AN EFFICIENT APPROACH FOR AUTOMATIC LICENSE PLATE RECOGNITION SYSTEM

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Abstract— **Auto Recognition of License Plate is a kind of image processing technology for recognizing the number plate information from images or videos. The observed plate images are normally in low resolution and suffer severe loss of edge data, which cast, incredible test to existing vehicle number plate detection and recognition patterns.The process of Auto recognition of License plate requires a high level of precision, when there are various vehicles going in a brief span and number plate abstraction is a number is a difficult task, basically because of number arrangement, and impact of environmental work.This step influences the accuracy of character separation and acknowledgment framework. This paper introduces a algorithm for Auto recognition of license plate system utilizing various approaches.Auto recognition of license plate method comprises of three segments: Character segmentation, Optical character recognition and template matching.The proposed framework presents the automatic vehicle number plate identification system utilizing a vehicle number plate extraction. Another strategy utilizing Gabor filtering for character recognition in gray scale image is proposed in this paper. Components are separated directly from gray-scale character images by Gabor filters which are exceptionally intended for measurable data of character structures. Template matching is a system which is exploited to find a subimage of an target image which coordinates a template image. Experiment result outcomes to show the superiority of our proposed approach as far as effectiveness.**

keywords—Automatic Number plate recognition(ANPR), Automatic License plate recognition(ALPR), character segmentation, vehicle number plate, template matching, Optical Character recognition (OCR).

I. INTRODUCTION

TheAuto Recognition of License Plate systemexist for anextended time, however just in the late 90s, it transformed into a basic application due to the substantial addition in the aggregate of vehicles.The data removed from the tags is for the most part utilized for activity observing, get to control, stopping, motorway street tolling, and making auto logs for stopping frameworks, travel time estimation and so forward by the law authorization organizations. The recognition issue is by and large subdivided into 5 sections: (1) image acquisition i.e. capturing the picture of the number plate.(2) pre-processing the image, i.e. standardization, altering the illumination, skewness and difference of the image (3) character segmentation i.e. finding and distinguishing the individual image on the plate, (4) optical character recognition. There might be further refinements over these (like coordinating the vehicle permit number with a specific database to track speculated vehicles, and so on.) however the major structure continues as before. A controlling parameter in such manner is nation particular movement standards and gauges. This fines tune the framework, i.e. amount of characters in the tag, content luminance level (relative file, i.e. dim content on light foundation or light content on dull foundation) and so forward. So the issue can then be limited for application in a specific nation. For instance, in India the standard is printing the tag numbers in dark shading on a white foundation for private vehicles and on a yellow foundation for business vehicles. The general configuration of the tag is two letters (for state code) trailed by locale code, then a four digit code particular to a specific vehicle. In U.S.A no strict rules have been set with respect to the textual styles that can be exploited for this reason. The vehicle number plate is an example with high varieties of contrast[1].

This paper gives a summary of the research work so far around there and the methods utilized in built up a LPR system .The work is isolated into a few sections:image acquisition,number plate extraction, and number plate Character separation and number plate recognition stages [2].

Image Acquisition: This stage manages getting a image by a acqusition technique. In our proposed system, we utilized a high or low determination computerized camera and sufficient light source to secure the information picture.

Number Plate Extraction: This stage removes the locale of intrigue, i.e., the tag, from the gained picture. The proposed approach includes "Covering of a district with high or low likelihood of tag and afterward examining the entire veiled area for tag.

Number Plate Character Segmentation : License Plate Segmentation, which is now and then alluded to as Character Isolation takes the locale of intrigue and endeavors to gap it into specific characters. In the proposed frame division is done in the OCR segment.

Optical Character Recoganization: There are numerous strategies used to perceive confined characters. In the proposed framework we are utilizing Optical Character Recognition[2].

