A Review Paper on Vehicle Number Plate Recognition

Chinmayi Gurav
Department of Electronics and
Telecommunication Engineering
Finolex Academy of Management and
Technology, Ratnagiri

Vedika Kamble
Department of Electronics and
Telecommunication Engineering,
Finolex Academy of Management and
Technology, Ratnagiri

Rupali Gurav
Department of Electronics and
Telecommunication Engineering
Finolex Academy of Management and
Technology, Ratnagiri

Prof. Neha S. Sakhalkar
Assistant Professor
Department of Electronics and
Telecommunication Engineering,
Finolex Academy of Management and
Technology, Ratnagiri

Sharmishtha Mohite
Department of Electronics and Telecommunication Engineering,
Finolex Academy of Management and Technology,
Ratnagiri

Abstract: **There are very large number of vehicles in India as it is very densly populated country across world. So, there is a need of detecting vehicles accurately using traffic management system. This system detects the image of the number plate of a vehicle from video using video processing with raspberry pi and the number is extracted using different methods and algorithms. The system is applicable for entrances of gates in colleges and highly restricted areas. When any vehicle passes by the system the video is captured and then video is converted into images using OpenCV software.**

I. INTRODUCTION

There are large number of vehicles in todays generation around the world. So it is very important to keep track on vehicles. In todays world we can use computer to keep track any vehicles without manually looking keeping track on vehicles because of which there will be better accuracy. Thus vehicle number plate recognition system is a technology used which identifies the number plate from video captured by the camera. It uses methods like extraction of number plate, segmentation, character recognition,etc. This system is a combination of hardware plus software which uses the number plate and then sends this number plate to convert it to image. This technology can be used in any gate entrances. Thus this system can be accurate if image extracted from the number plate captured by camera is clear and visible. The image used should be of very good resolution.

II. LITERATURE REVIEW

This paper represents that-In first step, camera captures the video of vehicles number plate. To read this video MATLAB software is used. The video used for operations has timing of 10 to 15 seconds. The 10 second video contains 240 frames/images. In second step, video gets converted into frames at frame rate 24 fps. In third step, frames are converted into Images which is very important step. Then Opening and closing operations are done. To extract vehicle number plate, Image processing like segmentation, recognition, localisation has been done. First canny edge detection algorithm detects the edges of image. Then morphological operator are used. And in this way number plate gets detected[1].
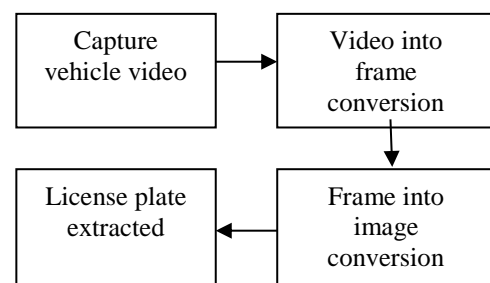

Fig.1.Block diagram of proposed approach

India has a general format of number plate like first two letters are state code then district code followed by four unique code for that particular vehicle number plate. If the color of number plate is identical to background then there

can be errors while detecting and locating the number plate. The operations like opening and closing, erosion and dilation are performed on image. The work is divided into several parts like-

First input colored image is taken from camera. Next the colored image is converted into grey scale conversion. To remove noise from image various filtering methods are used, in this median filtering is used which removes salt and pepper noise. The contrast of image can be cleared using histogram equalization. After that localization of plate is done using Sobel Edge detector where regions and edges of image is done. Then the numbers of plate is segmented using segmentation method[2].
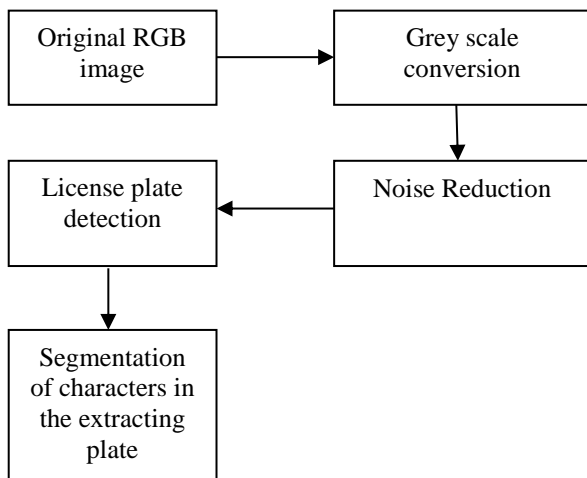

Fig.2.Block diagram of proposed approach

Number plate recognition uses image processing and character segmentation technology. The highly resolution camera can be used to capture the images or video so after taking it as input the output should be clear. This system is has four basic steps-In first step as a input a video is captured from the camera. Next the video is converted into frames and from that a clear frame or image is selected. Then the region of plate is extracted using two features like aspect ratio and edge density. The Segmentation is done on the number plate to segment each number from the plate and to identify it. Lastly the recognition is done on number plate to recognize the numbers properly and correctly[3].

