RECOGNITION OF NUMBER PLATE FOR VEHICLE IDENTIFICATION USING DYNAMIC IMAGE PROCESSING TECHNIQUES IN INTELLIGENT TRANSPORTATION SYSTEM

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Abstract - In this paper, we propose an image enhancement algorithm to improve license plate extraction rate in various environments. The proposed algorithm is composed of image enhancement algorithm and license plate extraction algorithm. The proposed algorithm employs an interpolated Probability Distribution Value (PDV) in order to control a sudden change in image brightness. Probability distribution value can be calculated using Cumulative Distribution Function (CDF) and Probability Density Function (PDF) of the captured image, whose values are achieved by brightness distribution of the captured image. Also, by adjusting the image enhancement factor of each part region based on image pixel information, it provides a function that can adjust the gradation of the image in more details. This processed gray image is converted into a binary image, which fuses narrow breaks, eliminates small holes, and fills gaps in the contour by using morphology operations. Then license plate region is detected based on aspect ratio. The images have been captured by using a video camera. The captured images have included several license plates on multilane roads. Simulation has been executed using OpenCV and MATLAB. The results show that the extraction success rate is more improved than the conventional algorithms.Potential applications includes vehicle parking facilities and campus security system for permitting authorized vehicles into the premises.

Index Terms - Probability Distribution Value, Car License Plate Extraction, Contrast Enhancement, Cumulative Distribution Function, Genetic Algorithm, IntelligentTransportation system

I.INTRODUCTION

In our paper, we proposed an algorithm for license plate recognition (LPR) applied to the intelligent transportation system [1][2] that is prepared on the basis of a novel shadow removal technique and character recognition algorithms. This paper has two major contributions. Our first contribution is a new binary method, i.e., the shadow removal method, which is based on the improved Genetic algorithm combined with the Gaussian filter [3]. Our second contribution is a character recognition algorithm known as support vector machine (SVM) integration. In SVM integration, character features are extracted from the elastic mesh and the entire address character string is taken as the object of study, as opposed to a single character [5].This paper also presents improved techniques for image tilt correction and image gray enhancement. Our algorithm is robust to the variance of illumination, view angle, position, size, and color of the license plates when working in a complex environment. The algorithm was tested with 100 images, such as natural-scene vehicle images using different backgrounds and ambient illumination particularly for low- resolution images. The license plates were properly located and segmented as 97.16% and 98.34%,respectively [10]. The optical character recognition system is the SVM integration with different character features, whose performance for numerals, Kana, and address recognition reached 99.5%, 98.6%, and 97.8%, respectively [5]. The rest of the paper is organized as follows: Section II contains the literature review, Section III contains proposed method, Section IV contains Simulation and Experimental Results, and Section V Concludes along with the list of References.

II. LITERATURE REVIEW

SerkanOzbay, and Ergun Ercelebiintroduced a new approach on Automatic Vehicle Identification (AVI),this has many applications in traffic systems (highway electronic toll collection, red light violation enforcement, border and customs checkpoints, etc.).License Plate Recognition is an effective form of AVI systems; this approach has a smart and simple algorithm. The proposed algorithm consists of three major parts: Extraction of plate region, segmentation of characters and recognition of plate characters. For extracting the plate region, edge detection algorithms and smearing algorithms are used. The performance of the proposed algorithm has been tested on real images in the paper Automatic Vehicle Identification by Plate Recognition(2007).[6] Christos-Nikolaos, VassiliLoumos and Eleftherios Kayafas proposed an algorithm called License plate recognition (LPR) it is composed of the following three processing steps: 1) extraction 2) segmentation and 3) recognition Finally, this paper offers to researchers a link to a public image database to define a common reference point for LPR algorithmic assessment in the paper License Plate Recognition from Still Images and Video Sequences: A Survey (2008).[7]

SatadalSaha, SubhadipBasu, MitaNasipuri, Dipak Kumar Basu suggested an algorithm called Automatic license plate recognition (ALPR). The technique is based on a novel multi-stage approach for analysis of vertical edge gradients from contrast stretched gray-scale images which is presented on the paper License Plate Localization from Vehicle Images: An Edge Based Multi-stage Approach (2009).[8]

S.Kranthi, K.Pranathi and A.Srisaila proposed an algorithm called Automatic Number Plate Recognition (ANPR) which is a mass surveillance system that captures the image of vehicles and recognizes their license number and the development of the number plate detection system in the paper Automatic Number Plate Recognition (2011).[9]

DhawalWazalwar, ErdalOruklu and JafarSaniie presented a new design flow for robust license plate localization and recognition. The algorithm consists of edge detection and Euler number of a binary image for identifying the license plate region. The license plate with rows of characters and sensitivity to license plate dimensions have been ad-dressed in the paper A Design Flow for Robust License Plate Localization and Recognition in Complex Scenes(2012).[10]

