Software Simulation of ANPR System using MATLAB

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Abstract—This paper highlights the importance and enhancement in the technology of the Automatic number plate recognition system (ANPR) system and its future applications for universities, large apartments, andhighly restricted areas. The ANPR system uses the concept of image filtering and character recognition technology to extract the characters from vehicle's number plate and correlate them with the pre-occupied database. This system will work as an access grant system when the vehicle's number plate matches with the pre-occupied database of the system, and then access will be granted. Otherwise, the access will be denied and the system will send an alert message to the security guard or the concerned admin via E-mail or SMS. A low-cost model of this system can be very well applied to apartments and societies where the problem of vehicle security in the parking lot, maintaining the record of residents' vehicles, and keeping a watch on suspicious intruders in societies can be solved.

Keywords—ANPR, Image recognition system, MATLAB, Number Plate recognition

I. INTRODUCTION

In the early 90s, the Automatic number plate recognition system (ANPR) was used as an integral part of the field of security and law enforcement in the UK. In the early 90s, this technology only used primary cameras to capture the image of suspected vehicle number plates for carrying out a clear investigation. However, the development in this technology increased when the primary cameras were replaced by the digital cameras having a higher range and wide-angle [1]. A synergy of data science and machine learning algorithms can be used to enhance the ANPR system to function in the real world. As the population increased over the period of time in India and abroad, this technology has become the need of an hour to manage traffic and also for the security and law enforcement. In essence, it consists of a powerful digital camera having a wide range that has the ability to capture images of the vehicle number plate in real-time [2]. When the image of the vehicle's number plate is captured, the system will segregate characters in the number plate by using a character recognition algorithm [3], when the characters inthe number plate will be checked with a pre-occupied large database with correlation [4]. OCR, i.e., Optical Character Recognition, plays a crucial role in this type of system [5].

MATLAB has commands integrated with it which help in Image Processing [6]. If the number plate is matched with the Pre-occupied database, access is granted. Otherwise, it's denied [7]. The increasing number of accidents day by day makes it important for ANPR systems (photo and video) to be used widely [8]. The amount of light present in the environment where is ANPR system is present needs to be monitored so as to get a better image for recognition [9]. As RGB images have a lot of data captured in them, it is important to convert them into grayscale for faster recognition [10].

Till now, we can see that the output for the Automatic Number Plate Recognition System is saved in a text file or directly in the command window of MATLAB. Here in this paper, we have showcased the system to be able to send an SMS or an E-mail to the user. This research paper focuses on the importance of using ANPR technology for universities and larger apartments or residential areas where security and maintaining records of every vehicle manually is a tedious task, especially in a country like India. This simulation is developed in MATLAB software which is easy to use and has good compatibility with cameras. Ease of use

II. METHODOLOGY

A. Image Acquisition

The first step in the process is to acquire the image. In the suggested method, we will take an input image from the user to aid the recognition process of the number plate, as shown in Fig. 1.

Fig. 1. Image Acquired from Input

B. *Pre-Processing Of Number Plate*

The acquired input images are in the RGB format. For faster processing speed, they need to undergo a conversion from RGB to Greyscale. The RGB image is hence converted into greyscale using the **rgb2gray() function.**

The RGB colour group consists of three primary colours, that is Red, Green and Blue. Greyscale, on the other hand, is composed of two main colours that are black and white. Therefore, this aids in quicker processing. This can be seen in Fig. 2.

Fig. 2. RGB to B/W converted Image

Identifying the size of the plate is the first step in the process of recognising a vehicle number plate. Since number plates often have a rectangular shape, it is important to recognise the edges of the plate. The mathematical morphology method is utilised to find the region, and the Sobel operator is used to get the threshold value that finds the regions that stand out due to their strong edges and large edge variance.

The image forms a binary gradient mask as a result of which distinct, sharp contrast lines are discernible. The target image's outline is not easily distinguished by these lines. There are still a lot of gaps and noise around the lines that surround the item in the gradient mask as compared to the original Image.

If the Sobel image is improved with linear structuring components, this linear gap is eliminated. Matrix representations of the structuring components are used to measure the form of a picture. Matrix representations are a characteristic of specific structures and characteristics. Other image processing processes are performed using this. The vertical structuring element is used first to improve the binary gradient mask, and then the horizontal structuring element.

The MATLAB toolbox provides a pre-defined function **imfill()** which fills any overlooked holes in the binarized image. The enhanced gradient mask distinguishes the outline of the cell quite appropriately but does leave unwanted holes (impurities) inside the boundary. The image is scanned for any impurities, and if found, they are filled in accordance with the pixels in the background.

C. *Image Filtration*

The target is successfully found, but it is the target with some extra characters that has been found. Any entities in connection to the image border must be removed. This is how the actual region of the plate is detected.

