AUTOMATIC LICENSE PLATE RECOGNITION [ALPR]-A REVIEW PAPER

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Abstract - *ALPR is the technique of extracting the information from an image or a sequence of images of Vehicle's Number Plate. The image will be captured from Android device. This captured device will be then sent to the System. System will perform pre-processing on this on this image using Algorithm image Segmentation. In the next step feature extraction will take place and after that matching of template will be done using the algorithm Bozorth3. The result will be send from the server to the android device to determine the correct authority of the person. Capturing image of number plate for displaying information regarding vehicle. The vehicles number plate photo will be captured by the android phone and then it will be send to the server. The server will perform the plate region extraction on the image and will convert it into grey scale. The Otsu algorithm will perform binarization and morphological operations on grey scale image. The number will be extracted using OCR algorithm. The server will send the correct result back to the android phone.*

Key Words: Segmentation, Binarization, Grey scale, Pre-processing, License plate localization ,Template matching.

1. INTRODUCTION

Each License plate has a unique number assigned to it for vehicle identification. ALPR will work in small scale with the use of Android device. The main challenge while working with ALPR is the Accuracy and Detection speed ie. ALPR should produce correct output within certain amount of time which is the prime necessity of ALPR. This can be obtained with quality of Algorithms used in a License Plate Detection. The distance between the camera and the car should be approximately constant. For license plate detection purpose the concept of edge detection, contour determination and bounding box formation and elimination is used. Selection of license plate areas (LPA) and their elimination to obtain the actual license plate was based on various heuristics. This stage is important since improper detection of LPA can lead to misrecognized characters. Character Extraction or character segmentation is the important component of our ALPR system. It takes a properly segmented license plate as an input. Some preprocessing is done on the license plate image for the removal of noise. Various morphological operators are used on the image for this purpose and the noise free output image is sent for character segmentation. Image binarization and image projections are used for character extraction. image for this purpose and the noise free output image is sent for character segmentation. Image binarization and image projections are used for character extraction. In this project work we have developed a full-edged Automatic License Plate Recognition (ALPR) system with hardware implementation. Including the main steps we have suggested heuristics to identify the number plate faster than the existing scheme. Further, Character recognition has been done using template matching and license plate are authenticated using rank based search strategy. The Automatic License Plate Recognition (ALPR) can be useful in Large scale area through the use of cameras mounted on such location so that it can capture multiple Car's License Plate images.

1.1 Phases of ALPR

ALPR system work according to the given phases:
- Obtain image
- License Plate Separation
- License Plate Segmentation
- Number Identification

As shown in (Fig -1), Image need to be captured first and the image should not be blurred so that system should be able to do necessary processing on image for number identification. Then the license plate needs to be extracted from the whole image. Segmentation is performed on extracted image. Through Segmentation the extracted image is divided into many segments for further processing. Noise needs to be removed from the image for proper number identification. The final phase of Automatic License Plate Recognition (ALPR) is Number identification.
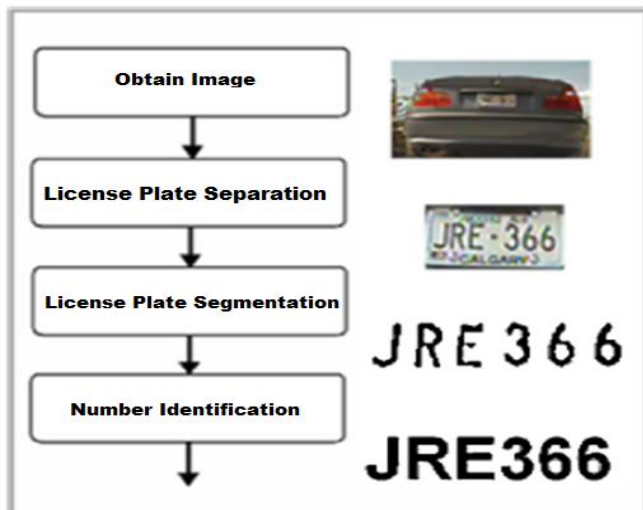

Fig -1: Phases of ALPR

1.2 Working of ALPR

1. **Input a raw image**
    Capture the image from an Android device Camera. The resolution of camera needs to be good so that the captured image can be further utilized for processing; Captured image is given to the ALPR as input.