Sneha G. Patel presented an approach on Automatic license plate (LP) recognition which is one of the most promising aspects of applying computer vision techniques towards intelligent transportation system. Neural Network is used to recognize the license plate character in the paper Vehicle License Plate Recognition Using Morphology and Neural Network (2013).[11]

Mohamed A. Mohamed ,Mohy E. Abou-El-Soud and Amr E. Rashid proposed an algorithm called License Plate Recognition (LPR) which is one of the most important types of intelligent transport system and is of considerable interest because of its potential applications to many areas such as highway electronic toll collection and traffic monitoring systems. The system captures images of the vehicles with a digital camera which is presented on the paper A Fast Algorithm for License Plate Detection (2013).[12]

IsackBulugu presented a paper on License plate localization and recognition (LPLR) which states that It uses image processing and recognition (LPLR) which states that It uses image processing and character recognition technology in order to identify the license number plates of the vehicles automatically. The algorithm is implemented using MATLAB 7.11.0(R2010b) is described in the paper Algorithm for License Plate Localization and Recognition for Tanzania Car Plate Numbers(2013).[13]

Jing Pang proposed a paper for discovering the candidate car license plate locations is presented. First, the image is decomposed using a Haar wavelet to get the HL band with vertical edges. Then, the HL band image is binarized using an Otsu threshold. Next a black top-hat algorithm is applied to reduce the effects of interfering large continuous features other than the license plate, the proposed method is robust enough to locate the plates in cases where the rough vehicle position has not been previously discovered and the cars are not centered in the image which is on the paper Variance Window Based Car License Plate Localization(2014).[14]

NoppakunBoonsim stated that License plate localization is considered to be the significant process in Automatic Number Plate Recognition (ANPR)system, because the accuracy rate of license plate recognition relies on the performance of license plate localization. The experiments were conducted on images at night in various lighting conditions and the method can detect license plate position with accuracy rate of about 85% in the paper License Plate Localization at Night(2017).[15]

III. LICENSE PLATE IDENTIFICATION USING IMAGE PROCESSING TECHNIQUES

An algorithm for License Plate Recognition (LPR) applied to the intelligent transportation system is proposed on the basis of a novel shadow removal technique and character recognition algorithms. This paper has two major contributions. One contribution is a new binary method, i.e., the shadow removal method, which is based on the improved Genetic algorithm combined with the Gaussianfilter.

This paper also presents improved techniques for image tilt correction and image gray enhancement. Our algorithm is robust to the variance of illumination, view angle, position, size, and color of the license plates when working in a complex environment. Most of number plate localization algorithm merges several procedure resulting in long computational time, but our proposed system is simple and easy to use even in complexeimages.

The algorithm presented in this paper is extremely useful in dealing with complex cases, while building a – real time license plate evolution system. Our proposed system can be applied for both image and video sequence

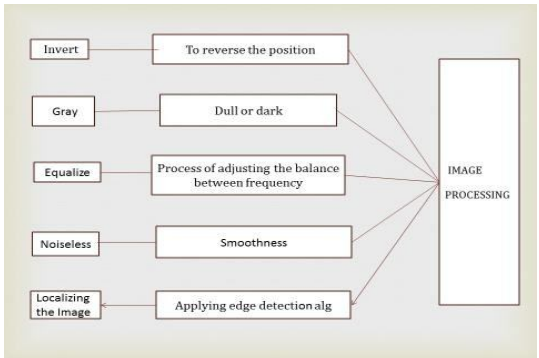


Figure 1 : System Architecture

From the figure 1 the system architecture works as follows first we have to capture an image and open it to perform filteringtechniques.

Invert& Gray Scale

Invert is technique which is used to give opposite color of our image. For example if our image is in white color the pressing our inert button it will display as black similarly RGB colors are converted into CMYcolors.Second technique used to display our image white or black that is dull or dark. For this we are using gray scale to convert those RGB colors to black and white, for this we are using an equation

F=0.299*R+ 0.587 * G+0.114 *B……..(1)

Where F represent luminance, R represent value of red color, G represent value of green color and B represents value of blue color.The gray scale could take every pixel of picture to number between 0-255.

Equalize& Noiseless

Next process is equalization here it will equalize that color contrast of our image (i.e.) process of adjusting the frequency range of colors.

Noiseless used to get our image as smooth as possible, this will remove all noises such as salt noise pepper noise etc. Median filter is best choice for removing all types ofnoises.

Canny Edge Detector

In order to avoid any possibility of false License plate detection we are using canny edge detector it can be performed both horizontally and vertically, this will give final output as clear aspossible.

