Automatic Number Plate Recognition (ANPR)

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Abstract—Vehicle Identification has become very important in today's scenario. These days' organizations are more concern about maintaining security. Many vehicles enters in and leave the organization so it is very important to maintain their record. It is a tedious and time consuming task for a human to keep record of all the vehicles. So it arise a need for developing an automatic system which can keep the record of all the vehicle entering and leaving the organization. And also maintain the timings of their arrival and departure. Systems like Automatic Number Plate Recognition are not only useful for this purpose but can be used at traffic signals to identity the vehicles violated traffic rules. There are various other applications that are mentioned in this paper.

Keywords—Automati Number Plate Recognition (ANPR), Optical Character Recognition (OCR).

I. INTRODUCTION

A smart city can be well defined when all the assets are managed by latest technological solutions in such a manner that it includes every major and minor resource, like schools, govt., hospitals and most importantly its citizens.

Smart city uses smart system to reduce human effort and to achieve accurate and efficiency in every factor. The goal of making any city smart is to provide better lifestyle to its citizens by offering them efficiency of services and enhanced performance. Taking all the factors in consideration systems use sensors, artificial intelligence and real time information.

The major problem of today's scenario is the manual data maintenance of information. Taking security into consideration till now the recording and maintenance of the vehicles at various places like at any organization, residential societies, industry etc the people have to stop and write their vehicle details and for this purpose human effort is required, also the paper work is increased. To make all this tasks automatic these smart systems are introduced. One of the system which would help the city in providing security factor is "Automatic Number Plate Recognition (ANPR)" which can have various application areas and is helpful in providing reduced human error and accuracy in maintaining the records of vehicles number plate. Using this system there is no need of hiring any human effort to maintain it and also it reduces the paper load. Making the automatic systems provide ease in achieving durability and stability.

There are various applications imposing similar techniques in different fields. One of the application of this system is at

National Borders where it aims at recognizing the vehicles number plate using Optical Character Recognition (OCR) by capturing the picture of number plate and processing it, which then store the number plate details into text format. Another area where it can be used is for Black list Vehicles, helps to recognize the vehicles through their number plates, which is then compared with the database if the data matches with database containing the information of Black listed vehicles then an alarm is rang to notify to the Govt. authority. Parking Management is another asset for same type of systems that is used for parking areas for taking record of parked vehicles and also helps to generate receipt for respective vehicles. There are various countries which are using one of the applications of such system one of them is for tracking the traffic rules violated vehicles. It is developed to avoid the traffic signal violations. Any vehicle if violates any traffic signal the camera placed captures the image of its number plate and sends the detail to respective authority.

This research paper details about one of the application of ANPR for one of the aspect of security. Security is the major concern these days at every level. This project includes a camera which would be placed at the entrance gate as soon as any vehicles enters the organization the camera will capture the image of its number plate and sends it for Image Processing. There the data extraction from the image will take place and stores that data into the text format which further would get stored into the database. Database is consist of the registered vehicles if the extracted data gets matched with that of stored data it will notify the safe alarm else a warning will be generated. The timings of entering and exit of vehicles is recorded and also the count is maintained.
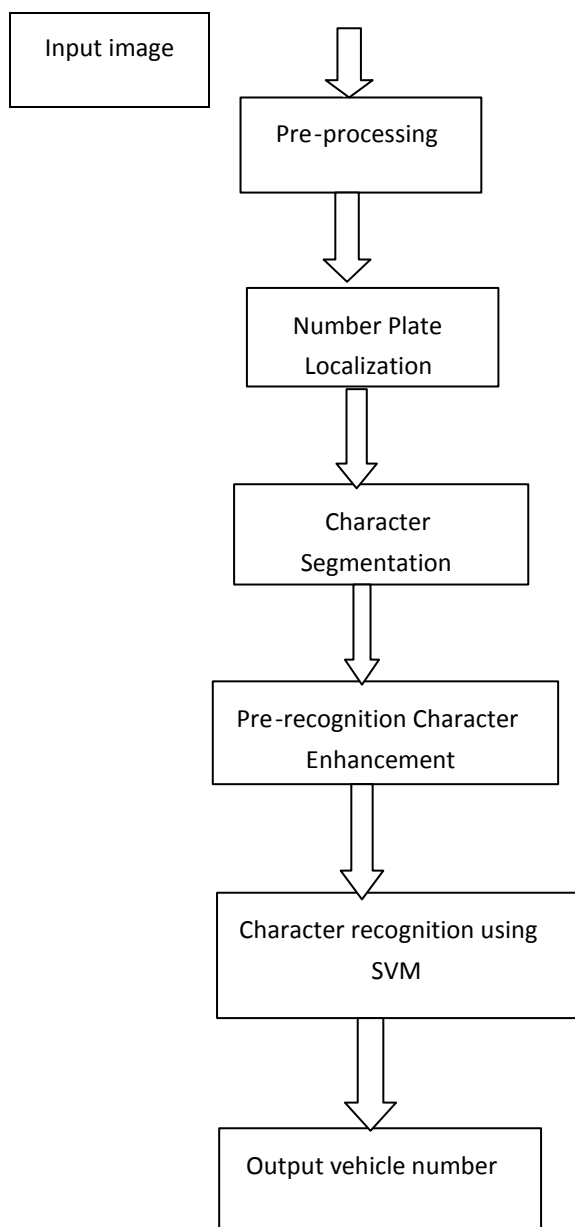
II. RELATEDWORK