2. **Converting image into Grey Scale.**
    Grey scale conversion is nothing but converting an image into black and white view with grey shades. Colored images doesn't help us to identify the important edges and other features. so the image needs to be converted in Grey scale format.

3. **Binarization**
    Otsu Thresholding method is used to convert the grey scale image to monochrome. This method reduces the complexity of captured image (input).

4. **Morphological operation on Grey scale image**
    This operation starts with the dilation of an image then erosion needs to be performed after that by applying median filtering noise can be reduced.

5. **License Plate Recognition**
    The main step is to detect the size of the license plate. In general the shape of the License Plate is rectangular. The edges of rectangular area needs to be find first. Depending upon the Threshold value of an input image, edges can be detected. hence the whole license plate can be recognized.

6. **Character Extraction from License Plate**
    OCR Algorithm is used for Character Extraction.

7. **Showing Document of the extracted Number**
    Search and Display the Details of extracted number of License plate on Android Application.

2. OCR

OCR stands for Optical Character Recognition. It describes the process whereby an image is captured by a paper document. Document recognition is 40 times faster than manual retyping. OCR is used to convert different types of documents into an editable and searchable data.
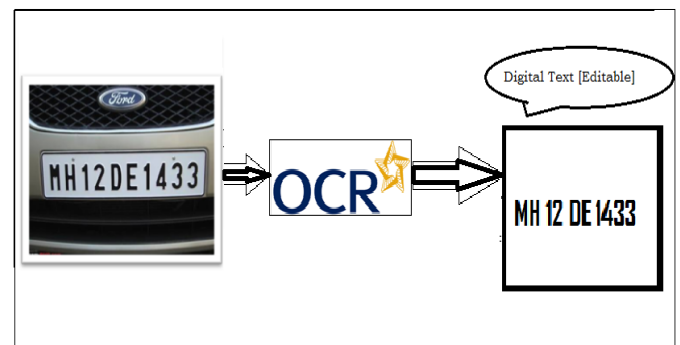

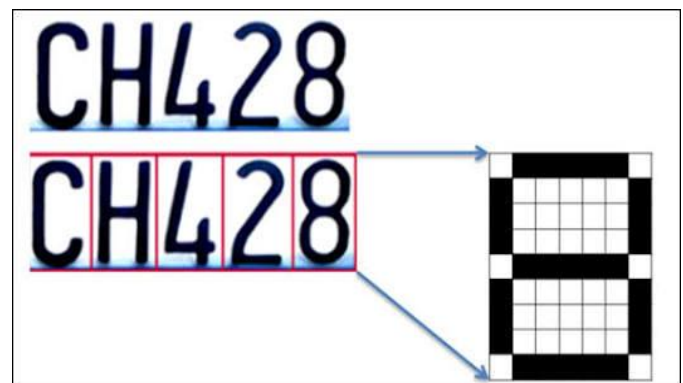**Fig -2**: OCR Conversion

2.1 Techniques of OCR

Fig -3: Sample of the recognized number

Digitization: It is the process of converting Hard copy into an electronic format. First of all the hard copy needs to be scanned properly. The image file format is produced as output. The digitized output is sent further for Pre-processing phase.

Pre-processing: In this phase , There are many operations that needs to be performed on scanned input image. OCR often pre-processes the image to improve the chances of successful detection of characters from an image.

Segmentation: In this phase whole image is divided into different segments. It is the separation of individual characters of an image. Segmentation is very useful stage.

Feature Extraction: In this phase, feature of Each character Is extracted. In order to find feature of each character includes parabola curve fitting based feature, intersection and open end points feature, diagonal features, zoning features, transition features, directional features and power curve fitting based feature.