Implementation is the stage of the paper when the theoretical design is turned out into a working system. Thus it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective. The implementation stage involves careful planning, investigation of the existing system and it's constraints on implementation, designing of methods to achieve changeover and evaluation of changeover methods and the detailed design in given in Figure 2.

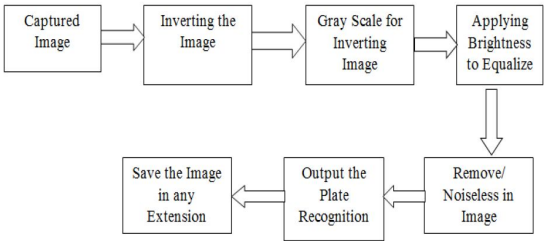


Figure 2 : Implementation

Filtering Technique

Input the source image which we will go to find out thenumberof the vehicle. The user can capture the image or he may can input the car image with license plate.There are many filtering techniques such as invert, grey, equalize and noiseless. Applying HSI to get the Invert of the image and then applying grey scale conversion to get the image in black and white and then applying equalization to adjust color contrast of the image and finally applying noiseless to remove noises. Let us see each phase in detail. Invert is technique which is used to give opposite color of our image. For example if our image is in white color the pressing our invert button it will display as black similarly RGB colors are converted into CMY colors. Second technique used to display our image white or black that is dull is dark .For this we are using gray scale to convert those RGB colors to black and white, for this we are using an Equation (1)

The gray scale could take every pixel of picture to number between 0-255. Next process is equalization here it will equalize that color contrast of our image (i.e.) process of adjusting the frequency range of colors. Noiseless used to get our image as smooth as possible, this will remove all noises such as salt noise pepper noise etc. Median filter is best choice for removing all types of noises.

HistogramEqualization& Canny Edge Detection

Finding the histogram values for the image to get the exact usage of the colors in the image.Applying Canny Edge Detection to the image to find out the individual colors edges. In order to avoid any possibility of false License plate detection we are using canny edge detector it can be performed both horizontally and vertically, this will give final output as clear as possible.

Detecting LicensePlate

Detecting the license plate by the technique which is based on a novel multi-stage approach for analysis of vertical edge gradients from Canny Edge Detection. The result vehicle number will be displayed

IV. SIMULATIONS AND EXPERIMENTAL RESULTS

The figure 3 represents the main form, after entering the correct username and password it will direct us to this main form window, in this window we have to open an image of a car and we have to perform various operations such as invert, grey, equalize, noiseless and canny edge detection.



Figure 3: Main Form

In the main form there is a button named open, when the user presses this button it will direct the user to open window. Here the user has to choose a car

according to his wish to perform various filtering techniques to display a number plate of the respected car.

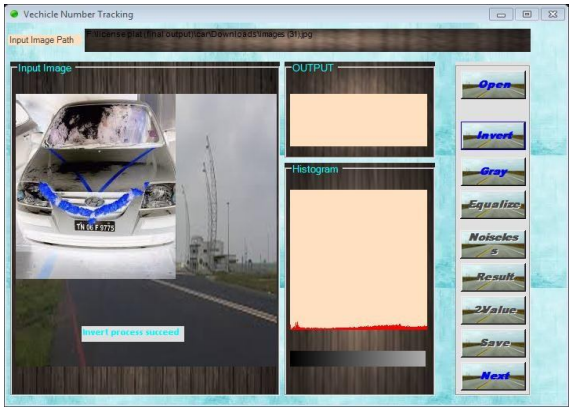


Figure 4: Applying the invert process

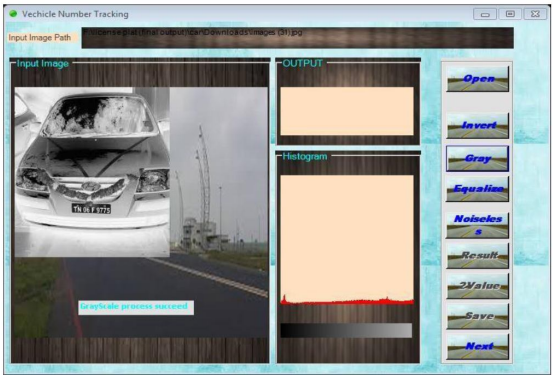


Figure 5: Applying the Gray Scale

In the figure 4 invert process is performed (i.e.) this will show the opposite color of an image. That is RGB color is converted to CMY color model or vice-versa.In the figure 5 grey scale technique is used which is used to convert RGB colors into black and white color. Here the user presses the invert button immediately the action is performed for this we are using the Equation (1).