Number plate extraction stage is the most vital stage in ANPR framework since all others stages rely on upon extraction of number plate range. The extraction of number plate is troublesome and specifically impacts the exactness of ANPR on the grounds that every single further stride rely on upon precise extraction of number plate. Numerous troubles happen amid the identification and extraction of number plate since for the accompanying reasons:-

1. The proficiency of extraction is influenced by scene intricacy.
2. Diverse vehicles have plates situated on various position.
3. Clamor can happen amid camera catch.
4. Climate conditions in charge of commotion landing.
5. Time of day influences lighting therefore coming about into difference issues.
6. Undesirable characters, edges and screws present perplexity.
7. Wrong camera or plate position result into bending that influence effectiveness of plate extraction.
8. Low or uneven brightening, obscured picture, low determination input picture, reflection, shadow influence the
effectiveness of number plate territory extraction[3].

II.   RELATED WORKS

Abbas M. Al-Ghaili, Syamsiah Mashohor, Abdul Rahman Ramli, and Alyani Ismail [4] proposed quick strategy for auto tag discovery (CLPD) and presents three primary commitments. The primary commitment was to propose a quick vertical edge discovery calculation (VEDA) in interpretation of the differentiation between the greyscale values, which upgrades the quickness of the CLPD strategy. The second commitment was proposed CLPD strategy forms low-determination pictures taken by a web camera. After the vertical edges have been acknowledged by the VEDA, the coveted plate points of interest in light of shading data are highlighted. The third commitment was to contrast the VEDA with the Sobel administrator as far as precision, calculation many-sided quality, and preparing time.

S. Ramalingam, M. Rhead, and R. Gurney [5] proposed Automatic Number Plate Recognition (ANPR) frameworks which utilize Optical Character Recognition (OCR) to help decide the individual characters of the number plate. They take a shot at creating key informational indexes through a reenactment procedure that will produce auto number plate pictures. As an initial step, such plates will indicate fluctuation in character dispersing for surveying ANPR frameworks which will exhibit the standards for benchmarking. This framework maintains a strategic distance from the requirement for doing any asset escalated field trials by the Police Force

Najeem Owamoyo [6] proposed Automatic Number acknowledgment for Nigerian vehicles. Number plate extraction is done utilizing Sobel edge location channel, morphological operations and associated segment examination. Character division is finished by associated part and vertical projection examination.

Shan. Du, M. Shehata, W. Badawy [7] describe an extensive study on existing (Automatic License Plate Recognition)ALPR Techniques by arranging them as indicated by the elements utilized as a part of each stage. Correlations of them in the terms of Pros, Cons, Recognition comes about, and Processing rates were tended to. A future figure for ALPR was likewise given toward the end. The future research of ALPR ought to focus on multistyle plate acknowledgment, video-based

ALPR utilizing world data, multi-plate handling, top quality plate picture preparing, uncertain character's acknowledgment.

P.Anishiya, prof. S. Mary joans [8] centered a number plate restriction and acknowledgment framework for vehicles in Tamilnadu(India) is proposed. This framework is created in light of advanced pictures and can be effortlessly connected to business auto stop frameworks for the utilization of recording access of stopping administrations, secure use of stopping houses and furthermore to forestall auto burglary issues. The proposed calculation be determined by on a blend of morphological operation with region criteria tests for number plate confinement. Division of the plate characters was accomplished by the utilization of edge finders, naming and fill gap approach. The character acknowledgment was expert with the guide of optical characters by the procedure of Template coordinating.

Chitode J.S [9] suggested that ANPR is consistent embedded system recognizes the characters particularly for the photo of tag. The proposed count relied on upon mix of morphological operation with domain criteria tests for vehicle number plate constrainment. The character affirmation was capable with the guide of optical attractiveness by technique of Template Matching.

