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Mobile Based Application to Scan the Number Plate and To Verify the Owner Details

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Abstract: *Any License plate recognition system usually passes through three steps of image processing: 1) Extraction of a license plate region; 2) Segmentation of the plate characters; and 3) Recognition of each character. A number of algorithms have been proposed in recent times for efficient disposal of the application. The purpose of this project was to develop a real time application which recognizes number plates from cars at a gate, for example at the entrance of a parking area or a border crossing. The system, based on regular PC with mobile camera, catches video frames which include a visible car number plate and processes them. Once a number plate is detected, its digits are recognized, displayed on the User Interface or checked against a database.The software aspect of the system runs on mobile hardware and can be linked to other applications or databases. It first uses a series of image manipulation techniques to detect, normalize and enhance the Image of the number plate, and then optical character recognition (ocr) to extract the alpha numeric text of number plate. The system are generally deployed in one of two basic approaches: one allows for the entire process to be performed at the lane location in real-time. The other will reveal the driver's profile by checking in the registered database.*

Keywords: *Character segmentation, Image Processing, Mobile IP Webcam, Number plate segmentation, OCR (Optical Character Recognition).*

I. Introduction

Plate readers have always been a tool of law enforcement. Police use them to track the stolen cars. However these come with scanners mounted on tow trucks and even on purpose-built camera cars whose sole mission is to drive around and collect plate scans. The main difficulty with this is poor file resolution, usually because the plate is too far away but sometimes resulting from the use of a low-quality camera.

While some of these problems can be corrected within the software, it is primarily left to the hardware side of the system to work out solutions to these difficulties. The mobile based scanning application system will simply scan the number plate. Once the plate is scanned, it will enable the passenger or any other driver to come in contact with the owner.

The system will store the images in the application and improve the quality of the clicked image with the help of image processing technology." It will be possible to get the number from the stored image. The derived number will be used to get the driver's profile. In case of an emergency, these details can be shared with our friends and family, with also our location.

II. Literature Review

Automatic number plate recognition system normally work through seven algorithms: 1) General preprocessing involves deblurring, resizing image and converting to grayscale in general. (2) Plate Localization involves scan and isolation of R.P. from image (3) Plate Reorientation and Resizing to account for skew of the plate and sets the isolated plate to an optimum size for processing (4) Intensity Transformation adjusting brightness and contrast of the image (5) Noise Removal removes unimportant details from R.P. (6) Character Segmentation, finds constituent symbols in R.P. image (7) Character Recognition, matches the segmented characters to a priori saved templates.

The existing techniques vary from simple algorithms to highly convoluted ones. When available, issues such as performance, execution time, and platform for each method are reported. It should be emphasized that there is a lack of uniformity in the way that methods are evaluated, and therefore, it is inappropriate to explicitly declare which methods actually demonstrate the highest performance. Indeed, one of the scopes of this paper is to highlight the lack of common test sets to achieve a common reference point for algorithmic assessment.

III. Technical Aspects

3.1. Image Acquisition

For real time application, the system can make use of a video camera (frame grabber) which acquires the images of vehicles from rear or front view. But for the present work, due to unavailability of the required hardware, we have used mobile camera.

3.2 Software support

All the experiments in this paper were performed and algorithms were implemented in MATLAB 8.1.0.604 (R2013a) and the inbuilt Image Processing Toolbox provided all the basic image processing functions. The test computer used was a Dell Laptop with an i3 CPU @2.3GHZ and 2GB RAM.

3.3 Working

3.3.1 General pre-processing:

Preprocessing is one of the most fundamental step to carry out on the image in order to implement higher order algorithms. The image was transformed to grayscale and resized to 480 x 640 pixels to increase the speed of execution. For fast moving vehicles, we have a proposed solution of image de-blurring.

3.3.2 Grayscale conversion

For every $(i,j)^{th}$ 24 bit RGB pixel, 8 bit Grayscale pixel is calculated by separating R,G and B channels and using the formula:

1) gray(i,j)=0.59*R(i,j)+0.30*G(i,j)+0.11*B(i,j)

3.3.3 Median filtering

Median filter is a non-linear digital filter used for removing salt and pepper noise from an image. It replaces the gray value of a pixel by the median of the gray values of its neighbours. We have used a 4x4 mask.

