License Plate Recognition Using Image Processing
Wasim Sakri\textsuperscript{1} Chirag Sanghvi\textsuperscript{2} Shubham Sarda\textsuperscript{3} Prof. Sumitra Sadhukhan\textsuperscript{4}
\textsuperscript{1}\textsuperscript{2}\textsuperscript{3}\textsuperscript{4}Department of Computer Engineering
\textsuperscript{1}\textsuperscript{2}\textsuperscript{3}\textsuperscript{4}MCT Rajiv Gandhi Institute of Technology, Mumbai-53

Abstract—License plate recognition is an important issue in Intelligent Traffic System (ITS). It utilizes Image processing and Pattern recognition technologies. In this paper, we had built an algorithm in MATLAB that will extract information from an image. It should be able to identify English capital letters (A-Z), numbers (0-9), Dash (-), and Blank space from the image. We tried to adopt a very simple yet natural flowchart to develop our algorithm. Firstly, we would convert true color image into binary image. Secondly, by using Filtering we would convert the binary image into binary filtered image to remove the unnecessary information and then by using image processing Toolbox, we tried to figure it out the connected components in the binary filtered image. Lastly, using the correlation coefficient, the function identifies each letter from the license plate image.

Key words: Image Processing Toolbox, License Plate Recognition

I. INTRODUCTION

License plate recognition (LPR) is an image-processing technology used to identify vehicles by their license plates. This technology is gaining popularity in security and traffic installations. With the advances in technology and social development, cars have been gaining in popularity worldwide, becoming an indispensable part of human life. With the popularity of cars, the Intelligent Traffic System (ITS) has increasingly become the target of attention, and license plate recognition system is an important part of the ITS. The license plate recognition system includes three key components: license plate location, character segmentation, and character recognition, among which license plate location is the key and difficult part of the system. This thesis presents a license plate recognition system as an application of Image Processing. Image Processing is a process of using an algorithm to extract high level information from a digital image. Images from a camera are fed into a computer where algorithms are written to process these images. Vehicle license plate recognition is one form of vehicle identification system. LPR systems are of considerable interest, because of their potential applications to areas such as highway toll collection, parking attendant, petrol station forecourt surveillance, speed limit enforcement, security, customer identification enabling personalized services, etc. Real time LPR plays a major role in monitoring of traffic rules and maintaining law enforcement on public roads. This area is challenging because it requires an integration of many computer vision problem solvers, which include Object Detection and Character Recognition. The identification of vehicles by the contents of their license plates is important in private transport applications. There are many applications of such recognition systems, some of them are discussed below.

A. Law Enforcement:

License plate recognition technology has gained popularity in security and traffic applications as it is based on the fact that all vehicles have a license plate and there is no need to install any additional tracking apparatus. The main advantage is that the system can store the image record for future references. The rear part of the vehicle is extracted off the filmed image and is given to the system for processing. The processed result is fed into the database as input. The violators can pay the fine online and can be presented with the image of the car as a proof along with the speeding information.

B. Parking:

The LPR system is used to enter pre-paid members and calculate parking fee for non-members (by comparing the exit and entry times). The car plate is recognized and stored and upon its exit the car plate is read again and the driver is charged for the duration of parking.

C. Toll Gates:

Toll gates require the vehicle to stop and the driver to pay an appropriate tariff.

The license plate recognition of which the main methods are: [1] the method of edge system includes three key components: license plate location, character segmentation, and character recognition, among which license plate location is the key and difficult part of the system. At present, the license plate location research focuses on the following aspects: The first aspect based on gray-scale image processing technology detection [2] the method of wavelet texture. [3] the method of the horizontal gradient of the differential texture; and [4] methods based on mathematical morphology. The disadvantages of these methods are the error rate increases when the contrast of a car image is poor or the illumination is uneven, or some interference similar to the license plate texture characteristics. The second aspect is the processing technique based on color features. In recent years, many scholars have taken this approach to the license plate location processing. The main methods are: [5] the method of using neural networks for image color segmentation [6] the method of the combination of color edge detection and region growing. Positioning a new method based on edge color on the license plate. Drawback of these methods which influence the effective rate of license plate location recognition include the color similar to the body color of the vehicle, the surrounding background and license plate background discoloration, license plate background color or image plate region with similar geometry, color and texture features of pseudo-plate region, car image due to uneven illumination, and non uniform brightness. In addition, these methods are based on color feature processing techniques for color image processing algorithm which may be time consuming and they won't be able to meet the real-time...
requirements. Thirdly, in recent years, a combination approach of the gray-scale image processing and color features have gained attention. This article aims at improving the reliability of the license plate location. By taking advantage of the characteristics of the plate area, reducing the impact of the background and body of the factors on the license plate location.

II. SYSTEM OVERVIEW

In License plate recognition system, operations like image processing and pattern recognition are used. The implementation alternatives include binary-scale formation, Edge detection through morphological operator and image processing Toolbox, image scanning, and optimizing technique.

![Flowchart Description](image)

A. Load Image:
In the first stage, we ask the user to load the image of the license plate in the GUI once the image is loaded through the program; it goes to the second stage.

B. Filtering:
This stage converts the true color image into a binary one and it processes and filters it out unnecessary information and noises. Once we have a filtered binary image, it moves to a third stage.

C. Identifying Zone of Interest:
This stage uses an image processing Toolbox to figure it out the connected components in the binary filtered image ,the alignment, height, position of this components are taken into considerations and then the program figures it out the set of components which actually holds the required information and select it.

D. Recognizing Letter:
On the fourth stage the program sends the snaps of these selected components to our read letter function. This function matches the snaps against our pre-recorded database which is analogous to the alphabet in our memory. Using the correlation coefficient, the function identifies each letter and returns it. Thus the program saves the letter in the string. To identify the space, the program simply judges the distance between the significantly enlarge than the average; it inserts a white space into the string.

Finally, a Graphical User Interface (GUI) displays the string into the user and completes its tasks.

III. DETECTION OF LP USING IMAGE ROCESSING AND ITS IMPLEMENTATION IN MATLAB

The algorithm initially used various inbuilt functions and implemented few user defined routines related to image processing. Once the algorithm was developed, it was verified with multiple input images containing car number plates. The input images contained number plates that were aligned horizontally as well as at some angle from horizontal axis. Once the algorithm was completely verified, the in-built functions of MATLAB were replaced by user-defined functions. A flow-chart showing the basic implementation of algorithm is shown Fig.2.

![Flowchart Showing LPR Algorithm in MATLAB](image)
IV. EXPERIMENTAL RESULTS

A. Original Image Conversation:

Fig. 3: Image of Original Image

B. Conversion of Original Image to Binary Image:

Fig. 4: Image of Binary Image

C. Applying Filtering Operation:

Fig. 5: Filtered Image

D. Final Display of Each Character:

Fig. 6: Recognition of Each Character

V. CONCLUSION

This new method was proposed on the basis of the results of previous studies, through the study of images of vehicles and license plate area features, with the characteristics of fixed color license plate background and character, using license plate structural characteristics and color characteristics. In this approach, initial image processing and binarization of an image is carried out based on the contrast between characters and background in license plate. After binarizing the image, it is divided into different black and white regions. These regions are passed through elimination stage to get the final region having most probability of containing a number plate. Extraction of symbols and characters from the image, Simulation method in the MATLAB environment provides a feasible and effective license plate location algorithm.

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