P. Anishiya and Prof. S. M. Joans [10] proposed Vehicle Number Plate Detection (VNPD) System for Indian vehicles contains three major modules particularly image preprocessing, contender territory extraction and character's acknowledgment [10]. In pre-setting up, the photo is being stacked and changed over to dim or matched, trailed by some denoising strategies. In contender territory extraction, disclosure of the number plate domain and division of characters is finished. In character acknowledgment, arrange organizing and

recuperation of characters is performed. Character acknowledgment can in like manner be performed by neural framework anyway it needs periodical get ready for better capability. It also requires a huge amount of speculation and aptitude for worthy outcomes[11].

T. Tsukada, T. Yamada, K. Kozuka, K. and Yamamoto, S., [17] used template matching. Template matching includes the utilization of a database of characters or template. There are different format for each and every input character. Acknowledgment(Recognition) is accomplished by contrasting the present into character with each of format so as to localize the one which coordinates the best. On the off chance that I(x,y) is the information character, $T_n(x,y)$ is layout n, then the coordinating capacity s (l, Tn) will return a value indicating how well template n matches the input.

M. Rama Bai [18] proposed innovative approach for the evacuation of the clamor and also the identification of the edges for both parallel and the dark scale pictures utilizing morphological operations. The outcomes exhibit that channel cum edge location technique defeats the restrictions of conventional strategies and effectively clear the commotion and concentrate more conspicuous edges.

Hontani.H and Koga.T[19] proposed a technique for removing characters without earlier learning of their position and size in the picture. The method can be determined by on scale shape investigation, which thusly depends on the presumption that, characters have line-sort shapes locally and blob-sort shapes all around. In the scale shape investigation, Gaussian channels at dissimilar scales obscure the given picture and bigger size shapes show up at bigger scales. To distinguish these scales the probability of central arch plane is

presented. By methods for standardized chief bends, trademark focuses are extricated from the scale space x-y-t. The position (x, y) demonstrates the site of the figure and the scale t shows the innate trademark size of relating figures. All these trademark focuses empower the extraction of the figure from the given picture that has line-sort shapes locally and blob-sort shapes all around.

Norizam Sulaiman [20] introduced the advancement of programmed vehicle plate discovery framework in which subsequently pre preparing the hopeful plate is distinguished by methods for highlight extraction strategy, character division is finished by limit box and character acknowledgment is finished by template matching.

III. PROPOSED APPROACHFOR AUTOMATIC LICENSE PLATEEXTRACTION

The proposed approach for number plate extraction is

spoken to in this segment. Contribution to this framework is vehicle picture that is gained through advanced camera and yield is the real number plate partition. Pictures are obtained in various light conditions and in various foundation. The proposed structure is indicated in[3] Fig. 1 comprises of taking after principle steps:

1. Capture image
2. RGB to Grey scale conversion
3. Gabor Filtering
4. Character Segmentation
5. OCR using Template Matching
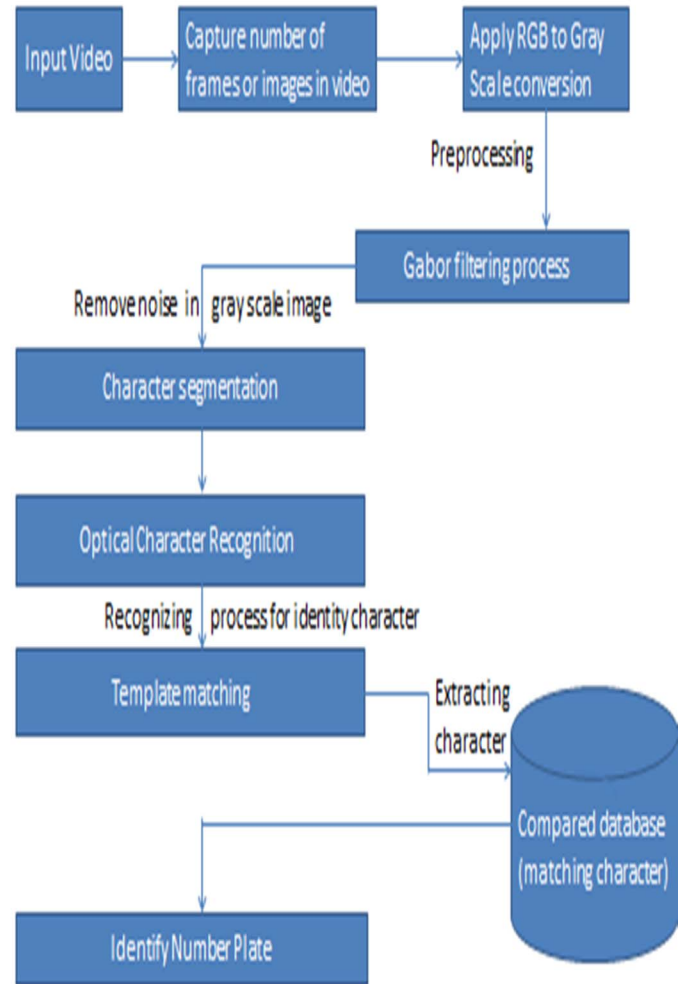6. Number Plate Extraction

