows binary image, axis 6 shows segmented image and last block shows recognized number on Graphical user interface. Fig.6. shows the extracted number on notepad

in the form text and after it has given to GSM for further feedback. Fig.7. shows the fine for the traffic signal which is directly generated when any traffic rule violation by vehicle and the fine amount sent directly to vehicle owner mobile.

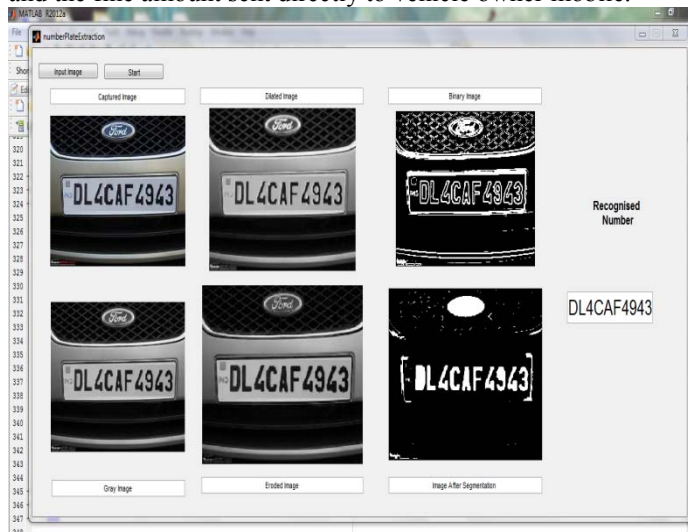


Fig.5. Step-by-Step process in recognition of Number Plate

which is processed in Matlab and after extracting number in notepad which is shown in Fig.9. Fig.10 shows the fine amount which is generated by the system and the SMS sent to vehicle owner.

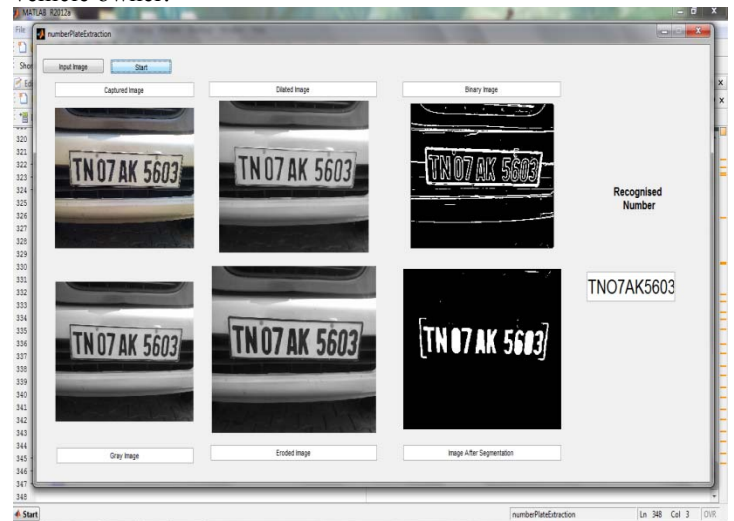


Fig.8. Step-by-Step Output of the Detected Number Plate 2

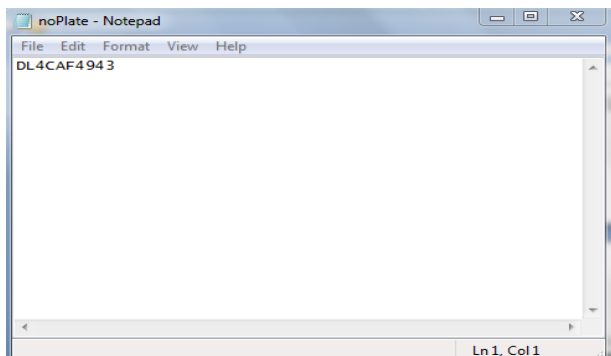


Fig.6. ASCII format of Detected Number Plate 1 in notepad

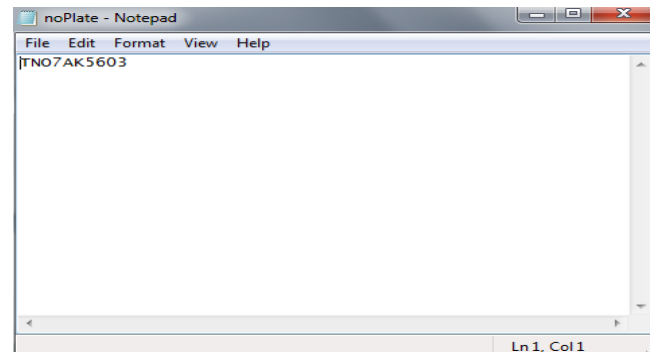


Fig.9. ASCII format of Detected Number Plate 2 in notepad



Fig.7. Fine amount send by the system to the vehicle owner mobile

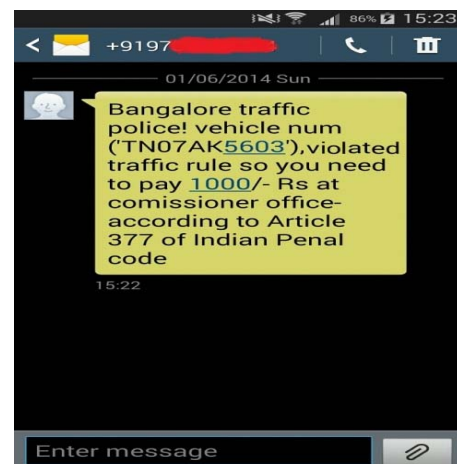


Fig.10. Fine amount send by the system to the vehicle owner through SMS using GSM Modem