Figure 1:-

As most of the methods discussed in these literatures use more than one approach, it is not possible to do caterozied discussion. Different number plates detection algorithms are discussed below. For faster detection of region of interest (ROI) a technique called sliding concentric window (SCW) is developed. It is a two-step method which contains two concentric windows moving from upper left corner of the image. Then analytical measurements in both windows were calculated based on the segmentation rule which says that if the ratio of the mean or median in the two windows exceeds a threshold, which is set, then the central pixel of the windows is considered to belong to an ROI. These two windows stop sliding when the whole image is scanned. The threshold value can be decided on the basis of trial and error. After applying SCW on vehicle image authors used HSI color model for color verification The distance between camera and vehicle varies from 3 to 7 meters. A cascade framework was used for developing fast algorithm for real time vehicle number plate detection. In this a concise frame detection module is used to segment number plate. This module is consist of three steps: First - Generation of Plate Region Candidates which is used to reject non plate regions by using gradient features. Second – Extraction of number plate regions which then contains three steps to identify plate region and reject non plate regions. Third – plate verification is used to make sure that no non plate regions are extracted in preceding steps. For detecting different style of number plates, a user can construct its own the algorithm by changing parameter value in the number plate detection algorithm. The authors define four parameters mainly:

• Plate rotation angle- to rotate number at certain angle plate if it is skewed .

• Character line number – to determine whether characters are spanned in more than one line or column. The algorithm works for maximum three lines.

• Recognition models – to determine whether number plate contains alphabets only, alphabets and digits or alphabet, digits and symbols.

• Character formats – To classify the number plate characters based on their type. For example, Symbols can be represented as S, Alphabets can be represented as A and digits can be represented as D.To locate Indian number plate, a feature based number plate localization is proposed in. A method is used to extract vehicle number plate by using salient features like shape, texture and color. The authors used Hough transform (HT) to detect vertical and horizontal lines from rectangular vehicle number plate and then processed it by converting red, green, blue (RGB) to hue-intensitysaturation(HIS). Finally, the number plate is segmented. Using MATLAB to find horizontal and vertical difference to find exact rectangle with vehicle number. Then converted vehicle image into gray scale and then applied automatic binarization using MATLAB. Any further detail regarding number plate detection algorithm is not mentioned in this paper. They also used morphological operation for better performance in complicated background. The system was implemented using MATLAB. A Sobel edge detector operator is also used. To detect license plate from CCTV footage, efficient localization of license plates in video sequence and the use of a revised version of an existing technique for tracking and recognition. License plate detection is a four step procedure including finding contours and connected components, selection of rectangle region based on size and aspect ratio, initial learning for adaptive camera distance/height, localization based on histogram, gradient processing, and nearest mean

classifier. After processing these steps final detection result is forwarded for tracking.
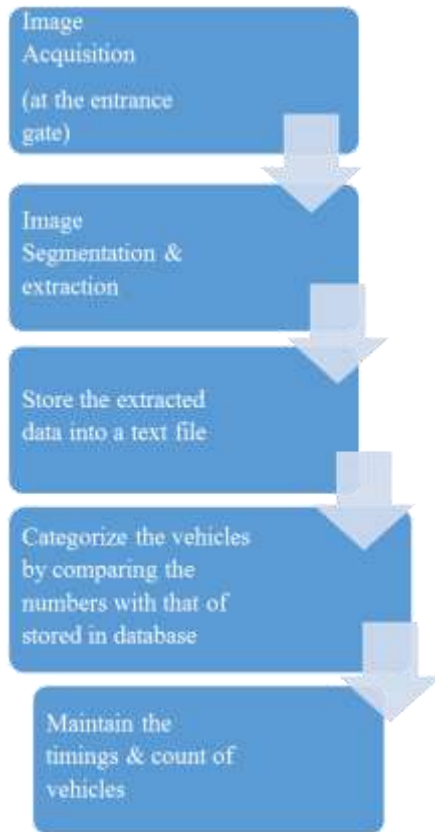
III. PROPOSED ARCHITECTURE

Image Acquisition (at the entrance gate)

Image Segmentation & extraction

Store the extracted data into a text file

Categorize the vehicles by comparing the numbers with that of stored in database

Maintain the timings & count of vehicles

Figure 2:-

A. *Image Acquisition*:
Image is Capture using high resolution camera**.** Images are taken in different background, under different climatic conditions and at various distances. So to manage the quality and avoid the loss of data pre-processing is also done.