3. Literature Review on ALPR

The review process was adopted by surveying the research in last 5 years (2010-2015) for collection of information about ALPR issues. In the Existing system extensive research has been done in the area of License plate recognition since its invention in the year 1976.This is the topic of recent research attracting several papers around the world. By taking an overview on studies of ALPR from the past few years, It is still a challenging task to detect characters from License plate. Here it is mentioned some of the relevant works in this section. Any basic ALPR system has 3 fundamental problems.

    i.   License plate localization from captured image
    ii.   Character segmentation
    iii. Character extraction from processed image

Some important concepts relevant to the LP detection approaches are mentioned. Processing of boundary lines, from a gradient filter, and an edge image is discussed. This edge image is threshold and then for detection of lines Hough transform (HT) is processed. Two parallel lines are considered as plate candidates. Finding horizontal pairs are not suitable for boundary lines detection. It may happen that the image boundary line is absent or due to noise system may not be able to detect it. Furthermore, HT is a heavy computation task. The texture and color of the captured image of LP have also been used to recognize it but it seem to be useless, especially when the image of plates of different colors and sign patterns is given as input to the system[1].

There are many algorithms for Character Segmentation but each algorithm has its own requirement then only they can produce accurate output such as in some algorithm the requirement can be the boundaries of the character region needs to be detected accurately, In some algorithms the requirement can be the number of white pixels of each vertical column is counted as the character region has more white pixels as compared to the other region on the license plate. Other approaches for segmentation includes segmentation through region growing approach and the most common one is segmentation using vertical and horizontal image histogram methods[2]. The region growing method takes quite much of the computation time so histogram method is mostly used which is very fast and its accuracy is also considerable.

The basic two approaches of character recognition are i) Feature Matching Approach ii) Template Matching approach. The first approach is the machine learning approach and is the most commonly and widely used approach for the recognition process. This method requires having a large database of test images on which the system is trained to give specific output. The training process takes much time and it depends on the varieties of the sample images taken for the training purpose. This method takes much time to evaluate but the accuracy of recognition is very high. The second method, template matching method basically measures the linear relationship between the captured images and the database images . This method totally relies on the quality of the captured image. The captured image is compared with all the database images of alphanumeric characters and then the most promising character is chosen. This way the recognition process is done. This method is quite faster than the feature matching approach but we have to compromise with the accuracy of recognition. So, the basic difference between Template matching and Machine Learning approach is that Template matching is a Shape-Matching approach but machine learning approach is a Feature-Matching approach. So, the time required to train any system for feature matching approach is quite long. In this project we assumed a controlled scenario, the template matching approach is use to reduce the total computation of the ALPR system[3].

The proposed system is to detect each character from License Plate separately. This can be done by morphological operation. It includes a technique to segment all the characters used in the License Plate[4]. After reducing noise from the input image we try to enhance the contrast of the binarized image using histogram equalization can be used further for Contrast enhancement of the Binarized image. This can be done after the noise reduction[3].

It approaches Morphological operation on captured image (Input given to the system) which includes erosion and dilation process on image, median filtering, segmentation is also used in this approach to get the result more accurately. By the paper [6],The results are shown in (Table -1).Consider image count = 100 and accurate detected count = 75 then Output Accuracy in percentage = 75%.

YEAR/MONTH	% Accuracy
2010	98
2011/JULY	94
2011/JULY	95
2011/DECEMBER	89.74
2012/APRIL	93
2012/OCTOBER	93

TABLE -1: Table of % accuracy per year/month

The next approach is to make use of neural network in the system implementation. It is more advantageous as it gives output as detection of each letter and number individually after segmentation of characters[5].

3. CONCLUSIONS

The Objective of this paper is to review the idea behind making ALPR System. Studying and resolving all the issues regarding Algorithms used for ALPR in previous few years. The algorithm used in this paper not only accelerates the process but also increases the probability of detecting the license plate and extraction of characters, under certain set of constraints. Character segmentation performs an important role. The result of ALPR shows higher accuracy of region removal other than character region and thus it results a better recognition of each letters and numbers after the segmentation process. The percentage accuracy for the entire process is found to be 80. The given ALPR system can be further improved by using the parallelization approach for various stages of development. Details of vehicles can be collected by taking its License plate's image and processing it and can also be seen those details on the Android mobile Application. The Users of the Application are Police and Traffic Police So the Application cannot be mistreated. ALPR Technologies are transforming the world of traffic monitoring. With more vehicles on the road than ever ALPR discovered how these license plates tracking could pave way for a new era of road surveillance.

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