D. *Character Segmentation*

Segmentation is a crucial process in the NPR process, as subsequent processes rely on it. If this stage fails, a character may not be recognized properly that is, the character may be divided into two or even merged to form a single character. To avoid this, we use the bounding box technique. The bounding box is used to measure the properties of the target region. Once a bounding box is created for each and every character in the image of the number plate, it becomes a separate entity for recognition of the number plate as shown in Fig. 3.
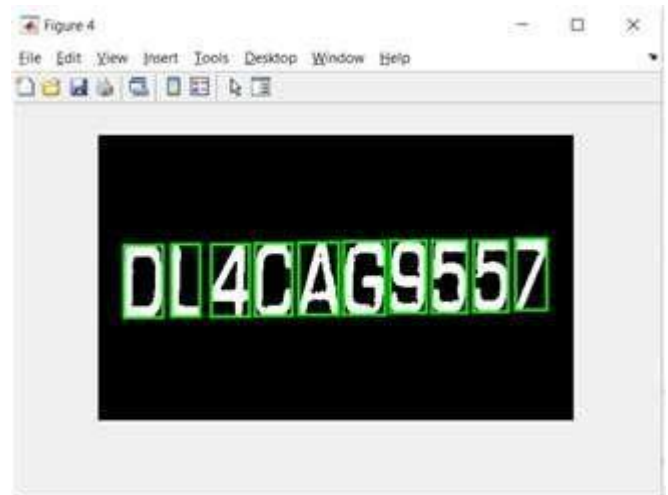

Fig. 3. Bounding Box Implementation

E. *Character Recognition Using Template*

The process of converting text images into characters uses character recognition. Now, utilising template matching arrays, the number plate identification process compares each character to the entire alphanumeric database. The template picture moves to every available point on the biggersource image throughout the matching process, and as a result, a numerical index is computed to show how well the template matches the image in that position. Pixel by pixel, the matching procedure takes place. Fig. 4 displays the image templates.

Fig. 4. Template used for Template Matching

F. MATLAB Results

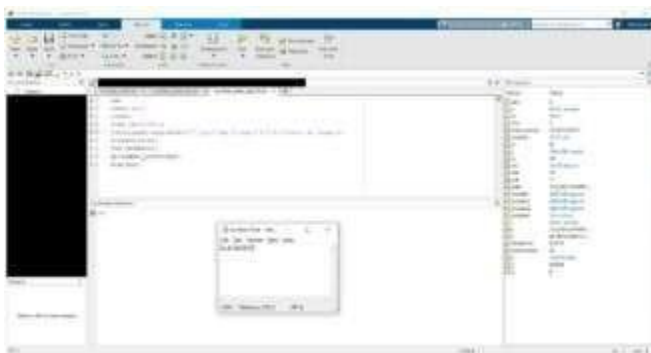The ultimate outcome of ANPR system is shown in Fig. 5 and Fig. 6 below:

Fig. 5. Resultant Image

Fig. 6. Image of E-mail

The system thus successfully recognizes the all the characters from the Input image by neglecting the surrounding environment. The system can segment each and every character individually for recognition. It displays the number plate of the desired vehicle and also sends a mail to the registered mail id that is present in the program so that it cannot be changed by the user.

III. CONCLUSION

In this paper, automatic vehicle identification and reporting system from vehicle license plates are presented. The system uses numerous image processing and character recognizing techniques for analyzing number plates. That is implemented using the MATLAB platform and gives results after processing images. The image processing uses the tools and commands provided in MATLAB software. Thisprogram developed in MATLAB first extracts the number plate from the image provided and then recognizes the character using MATLAB commands and it's saved in the array, which forms the output of the program, which can be sent to the user via text file or E-mail or SMS.

The real-world performances are to be tested, as of now, only virtual simulations have been performed, but the results are great. The integration with e-mail gives our system the ability to instantly notify the security team about unknown vehicles entering an area.

REFERENCES

[1] Rahini Bhat,Bijendra Mehandia, "Recognition of Vehicle Number Plate", IRJST, vol2, issue8, Aug2014.

[2] Mandeep Kaur Ahuja,Dr.Amardeep Singh, "Hand Gestures Recognition using PCA", IJCSET, vol5, issue7.

[3] Mithai Ovidiu, "Performance Study based on MALAB Modelling for Hybrid Vehicles", IJCA, vol99, issue12, Aug 2014.

[4] Muhammad Tahir Quadri,Muhammad Asif, "ANPR Systems for vehicle identification using optical character recognition, "IRJET, vol5, issue5, May 2018.

[5] Narendra Singh Tomar,Prakhar Sachen,Pranav Mittal, "Vehicle Number Plate Detection using MATLAB, "IRJET, vol5, issue5, May 2018.

[6] Shilpi Chauhan, Vishal Shrivastav, "MATLAB based vehicle number plate recognition", "IJCIR, vol3, issue 9,2017.

[7] Bhawana Tiwari, Archana Sharma, "Automatic Vehicle Number Plate Recognition Using MATLAB, "IRJET, vol3, issue5, May2016.

[8] Amit Kumar Parida,SH Mayuri. "Recognition of vehicle using MATLAB", "IJFCST, vol4, number3, 2014.

[9] Rathore, M., & Kumari, S. (2014). Tracking number plate from vehicle using Matlab. International Journal in Foundations of Computer Science & Technology (IJFCST), 4(3), 43-53.

[10] FAOUR, REHAM & Shanwar, Bassel & Zarka, Nizar. (2016). RECOGNITION OF VEHICLE NUMBERPLATE USING MATLAB. 10.13140/RG.2.1.1459.8640.