As soon as any vehicle enters the organization the camera captures the image of number plate. The image is captured using PHP code. Once the image is captured, it then sends to MATLAB for pre-processing.

B. *Pre-processing***:**
Taking climatic conditions into consideration, captured image may consist of blur factors, noise or other factors that may affect its quality and also may cause loss of information. To avoid these risks contrast adjustment, edge detection, de-blurring will be done. So in this phase the image is first converted into gray-scale. And then the smoothing and sharpening is done.
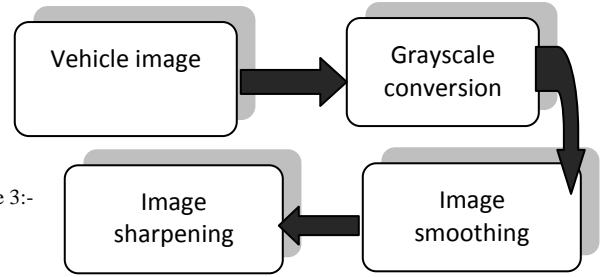
Figure 3:-

Vehicle image → Grayscale conversion → Image smoothing → Image sharpening

For edge detection there are various algorithms available such as laplacian, Sobel, Prewitt. Among which in this system Laplacian is been used. Lapacian edge detection algorithm works as follow:

Step1:- input an image & compare it with the similar images.

Step2:- blurring of images is done prior to edge detection. Then blurred image is accomplished by convolving image by a Gaussian.

Step3:-then perform Laplacian on blurred image.
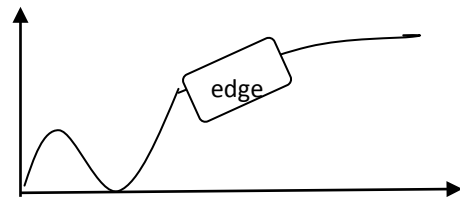
edge

C. *Segmentation and Character Extraction*:
The image is classified into two classes First is Surface and Second is edge. Image Segmentation deals with the separation of uniform patches. Range and Intensity both are segmented. First detection of edges is done. Then for the surface of image, characters are to be separated out from the image. Number Plates consist of different colours and fonts. To identify and extract the characters from various fonts and colour of number plate**.** Extracted data from the image is stored in a text file.
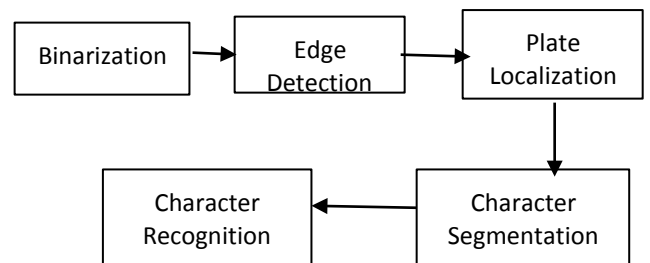
Binarization → Edge Detection → Plate Localization → Character Segmentation → Character Recognition

Figure 4:-

D. *Categorization*
After dealing with the image the data is stored from text file to database, where the categorization of vehicles as "safe" or "Threat" is done. Also the timings of entry and exit of vehicles is maintained.

This research paper contains one of the area where Automatic Number Plate Recognition (ANPR) can be used. Camera is been placed at entrance of the organization, as soon as any vehicle enter, image of its

number plate is captured. This captured image is then sent to MATLAB for processing. First the image is converted into grey scale. After the segmentation is done, where characters from image is extracted. Extracted characters are stored in a text file first then it is sent into Database. In the database number plate of organization is stored so that whenever any vehicle enters it matches its number with that of stored ones, if they match it notifies a safe alarm otherwise it generates a threat alarm.

So applying filters is very important image consist of low and high frequency components. Hence we use low pass and high pass filter to remove respective frequency components. Filters help in smoothing and sharpening of image. Here median filter is also applied on the image. Median filter is a non-linear digital filter.

Figure 5:- Input Image With Noise

Figure 6:-Input Image without Noise

Due to climatic change quality of image may be degraded. Means that image may contain noise. Here noise can be of various type:

Gaussian noise: This is normal noise present in the image. Random change in pixel values of an image is referred as noise.