Table 1- Proposed approach

Detection	Finds or detects the number plate.
Binarization	Conversion of grey scale to binary.
Character Analysis	Finds characters in the number plate.
Plate Edges	Finds or detects edge of the number plate.
Deskew	Transforms the size of number plate
Character Segmentation	Segments each number separately.
OCR	Recognises the number plate
Post Processing	Processes the number.

[4] This paper represents the following methods-In first method the preprocessing is done. In this the colored input image is converted to the grey scale image which divides the image into number of pixels. Next the Detection of egdes is done using canny edge detector where the edges of image is detected to reduce the discontinuities. Then the input image is dilated using morphological operator to increase the thickness of the number so that the number can be detected easily. Segmentation is done on the dilated image. It performs like the numbers of the plate is obtained separately. The segmentation uses template matching algorithm like OCR. Lastly the numbers are enhance to get better desired image at output. The camera should be of very high resolution so that the output can be of very high quality[4].
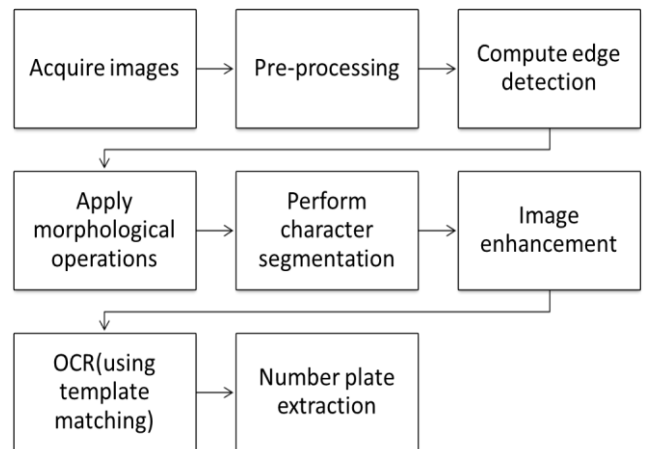

Fig.4-Block diagram of number plate extraction

The main motive of this paper is to detect number plate in different environment using Restoration technique. Restoration technique is similar to Image enhancement. In Image enhancement

the quality of image is improved. In this paper the system work as follows: First of all a video is captured using camera which is placed at fix location. After the video is captured it is divided into frames with the help of matlab operations. The video is of 10 sec which contains 240 frames/images. After the video to frame conversion it is converted into images. On these images certain operations are done for extracting number plate. The various resolution techniques are performed on the selected. Image Restoration and contrast enhancement is applied on extracted images to detect number plate. Unsharp mask filtering is done to remove the noise such as fog and rain. Once the noise is removed an output image comes which contain the number plate[5].

In this paper firstly the image is captured using pi camera and video is taken as input and captured images will be stored as color jpeg format. The noise is present in the system. To remove the noise grey processing and median filtering is used. Grey processing is used to convert the image into grey color format and median filtering is used to remove noise. For detecting the license plate region the borders of rectangular plate is detected using Bounding Box and Edge Detector is used to detect the edge of

vehicle. After Extraction segmentation is done. Segmentation is used to separate the characters present in the license plate. The OCR is used to recognize different characters and Digits. After recognition the characters are displayed at output in the form of .txt[6].

In this paper they have discussed about different noises like Gaussian noise, Poisson noise, speckle noise and salt and paper noise which occur during image digitization or during image transmission. They have also mentioned some filtering techniques like linear, min-max, median, wiener, Gaussian, guided, BM3D.They have comparatively studied which filtering techniques are suitable for which type of noises. They have came up with the conclusion that there is no specific filter which is the best one .Block Matching Filter(BM3D) was found to be stable and comprehensive. Median filter can be used to remove salt and paper and Gaussian noise. Liner filter can be used for Poisson noise. Wiener filter works well for Poisson .Similarly min and max worked well for salt and pepper , Gaussian , Poisson and speckle noise. Guided filter worked well for Poisson noise. Adaptive fuzzy median filter was best for salt and pepper noise. Final conclusion was made that BM3D was considered to be the best for most of the filter[7].