3.3.4 Image mask

An image mask isolates parts of the image for processing.An image mask is an 8-bit binary image that is of same size as the inspection image. Pixels in the image mask decide whether the corresponding pixels in the inspection image are processed or not.

3.3.5 Extract colour planes from the image

Since the color information is redundant in our application so we extract color plane from the acquired 32-bit colored image to make it an 8-bit grayscale image.

3.3.6 Plate localization

The R.P. localization is based on the approximation that the vehicle to camera distance is a constant for all images.

3.3.7 Sobel edge detection

Edge detection is by far the most common approach for detection of meaningful discontinuities in an intensity image. Although more complex and advanced edge detectors have been proposed, Sobel Edge Detector ever after all its primitiveness is most commonly implemented edge detector owing to its fairly simple hardware implementation.

3.3.8 Plate reorientation and resizing

The isolated R.P. does not always perfectly follow perfect rectangular aspect, so deformations are to be taken into account. This was the motivation leading to rotational correction using Radon Transform. Resizing is not required for the images meeting the approximation of fixed camera to vehicle distance.

3.3.9 Intensity transformation

The algorithm was primarily implemented in following 2 steps: Object enhancement and binarization. Selective scaling approach to be applied on pixels to adjust brightness and contrast. Consequently, the character pixels (irrespective of their significance to the R.P.) are enhanced, while background pixels remain weakened.

Binarization converts the binary image into a grayscale image and accordingly ensues the image skew estimation task. Binarization technique used in this system will make use of image contrast defined by local maximum and minimum. Compared with image gradient, image contrast is more capable of detecting the image pixels lying around the text stroke boundary. This technique first determines the contrast portion in an image using local maximum and minimum. The high contrast image pixels around the text stroke boundary are then detected through global thresholding of the determined contrast image.

3.3.10 Noise removal

Firstly, the entire plate was divided into 8- connected components. The average height of the characters was computed and noted. Any set of connected components smaller than the average height was culpable of

being a noise. A height tolerance of 20 rows was considered. Secondly, any set of connected components having less than 800 pixels was considered a candidate of being noise. A pixel essentially meeting both the above requisites was deemed as noise and therefore removed by replacing by a black (0) pixel.

3.3.11 Character segmentation

The output of binarized image is complemented and from thereon, the selection of characters is straightforward. The connected components of binary image were marked. An adaptive algorithm iteratively scanned for the occurrence of lowest order connected component. Taking into account the first and last row and column of their occurrence, the portion containing the alphanumeric character was selectively cropped from the image and displayed on a GUI. The cropped out pixels from the plate were replaced by black pixels on it to avoid introduction of a void and the let the algorithm successfully run iteratively.

IV. Optical Character Recognition (OCR)

Optical Character Recognition (OCR) is a type of document image analysis where a scanned digital image that contains either machine printed or handwritten script is input into an OCR software engine and translating it into an editable machine readable digital text format (like ASCII text). OCR works by first pre-processing the digital page image into its smallest component parts with layout analysis to find text blocks, sentence/line blocks, word blocks and character blocks. Other features such as lines, graphics, photographs etc are recognized and discarded. The character blocks are then further broken down into components parts, pattern recognized and compared to the OCR engines large dictionary of characters from various fonts and languages. Once a likely match is made then this is recorded and a set of characters in the word block are recognized until all likely characters have been found for the word block. The word is then compared to the OCR engine's large dictionary of complete words that exist for that language.

V. Integration with The Mobile IP Camera

Towing truck fixed with bulky cameras wander around just to click the number plates to test for its valid registration. The system proposed above will make use of mobile IP webcam to replace the bulky cameras. On any day, you would definitely prefer a system wherein the mobile camera is held against a number plate. The clicked image will remain in the server. The computer in the system connected to the same LAN or a different network will be able to get an access to the server's saved image using the IP address of the mobile. The image will undergo processing to retrieve the details from the database which will be sent on the same mobile phone via an SMS. The SMS is sent with the help of SIM 300 GSM module.

5.1 How does a Mobile IP works

Mobile IP enables routing of IP datagrams to mobile nodes. The mobile node's home address always identifies the mobile node, regardless of its current point of attachment to the Internet or an organization's network. When away from home, a care-of address associates the mobile node with its home address by providing information about the mobile node's current point of attachment to the Internet or an organization's network. Mobile IP uses a registration mechanism to register the care-of address with a home agent.

