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An Efficient Hybrid Technique for Automatic License Plate Recognitions

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Abstract. Automatic License Plate Recognition (ALPR) is an embedded real-time technology that automatically recognizes a vehicle's license plate. There are numerous uses, ranging from complex security to shared spaces, parking to acceleration. The ALPR is used to control the traffic and to take hold for those who violate the traffic rules. Automatic recognition of vehicle license plate numbers has become critical in our daily lives due to the rapid expansion of autos and transportation systems, which makes it difficult for the general public to keep up with and monitor. A license plate identification system uses image processing theory and soft computing technology to identify cars based on their number plates. Using fewer and simpler algorithms can reduce both calculation time and execution time needed by most number plate localization approaches. This is because most of these techniques require several operations. License plate recognition is the most used approach in traffic-related applications. Various approaches, tactics, and algorithms have been developed for the identification and recognition of license plates. In the context of Indian license plate identification, only a few research have looked at the topic. Character segmentation and character recognition are two of the three key steps in identifying a license plate.

Keywords: ALPR, Plate recognition, Character recognition, Image segmentation

1. Introduction

The ALPR is method which uses OCR (Optical Character Recognition) and other camera techniques to capture an image for various purposes like electronic toll collection, automated parking and also used by various police forces across the world [1]. Locate a standard number plate, segment and recognize the characters are the aims of the article The system must take angles, distances, scales, resolutions, and lighting conditions into account. Binary image processing, greyscale processing, color processing, and classifiers are utilized to extract the plate region technique. This paper discusses many approaches to solving the problems associated with license plate recognition [2, 3]. Detection and extraction of the vehicle plate image, as well as recognition of the characters separated from the vehicle plate image, will be the] subject of this research project. It is essential to develop a new plate recognition system that outperforms current ones while also removing a large number of workplace restrictions [4, 5, 6]. Image processing is a technique in which the image which is captured by the camera, the processing is done on that image and the characters are extracted for the further investigation [7] and LPR systems for an Intelligent Transportation System are all possible uses for the systems.

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A license plate identification system uses image processing theory and soft computing technology to identify cars based on their number plates. Traffic monitoring, highway toll collection and various LPR methods are being developed and present system performance is being improved with the help of these approaches and tools [8, 9, 10, 11]. These number plate identification techniques have been refined, and they're currently in use for various traffic and security purposes, such as parking, access and border control as well as tracking down stolen vehicles [12, 13, 14, 15]. The number plate recognition systems Parking systems monitor license plates for a predetermined amount of time while a vehicle is parked. When a car enters the parking area gate, the license plate number is automatically gathered, captured, identified, and entered into the database. The number plate is once again identified and matched to the database of number plates at the point of exit. ANPR devices placed in various areas can detect and monitor border crossings, access control, and surveillance applications [16, 17, 18, 19]. Specific Topic: This sort of optical character recognition recognizes license plate numbers using Automatic Number Plate Recognition (sometimes referred to as 'number plate recognition') (OCR) [20, 21, 22, 23]. Computer systems can automatically read a vehicle's registration number (license number) from digital pictures using license plate recognition (LPR) shown in Figure 1.

Figure 1. Images of Indian license plates

2. Literature Review

A method for several images on the basis of their texture and quality of the license plate which is to be extracted and the image is run through a projection algorithm are used to verify the right number plate amongst the many [11]. Extra image that not containing the license plate are removed using the compact factor, which declares the true license plate and after that the image is further examined for the character segmentation. In this paper this person developed the character segmentation easy using the Hough transform [12]. In this paper it simplifies the work segmenting the characters in which the time consumption is less. Using the Hough transform, which mostly helped the characters to get segmented with the large rotation [13, 14, 15, 16].

An image-processing technology is used to identify a car based on its license plate. License plate placement is an important stage in vehicle license plate identification for automated transportation systems [17]. The procedure begins with signal conditioning and pre-processing before locating the license plate using morphological operators. Template matching is used to recognize the numerals and characters on the plate. The results showed that 98.2 percent of plates were accurately identified and localized, and 92 percent of characters were successfully recognized, thanks to the help of the Isfahan Control Traffic organization. The method was found to have great accuracy and robustness, and it might be applied in other applications in transportation information systems, such as automatic registration plate and signpost identification [18]. This

algorithm has been rigorously tested on a huge number of pictures and has been tuned to detect Iranian license plates. The mechanism for global car license plates can be redesigned and tested [19, 20].

Problem Find: The problems in this technique are that the problems in capturing the image i.e., the quality of the image is very poor as the cameras used are no very good. Capturing the image is not very easy for the moving vehicles and sometimes the difference in the number plate makes it difficult for the camera to recognize the image because of the different style of the number plate and the different styles of character.

3. Proposed Work for Number Plate Detection

In an LPR system, character segmentation is critical [18, 19]. Character segmentation is complicated by factors such as image noise, plate frame, rivet, space mark, plate rotation, and illumination variation. Laplacian One of the unique ways of character segmentation for license plates makes use of transformation, region expansion, and prior knowledge of the license plate. Severe character enhancement, character edge detection, character localization of candidate regions for segmentation and segmentation and binarization are all processes in this approach. Image preprocessing is just one of the six steps in this procedure. In order to find the standard length and width, utilize Equations (1) and (2).

$$\text{Charcter\_width} = \left(\frac{45}{440} * n\right) \tag{1}$$

$$\text{Charcter \_Height} = \left(\frac{90}{440} * m\right) \tag{2}$$

where m and n are the width and height of the real licence plate, respectively.
The grey level of the licence plate is calculated using Equation (3) to improve the character region of the licence plate:

$$gray\ A(a, A(i,j) + 1 = gray\ A(1, A(i,j) + 1 \tag{3}$$

This technique's threshold for density of grey level density is determined by the average density, which can be calculated using the following Equation: (4).

$$\text{Thershold} = \frac{\text{m} * \text{n}}{256} \tag{4}$$

Vehicle image capture: In this stage, the image of the vehicle is captured by high resolution camera. The camera may be adjusted with deference to the authorization plate. The parameters of the camera resolution, type of camera and light has to be considered. Pre –processing stage is used to enhance the quality of image which is captured. It contains two processes shown in Figure 2.