Salt and Pepper noise: Salt refers to random presence of white pixels and pepper means random presence of black pixels in image.

Speckle noise: it is the granular noise that is present in the image which results in degrading the quality of image. There are several more noise that can be present in an image like thermal noise, impulse noise, Rayleigh noise, photon noise and so on.

E. Optical Character Recognition (OCR)

It is the electronic conversion of text into machine code. There are various techniques available for OCR few of them are *De-skew*-it is used to make line of text horizontal or vertical if it is not aligned properly.

Despeckle- used to remove positive and negative spots from an image.

Line removal-if an image contains any unwanted line or box it helps in removing it.

Script Recognition-for multilingual scripts it is important to identify correct script type.
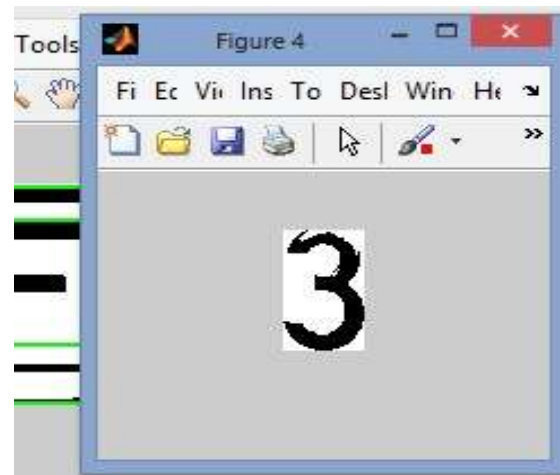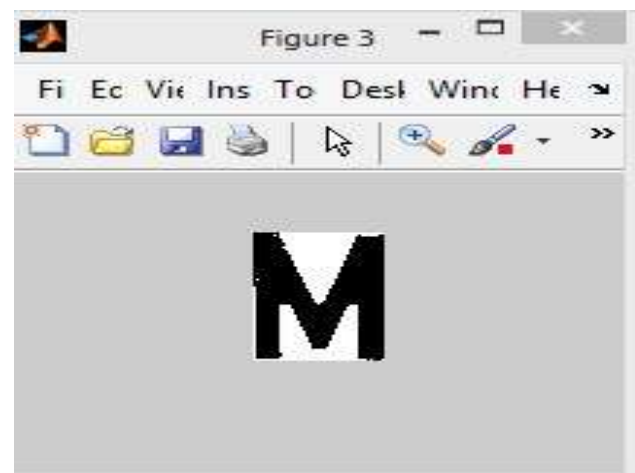

Figure 7:-extracted characters

Figure 8:-extracted data

Once the pre-processing and character recognition part is done. The characters fetched from the image is stored in a text file.
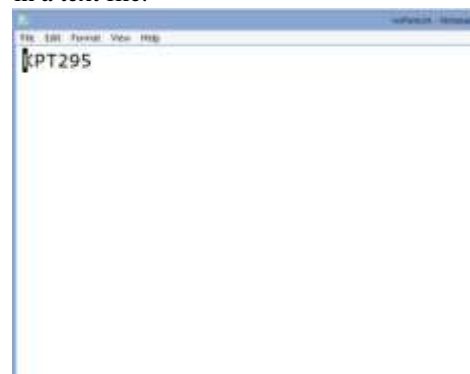

Figure 9:-text file in which extracted data is stored.

This data from text file is stored in Database where some vehicles are already in it. And then the categorization is done. The system also have GUI that helps its manger to manage it. GUI is build using

PHP where the video tag of HTML5 is used. So that as soon as any vehicle enters the organization the person or the guard standing on the entrance will capture the image of vehicle's number plate and send it to the MATLAB part.

GUI contains two canvas one for capturing the image and other to store the captured image. The saved file is preprocessed and segmented.

When data is stored in database the system time is recorded and saved to maintain the complete detail.

GUI of registering vehicles is given below. Also the database design the system is using is also listed below.

Figure 10:-GUI of driver's detail form

Figure 12:- database for driver's detail.

Figure11:-database for storing number plate.

IV. FUTURE SCOPE

The system can be enhanced using sensors at the entrance. As any vehicle enters the gate it first capture the image of its number plate. Then the image is sent to MATLAB and then to database where it is categorized. If the number plate matches then gate would open, else it will send an alert.

V. CONCLUSION

The system is successful in recognizing the number plate of vehicles. Along with recognizing the number plates also the timings of vehicle's entrance is recorded and stored into database. The system is ready to categorize the vehicles as safe or threat. The

problem that was faced by many organizations can be resolved using ANPR system. It draws accurate and efficient record of all the vehicles. Also the error rate in manual checking is also resolve. Making an Automatic system not only provides ease of use also increases level of accuracy.

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