The home agent redirects datagrams from the home network to the care-of address by constructing a new IP header that contains the mobile node's care-of address as the destination IP address. This new header then encapsulates the original IP datagram, causing the mobile node's home address to have no effect on the encapsulated datagram routing until it arrives at the care-of address. This type of encapsulation is also called tunneling. After arriving at the care-of address, each datagram is de-encapsulated and then delivered to the mobile node.

VI. Applications

6.1 Homeland security

The system's ability to read strings of alphanumeric characters and compare them instantaneously to lists allows a Command Center to organize and strategize efforts in reaction to the information captured.

6.2 Border crossing

This application assists the registry of entry or exits to a country, and can be used to monitor the border crossings. Each vehicle information is registered into a central database and can be linked to additional information.

6.3 Parking management

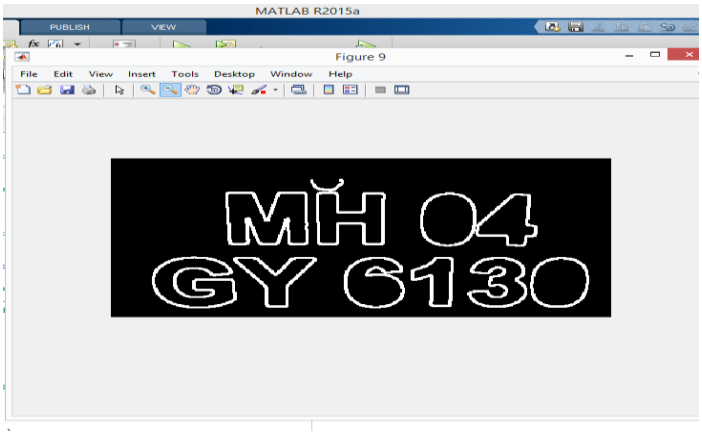
The License plate recognition system is used to automatically enter pre-paid members and calculate parking fee for non-members (by comparing the exit and entry times). The car plate is recognized and stored and upon its exit the car plate is read again and the driver is charged for the duration of parking.

6.4 Automatic toll gate

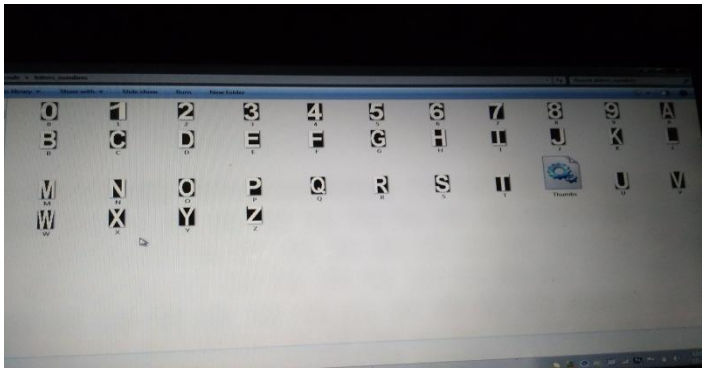
Manual toll gates require the vehicle to stop and the driver to pay the appropriate tariff. In an automatic system the vehicle would no longer need to stop. As it passes the toll gate, it would be automatically classified in order to calculate the correct tariff.