Figure 8 shows the Tamilnadu vehicle number plate taken for analysis. It shows the step by step processing of number plate

We are able to achieve 95% of success rate in number plate detection i.e., we are able extract nine out of ten vehicle

number plate without any error, the one or two vehicles which is failed because some of images have different intensity, different font type, noise in image and tilting etc. Error due of font size and broken boundary of character is shown in Fig.11 and Fig.12 which recognizes nine characters and last character it's giving some other character. In this work it is observed and evaluated the accuracy of the Optical Character Recognition technique. The Template matching affects the accuracy of recognition. We have found that there are some factors which affect the effectiveness of template matching based on OCR technique i.e. different font type, noise in image, tilting etc.

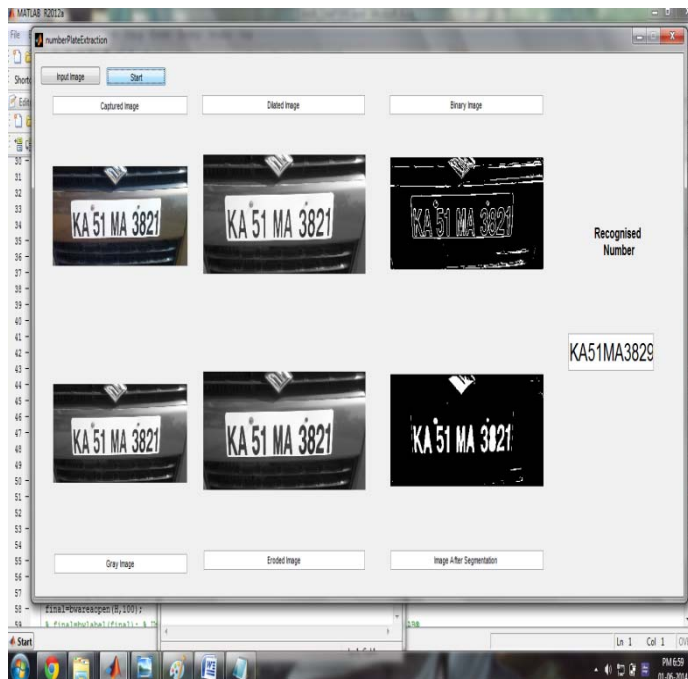


Fig.11.Step-by-Step Output of the Detected Number Plate 3

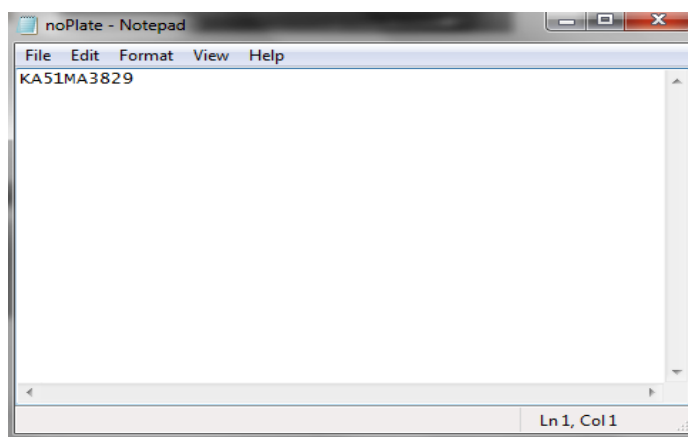


Fig.12. ASCII format of Detected number plate in notepad

V. CONCLUSION AND FUTURE SCOPE

As we have discussed about various problems faced by traffic police to maintain the database of all the vehicles violating the traffic rules, this module provides an easier solution for the same. The module what we have developed is able to justify 80% of the purpose. There are still some imperfections in the code that we are still working on. Only in the case of 10 character image we are unable to get the accuracy of all the characters getting decoded. We are able to decode the image of the car number plate and extract the vehicles number. Identified owner will be sent an SMS with the use of GSM module. This SMS will contain the details of the penalty which owner needs to pay to get his fine record cleared.

Here we made the work easier by sending an SMS which is not available in the currently existing system used by traffic police. In such cases the penalty is paid only when the person is caught by the traffic police, but with the installation of the system developed by us person has been notified about the penalty through SMS, making it easier for both traffic police and concerned person. The efficiency of this system is good and can sustain for long without failure.

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