Figure 1:Overview of proposed system framework.

1. Capture image

The initial step is the capturing of a image utilizing electronic gadgets, for example, optical (advanced/video) camera; webcam and so forth can be utilized to catch the procured pictures. For this venture, vehicle pictures will be brought with a Panasonic FX/Nikon computerized camera. In this venture pre-caught picture will take. The pictures will be put away as shading JPEG design on the camera. Next, we may continue in utilizing the Matlab capacity to change over the vehicle JPEG picture into dim scale organize Input of

this framework is the picture caught by a camera set at a separation of 1-2 meters far from the vehicle as appeared in taking after Figure2(a)[12].

2. RGB to Grey scale conversion

In RGB arrange, every Pixel has three shading parts: Red, Green, and Blue.

| (a) | (b) |

Figure 2: (a) input image (b) Grey scale image

In pre-preparing step, the shading picture is given as an info and it is changed over into dark scale picture appeared in figure3 (b). The preliminary step to digitize a "highly contrasting" picture through out of a variety of dim shades is to isolate the picture into various pixels, contingent upon the required spatial determination. This range is spoken to in dynamic path as a range from 0 (dark) and 1 (white), with any fragmentary values[12].

3. Gabor *Filtering*

The Gabor filter is a linear filtering technique used to expel noise from image under thought. While it helps in evacuating the motivation commotion it protects the edges. After division separating was utilized for expel all lines expect characters. It is take consider clamor. It is broadly utilized and it is exceptionally compelling at expelling clamor while saving edges. It is especially successful at evacuating 'salt and pepper' sort noise[12].

Fig 3: Filtered Image

4. Character Segmentation

The objective of this stage, given the expansion image, is to segment every one of the characters, without losing components of the characters. Division is a standout amongst the most essential procedures in the programmed number plate acknowledgment. On the off chance that the division falls flat, a character can be shamefully isolated into two pieces, or two characters can be despicably consolidated. Keeping in mind the end goal to perceive the vehicle number plate characters a while later, each character must be partitioned individually. The individual characters must be recognized (sectioned) from each other. In Character Segmentation, the characters and digits of the plate are sectioned and each is spared as various picture. It quantifies an arrangement of properties for each marked district in the name lattice. The bouncing box is utilized to quantify the properties of the picture district. This system utilized for check the numbers with format utilized by layout coordinating calculation in Optical Character Recognition (OCR)[12].