(a) Input image

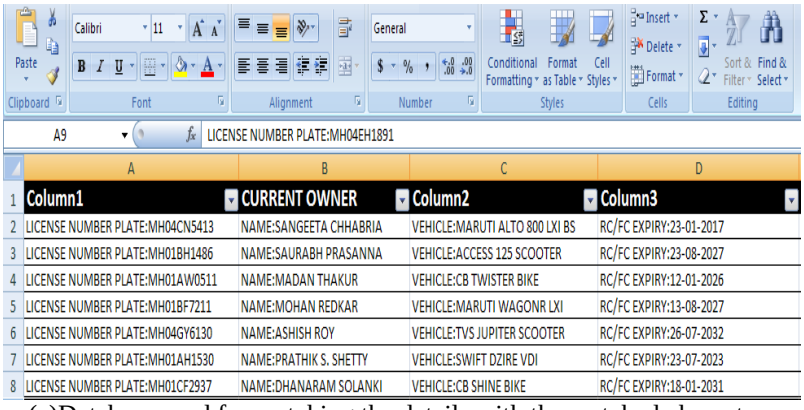
(b) Cropped image



(c) Image after preprocessing and noise removal



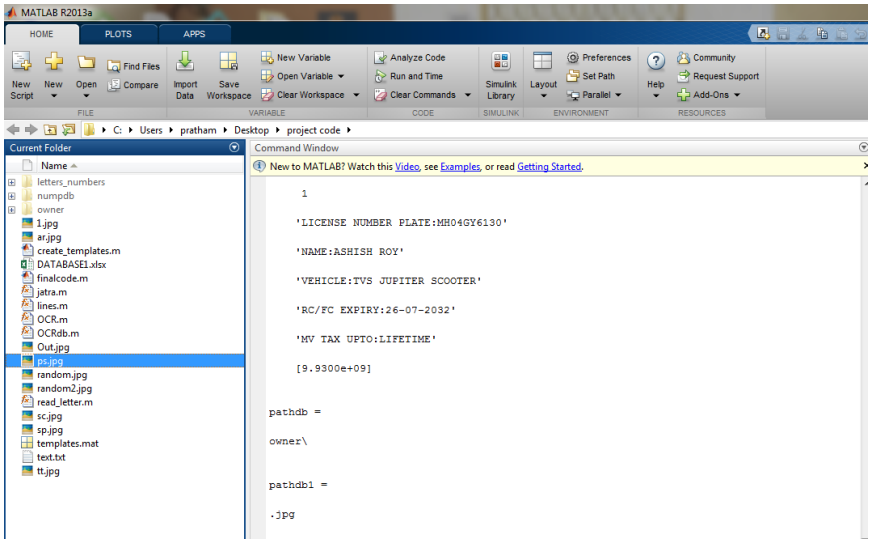
(d)Character set used for matching in OCR



A9: LICENSE NUMBER PLATE:MH04EH1891

	Column1	CURRENT OWNER	Column2	Column3
2	LICENSE NUMBER PLATE:MH04CN5413	NAME:SANGEETA CHHABRIA	VEHICLE:MARUTI ALTO 800 LXI BS	RC/FC EXPIRY:23-01-2017
3	LICENSE NUMBER PLATE:MH01BH1486	NAME:SAURABH PRASANNA	VEHICLE:ACCESS 125 SCOOTER	RC/FC EXPIRY:23-08-2027
4	LICENSE NUMBER PLATE:MH01AW0511	NAME:MADAN THAKUR	VEHICLE:CB TWISTER BIKE	RC/FC EXPIRY:12-01-2026
5	LICENSE NUMBER PLATE:MH01BF7211	NAME:MOHAN REDKAR	VEHICLE:MARUTI WAGONR LXI	RC/FC EXPIRY:13-08-2027
6	LICENSE NUMBER PLATE:MH04GY6130	NAME:ASHISH ROY	VEHICLE:TVS JUPITER SCOOTER	RC/FC EXPIRY:26-07-2032
7	LICENSE NUMBER PLATE:MH01AH1530	NAME:PRATHIK S. SHETTY	VEHICLE:SWIFT DZIRE VDI	RC/FC EXPIRY:23-07-2023
8	LICENSE NUMBER PLATE:MH01CF2937	NAME:DHANARAM SOLANKI	VEHICLE:CB SHINE BIKE	RC/FC EXPIRY:18-01-2031

(e)Database used for matching the details with the matched characters



(f) The final output after matching with the database

VII. Conclusion And Future Work

In this review paper, the automatic number plate recognition system using vehicle license plate is presented. The system use image processing techniques for identifying the vehicle from the database stored in the computer. The system works satisfactorily for wide variation of conditions and different types of number plates. The system is implemented and executed in Matlab and performance is tested on genuine images. The system works quite well however, there is still room for improvement. The camera used in the system for this project is sensitive to vibration and fast changing targets due to the long shutter time. The system speed can be increase with high resolution camera. The OCR method is sensitive to misalignment and to different sizes, so the affine transformation can be used to improve the OCR recognition from different size and angles. The statistical analysis can also be used to define the probability of detection and recognition of the vehicle number plate. At present there are certain limits on parameters like speed of the vehicle, script on the vehicle number plate, skew in the image which can be removed by enhancing the algorithms further.

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