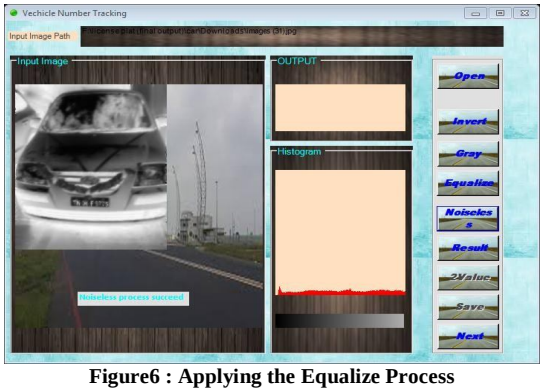


Figure6 : Applying the Equalize Process

The Figure 6 shows the equalization process,thus equalization is a process which will adjust color contrast of an image. This will also adjust the frequency range of colors. It will also adjust the background image of the vehicles.

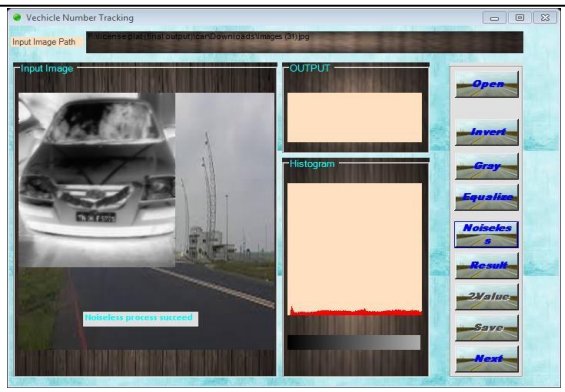


Figure 7 : Applying Noiseless Process

In this process salt and pepper noise which presented in the vehicle license plate are removed. Noiseless used to get our image as smooth as possible. Median filter is best choice for removing all types of noises and is shown in the figure 7.

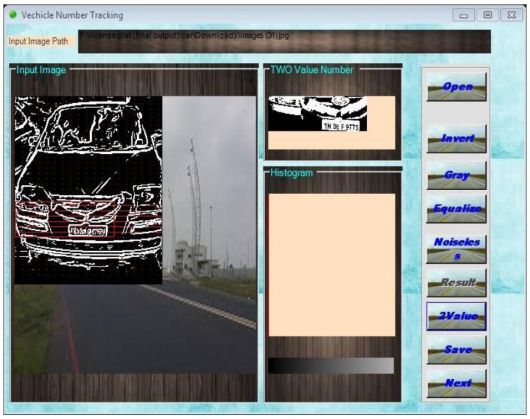


Figure 8: Applying Canny Edge Detection

Canny edge detection is process which performs horizontal and vertical edge detection here only license plate symbols of a vehicle is displayed as output in Figure 8.In order to avoid any possibility of false License plate detection we are using canny edge detector it can be performed both horizontally and vertically, this will give final output as clear as possible Open the file to view the result that is license plate of the car and the figure 9 shows that the final output number plate of the car is displayed

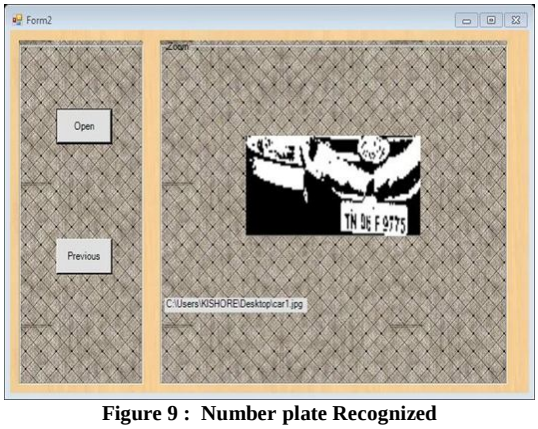


Figure 9 : Number plate Recognized

CONCLUSION

Thus the implementation phase has been successfully performed and the user requirements are satisfied. The snapshots provide the entire process description and prove to be useful for understanding purpose. The results were encouraging and a new approach for solving the LP detection problem relying only on the geometrical layout of the LP symbols was experimentally proved.

Future research may consider clustering objects according to their sizes and positions before being supplied to the genetic phase to allow for the detection of multiple plates and at the same time to increase the system speed. Currently, our system can be used as it is in parking management systems rate was achieved with the aid of the adaptability aspect of the GAs. The ability of the system to differentiate between LP text and normal text was proved experimentally. A very important achievement is overcoming most of the problems arising in techniques based on CCAT by allowing the GA to skip gradually and randomly one or more symbols to reach to an acceptable value of the objective distance. Moreover, an enhancement in the performance of the developed GA was achieved by applying the new USPS crossover operators, which greatly improved the convergence speed of the whole system.

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