| (a) | (b) |

Fig 4: (a) Dilated image (b) Segmented image

5. OCR using Template Matching

Template matching is one of the Character Acknowledgment procedures. It is the way toward finding the area of a sub-picture called a format, inside a picture. Format coordinating includes deciding similarities between a given template and windows of a similar size in a picture and recognizing the window that delivers the most noteworthy likeness measure. It works by pixel-by-pixel correlation of the picture and the format for every conceivable uprooting of the layout. This procedure includes the utilization of a database of characters or layouts. There exists a format for all conceivable information characters. Formats are made for each of the alphanumeric characters (from A-Z and 0-9) utilizing "Normal" textual style style[15]. Figure 2 demonstrates the template for few of the alphanumeric characters[14].
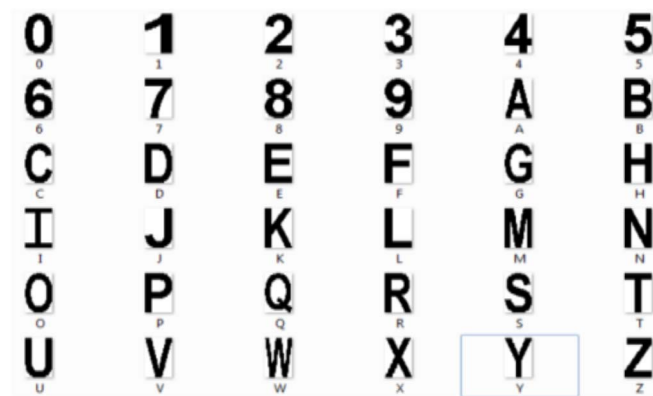

Fig 5: Template

6. Number Plate Extraction

The character segmentation algorithm is utilized to segment the character. Because of this character segmentation handle noise is included and that commotion is evacuated utilizing the channel. The commotion evacuated character is coordinated with format utilizing template matching lastly the character is extracted[12].

IV.Number Plate Extraction Algorithm

A. The Gabor Filter

The Gabor filter is a linear filter whose representations of spatial introduction and sigmal frequency are fundamentally the same as the human visual framework. It is a great approach to detach and survey surface elements. It is found to carry on like a "band pass channel for the nearby spatial recurrence circulation in the surface" [13].

A complex Gabor filter is given by the convolution of a mind boggling sinusoid with a Gaussian. Considering two-dimensional Gabor filters, this paper considers the group of filters given by,

$g(x,y; \lambda,\theta,\sigma,\psi,\gamma) = exp((- x'2+ \gamma2y'2)/2\sigma2)*exp(i(2\pi x'/\lambda + \psi))$

where,

$x'=xcos\theta + ysin\theta$
$y'=-xsin\theta + ycos\theta$

In the above equations, λ is the wavelength of the complex sinusoid, θ is the introduction regarding the ordinary, σ is the fluctuation of the Gaussian wrapping, ψ is the balanced and γ is the angle proportion.

Rather than indicating the fluctuation of the Gaussian wrapping, it is fairly commonsense and instinctive to determine the data transmission b of the Gabor channel, which is a logarithmic capacity of the proportion 'σ/λ'[14].

A couple of cases of 1D and 2D Gabor channels with various parameter qualities are given in the accompanying figure 6[14]:
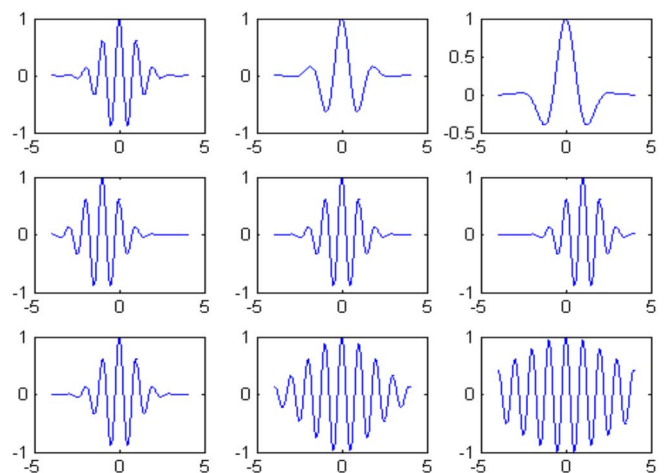
Figure 6. 1D Gabor filters. Rows (from top to bottom) show the special effects of unpredictable time period, mean and variance, respectively

Figure 3. 2D Gabor filters. Rows (from bottom to top) show the distinct effects of bandwidth, aspect ratio, phase offset and orientation, respectively.