This paper is used to detect the number plate in dark and light images but it is not suitable for blurry images, low contrast and noisy images. The flowchart of proposed approach in this paper is given below[8]:
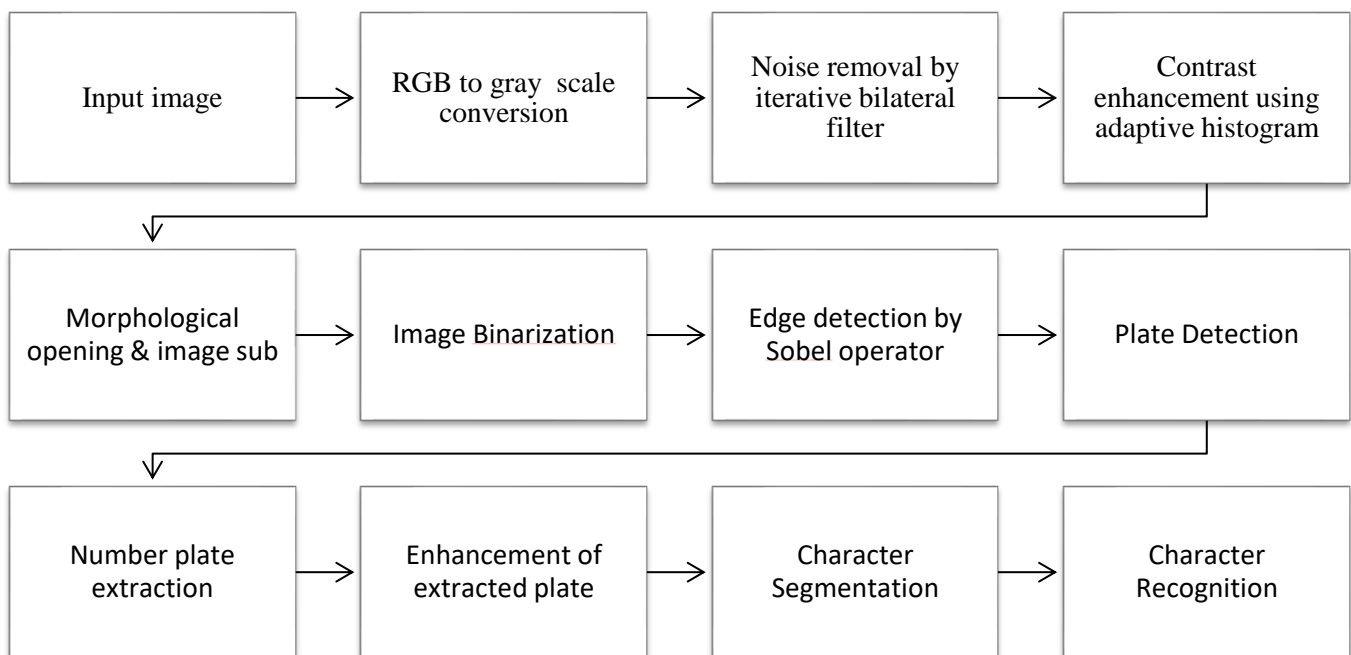

Fig 5:Block diagram of proposed approach

This paper focuses on security of parking at any premises. The implementation of Vehicle number plate recognition was achieved using Raspberry pi and performing Matlab operations. First step is Image acquisition .Image acquisition is possible if the image is stable and balanced under any conditions. It consist of Imaging system and Sensor network. Imaging system makes use of Raspberry pi camera and the sensor network has TSOP 1738 sensor which detect the incoming vehicle and provide a trigger to raspberry camera to capture image of that vehicle. The next step is Image pre-processing in this various operations are performed like cropping the required area, performing gray scale conversion. After performing gray scale conversion some parameters gets affected such as difference in color, lighter edges of object, etc. To avoid such losses dilation process is used which helps to nullify such losses and enhances the edges. Next step is Localization of plate. In this paper they have compared to processes of localizing plates i.e Morphological processing and Edge processing. At first Morphological processing was performed for localizing of plate but later on it was found that that this algorithm was found out to be poorly performed for high contrast images. This drawback was overcome by using Edge processing algorithm which drastically improved the plate localizing efficiency. This was followed by implementation of Neural network using feed-forward back propogation algorithm.The system was tested in dynamic environment where the number plate was detected automatically and plate localization and character recognition was accomplished in a time of 1.3 seconds[9].

Number plate recognition system is used for monitoring and managing the entrance gates of colleges in private and public organizations to identify vehicle license plate numbers at the parking gate. This system also works on stolen vehicles on roads. In this system camera is placed near entrance and exit gates. The images taken from camera are processed in computer and the vehicles information is stored in the system database for longer period. Also this system can control the automatic opening and closing of parking gate giving permission to only authorized vehicles. Likewise, more information regarding vehicles can be extracted from the system. This system uses waterproof and dustproof camera which provides high quality images for processing. .This cameras are used under any weather conditions with powerful infrared radiations for detecting the vehicles under darkness. It can also be able to detect the vehicles under any temperature range so that a clear image is obtained. This system uses a software which can be available to users with low cost. The software proposed in the system is used to define both white list for authorized vehicles and black list for unauthorized vehicles which will not be allowed to enter the gate.This system by implementing proposed system can provide higher security and safety for the vehicles. The system can be connected to gates for automatic opening and closing of gates. If further modifications like the system is connected with alarms lights or smart boards, the system can display any message like hello, welcome,etc[10].