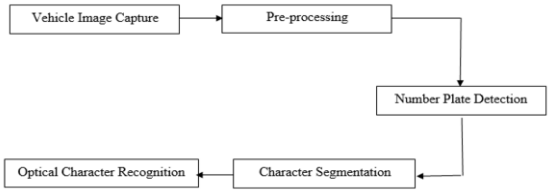

Figure 2. Basic architecture of license plates detection

a) Resize: The image is reduced in size to a more manageable aspect ratio because the camera's image scale is likely to be large and cause the system to slow down. So that number of similar type of images can be stored in the system without making the system slow. The resize of images can be depend on the requirement of different system.
b) Color space: The acquired image is enhanced by converting RGB image to Grey image, thresholding, median filtering etc. To improve the image's quality, median filters are applied to the input isolated image. By swiping a window over the image, a median filter calculates the output pixel's brightness as the median value.
In this stage, we use various image processing techniques to recognize and extract the license plate. The different techniques in number plate detection are: Images are converted to black-and-white using image binarization, which converts color images to monochrome. Additional image processing is applied to the recovered license plate in this stage in order to remove any irrelevant information. After character segmentation, the extract license plate only has the characters that match the licensee plate's actual characters. It's major technique categories are CCA, pixel projection, etc. It is very important part of ALPR.

The selected character is sent to an optical recognition engine, which returns the licensee number in ASCII via optical character recognition License plate characters can be segmented using a quick region marking approach and the large-interval character finding algorithm as another character segmentation method [18-20]. As a result, the automatic license plate reader will read plates more accurately. By calculating the density of each license plate grey level and the threshold of the -density, and specifying a contrast stretching mapping to the original license plate, this strategy raises the grey level of the characters in the license plate picture. The Gray Stretching equation is as follows: (3-6).

$$f(a) = \left\{ \frac{b_1}{a_1} a \qquad\qquad a < a_1 \right\} \tag{5}$$

Equation is used to binarize the image during the pre-processing stage.

$$\mathrm{T} = \mathrm{M} + \mathrm{C}\sqrt{\frac{r_1}{r_2}} \tag{6}$$

when r_1 and r_2 reflect the rate at which characters and background change in a license plate photo where T is the image's overall threshold, M its overall mean, and C its overall variance.

4. Results and Discussions

A hybrid approach to license plate recognition is presented in this chapter, along with data from the LPR system's early stages. The method's effectiveness was also assessed in light of some of the most well-known previous contributions to LPR research. The implementations were made on a 2.67 GHz Intel Core 2. Because of its location and direction in regard to the camera, LP may appear skewed in some situations, and inclined plates may be used on occasion. From the time the image is taken as input through the extraction of the letters, it is shown in Table 1.

Table 1: Performing a timing study at several points throughout the project.

Process	Timing (Seconds)
Extraction Process	0.7
Element Extraction	0.3
BCD to Binary	0.1
Increase Intensity	0.3
Gray Scale Conversion	0.2
RGB Conversion	0.3
Removal of Aliasing Effect	0.2

It presents performance of the segmentation method used applied over different number of samples taken during different timing. The success rate also has been reported in this table. Total number of samples was 280. Table 2 reports a comparison of segmentation and success rate of plate extraction of various methods. The methods worked upon different number of samples that required different timing. The proposed produced much better results as compared to many of the noteworthy contributions.

Table 2. Performance of the segmentation

Condition	Varying illuminations	Front image	Tilted image	Night	PM	AM
No. of Sample	60	45	80	70	50	40
Segmentation Rate (%)	89	90	96	92	89	96

Numerous steps are usually included in number plate localization procedures, which increases computation or execution time. Using fewer steps and simpler algorithms can help to reduce this. Automatic license plate detection and identification is used in the majority of traffic-related applications. When exposed to noise signals, some characters, such as 'T' and 'I,' 'E' and 'F,' 'O' and 'Q,' etc., resemble each other. Several major concerns have been addressed and fixed as part of the present endeavor. The structure of the network (number of neurons in the input, output, and hidden layers) and recognition accuracy were compared, as well as the researcher's techniques. Existing nonhybrid LPR approaches employ a range of methodology and topologies, as can be shown, however the results are insufficient. When compared to the hybrid approaches in the table, the proposed 117 strategy excelled them in terms of recognition accuracy. The number of neurons was enhanced even though the time spent at different phases of LPR did not increase much when compared to other techniques.

5. Conclusion

This article provides the details of the findings of the suggested hybrid approach for license plate recognition, as well as the results of the LPR system's intermediate stages. The database photographs were captured with a high-quality digital camera. In this paper we did a case study related to the OCR (optical character recognition) and studied about it with the help of a camera which works on a software of **Syber**-Hawk. This case study gave us a lot of exposure about how it works and it also showed some trials of the camera in the day time and at the night time. The stats in the day time were better as compared

to the ones at night. An OCR-based method for character detection and recognition is presented in this research. License plates are critical for vehicle identification since they include specific information about the vehicle. Detection of a license plate and character recognition are the two parts of the system's design. Accurate placement of the license plate region is obtained by carrying out a process known as license plate localization (LPL). The test results show that the proposed method is effective for use in a license plate recognition system, and this has been proven.

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