B. Edge Detection

As already expressed, the license plate is a region of high vertical edge thickness. This data is utilized to concentrate applicant areas from the picture. The picture of the mind boggling scene is convolved with a vertically situated Gabor filter (refer to Figure 3) to such an extent that lone the vertical edges deliver a solid response. The resultant picture just demonstrates the vertical edges, with some commotion, and is then binarized utilizing Otsu's strategy.

The Restrictions of the Gabor filter, aside from the introduction θ, are experimentally determined. A couple of commonplace cases are appeared next, which firmly propose that the Gabor channel is effective in removing the candidate from any image.

Figure 7[14]. Original image (left) and result of vertical Gabor filter based edge detection (right)

V. Experimental Results and PerformanceAnalysis

A database comprises of various estimated JPEG colored images. Images are resized to 1024 X 768. Add up to 250 pictures are exploited to test the calculation. The pictures are brought with various foundation and also light conditions. Tests demonstrate that the algorithm has great execution on number plate extraction, and character segmentation work[16].

Table 1 illuminates number plate extraction and character segmentation success rate[16].

Algorithm	Total No. of Images	Success Rate (%)
Number Plate Extraction	250	85
Character Segmentation	214	80

Table1 Performance of vehiclenumber plate extraction and characterSeparation.

Shallowdarkness and reflections affect number plate extraction work. On account of uneven enlightenment, recolored number plates, genuine

number plates couldn't get accurately removed. Disappointment in character division was chiefly on account of converging of characters on number plate, recolored number plates, introduction of the image and poor light.

Character acknowledgment work is done on 10 digits (0 to 9) and 26 alphabets (A to Z). The acknowledgment rate accomplished utilizing "polynomial" part is 79.84 %. The false acknowledgment is because of closeness in the character shape, e.g.6 and B, 5 and S etc.[16].

VI. CONCLUSION

In this project, the proposed strategy is connected and tested on various images and contrasted with deference with acknowledgment time and accuracy. Broad research has been made in this proposed work to grow an accurate number plate acknowledgment framework. OCR produces less time and remarkable accuracy for template matching acknowledgment when contrasted with the past strategies. This demonstrates the speed of acknowledgment is enhanced a great deal.

FUTURE WORK

Although critical advance of ANPR strategies has been made over the most recent couple of decades, there is still a great deal of work to be done since a strong framework ought to work successfully under an assortment of natural conditions and plate conditions. A powerful ANPR framework ought to be able to manage multi-style plates, e.g., distinctive national plates with various text styles and diverse sentence structure. License plate acknowledgment can likewise be utilized for vehicle manufacturer and model acknowledgment.

There are numerous other open issues for the future research.

- Multi-plates ANPR systems
- Car manufacturer and model recognition

REFERENCES

[1] Ms.Sushama H.Bailmare, Prof. A.B.Gadicha "A Review paper on Vehicle Number Plate Recognition (VNPR) Using Improved Character Segmentation Method",*International Journal of Scientific and Research Publications*, Volume 3, Issue 12, December 2013 1 ISSN 2250-3153.

[2] Prashant Chaudhary, Dr. V. S. Dhaka, Manoj Kumar"Automatic License Plate Recoganization System Using LabVIEW: Review ",*International Journal of Advanced Research in Computer Science and Software Engineering*, Volume 6, Issue 2, February 2016 ISSN: 2277 128X.

[3] Sarbjit Kaur, Sukhvir Kaur "An Efficient Approach for Number Plate Extraction from Vehicles Image under Image Processing", *International Journal of Computer Science and Information Technologies*, Vol. 5 (3) , 2014, 2954-2959.