The system represents of automatic representation of the system by recognizing the number plates of the vehicles. It uses image processing and character recognition methods. They are:
1.Image Acquisition-Various approaches can be used to give input of image in the system like analog or digital cameras.
2.Number plate area extraction- Capturing the image from number plate gives background also. So the next step is to determine the region of the license plate. To know whether the extracted image is number plate plate or not two features are determined- a)Aspect ratio-The ratio of width to height of region is defined as aspect ratio. It is used to determine the object region,width as well as height of the region. b)Edge Density-The regions can be removed by applying the above features but still some regions are remained.So edge detection is used to quantize the local variance extracted plate region.
3.Character segmentation-This is used to segment the number plate and identify each numbers. It becomes difficult if factors like image noise, illumination, etc are present.
4.Number plate recognition-Now the final image is obtained by extracting the number plate and can be manually compared with the input images.
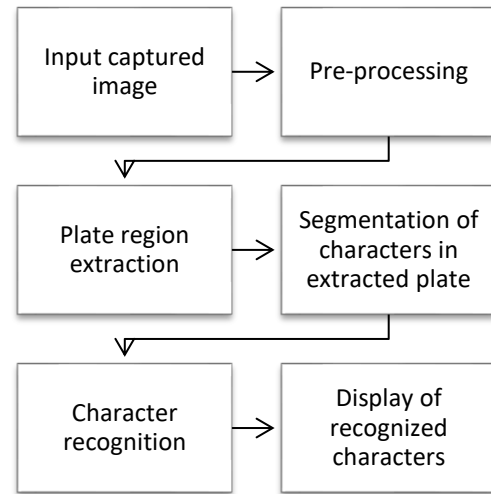

Fig 6: Flow Diagram representing number plate extraction

The paper consists of following points:
1. Real time Input: The input can of an image or a video. Camera is used to take a realtime image or video and goes through some image processing stages.
2. Pre-processing: This is an important step in analyzing an image. It includes grey scale conversion, noise reduction and binarization.
3. Segmentation by ROI: Character segmention is carried on binary image. Horizontal scanning that makes use of a scanning line that finds the conditions satisfying the beginning and the end position of the characters.
4. Extraction :Images are converted into grey images. Here the images level is extracted based on the parameters and the matix values.
5. Plate Recognition and classification convolution using neural network.
6.Recognized characters: Number plate is recognized[12].

In this paper a system captures image of vehicle and identity is verified using Raspberry pi processor that there is no change in the original image and test image. If any unregistered vehicle is detected then system gives alerts to the computer using buzzer alarm sytem. Input to the system is taken as image of vehicle and the output is detected number plate .This paper consists of following processes: Colored image to gray scale conversion, vertical edge detection using Sobel detector , converts non-linear image to linear image, opening-closing and dilation, vertical projection and thresholding, location of number plate, filtering the number plate and image enhancement, linearization and character segmentation for obtaining separate numbers. Linux operating system is used. Linux is an open source operating system. Here one can change codes and add programs[13].

This paper indicates the opening and closing of gate using raspberry pi processor. When the vehicle enters the gate camera captures the number plate and convert it to text and if the number plate is not matched the buzzer alarm

used indicates that the unauthorized vehicle has entered the gate.

The ultrasonic sensor is used to measure the distance from camera to vehicle. The proposed system sees whether the there is no change in the original image and test image , captures vehicle number plate using cameras, verification of number plate and addition to it buzzer alarm or led indicator is used. Here raspberry pi 3 an onboard computer is used which acts as the heart of the project. Also libraries and some packages are installed to convert image to text. The camera is used to interface with raspberry pi which plays an important role. The ultrasonic sensor is used to extracted the number plate from vehicle and from which the image is taken for converting it to text using ocr or opencv. When the extracted number plate and image text gets matched the servo motor opens the gate otherwise it doesn't open the gate and blows the buzzer if unauthorized vehicle is found. In this paper for detecting the image an ocr technique is used, which converts image to text and the text is displayed on the screen of the computer. When the number plate detected contains correct number of vehicle then only the gate is opened otherwise the gate will not open. In future, cloud computing can be used which can be useful to detect and store the information permanently[14].

CONCLUSION

Reviewing all the concerned Research Papers and Articles it can be thus concluded that Open CV gives the best result in vehicle plate detection consisting more function in computer vision than Matlab. For the recognition we have preferred tesseract OCR(Optical Character Recognitio) for better result.

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