[4] Abbas M. Al-Ghaili, Syamsiah Mashor, Abdul Rahman Ramli, and Alyani Ismail. "Vertical-Edge-Based Car-License-Plate Detection Method "*IEEE Transactions on Vehicular Technology*, Vol. 62, No. 1, Jan. 2013.

[5] S. Ramalingam, M. Rhead, and R. Gurney " Impact of character spacing on the performance of Automatic Number Plate Recognition (ANPR) systems through simulation", *Security Technology (ICCST), International Carnahan Conference on. IEEE*, 2014.

[6] Najeem Owamoyo, A.Alaba Fadele and Abimbola Abudu, "Number Plate Recognition for Nigerian Vehicles", *Academic Research International Journal (ARIJ)*, Vol.4, Issue.3, pp.48-55, 2013.

[7] Shan. Du, Mohamed. Shehata, Wael. Badawy ,"Automatic License Plate Recognition(ALPR):A State-of –the-Art Review" *IEEE* Vol. 23, No.2, June 2013.

[8] P.Anishiya, Prof. S. Mary Joans," Number Plate Recognition for Indian Cars Using Morphological Dilation and Erosion with the Aid Of Ocrs."*International Conference on Information and Network Technology*, Vol.4,2011.

[9] Rupali Kate, Dr.Chitode J.S "Number Plate recognition using Segmentation*" International journal of engineering & technology*(IJERT) ISSN: 22780-0181. Vol.1 ISSUE 9-Nov-2012.

[10] P. Anishiya and Prof. S. M. Joans, "Number Plate Recognition for Indian Cars using Morphological Dilation and Erosion with the Aid of Ocrs" *International Conference on Information and Network Technology,Singapore,* 2011.

[11] Hanit Karwal, Akshay Girdhar " Vehicle Number Plate Detection System for Indian Vehicles " IEEE *International Conference on Computational Intelligence & Communication Technology,* 2015.

[12] Mr A. N. Shah, Ms A. S. Gaikwad. " A Review-Recognition of License Number Plate using Character Segmentation and OCR with Template Matching ", *International Journal of Advanced Research in Computer and Communication Engineering,* Vol. 5, Issue 2, February 2016.

[13] V. Tadic, Z. Trpovski & P. Odry " License Plate Detection using Gabor Filter Banks and Texture Analysis", *Proc. IEEE 9th International Symposium on Intelligent Systems and Informatics, Subotica, Serbia,* 2011, 381-386.

[14] Subhradeep Kayal " Automatic License Plate Detection Using Gabor Filtering And Cross-Cuts " , *Singal Processing,Pattern Recognition and Application /779 :Computer Graphics and imaging*-2012.

[15] Aniruddh Puranic,Deepak K. T.,Umadevi V " Vehicle Number Plate Recognition System: A Literature Review and Implementation using Template Matching " , *International Journal of Computer Applications* (0975 – 8887) Volume 134 – No.1, January 2016.

[16] M. M. Shidore, S. P. Narote " Number Plate Recognition for Indian Vehicles " , IJCSNS *International Journal of Computer Science and Network Security*, VOL.11 No.2, Feb. 2011.

[17] Naito, T. Tsukada, T. Yamada, K. Kozuka. K. and Yamamoto, S., "Robust recognition methods for inclined license plates under various illumination conditions outdoors",Proceedings IEEE/IEEJ/JSAI *International Conference on Intelligent Transport Systems*, pp. 697-702, 1999.

[18] M. R. Bai, V.V. Krishna, and J. Sreedevi, "A new morphological approach for noise removal cum edge detection," IJCSI *International Journal of Computer Science Issues,* Vol. 7, Issue 6, November 2010.

[19] Hontani, H., and Koga, T., "Character extraction method without prior knowledge on size and information",Proceedings of the IEEE *International Vehicle Electronics Conference* (IVEC'01), pp. 67-72, 2001.

[20] Norizam Sulaiman,"Development of Automatic Vehicle Plate Detection System",*3rd International Conference on System Engineering and Technology*, pp.130-135, IEEE 2013.