Building a Character Recognition System for Vehicle Applications

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Abstract. Today number plate for vehicles is very important for their verification of its owner Id, address, vehicle identification and or for security purposes. Number plates are of different shapes, colors and sizes in different countries. In India, number Plates are of white background with black foreground color. By number plate we can identify the number by using image processing technique. By using image processing an image of the vehicle is captured to identify the number. We can also check the location and detect the non-permit holders of the stolen vehicles. The OCR, i.e., Optical Character Recognition (OCR) technique is used to read the characters from the image captured of the vehicle. Character Recognition is the one of the form of the OCR. In which we can read the characters from the vehicle number plate and use this for the identification of the owner of the vehicle with its detail like name of the owner, Place (state and district), the date of registration of the vehicle and its registration number and vehicle type, i.e., Either it is four wheeler or two wheeler. We have proposed this methodology to detect or check the detail of the vehicle. The vehicle number plate is also used for the Electric tolls to collect charge of pay-per-use of highways and note down the journey time measurement and ticket collection. The camera which is used for this process is infrared camera which capture the image at all conditions of the weathers either it is day or night.

Keywords: Licensed number plate system · Template matching · Optical Character Recognition techniques and its applications

1 Introduction

The licensed number plate in these days is very useful because of large increase of vehicles. The information extracted from the vehicles number plate [1] is used for various purposes like Access Control, Traffic Monitoring and Toll roads and border control areas, military areas and other restricted societies etc. for security purposes. The main concern of this paper is to provide effective security or to control crime activities. For this we have to capture the image of the vehicle by using HD-Cameras and then scan that image by using the OCR technique as shown in Fig. 1. By using this technique the number will compare with the database to check the vehicle [2] is belongs to its own owner or not. The recognition process is generally sub-divided into five categories:

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(a) Capturing the image of the license plate, i.e., Image acquisition.
(b) Normalization, adjusting the brightness and contrast of the image.
(c) Localizing the license plate.
(d) Locating and identifying the individual symbol images on the plate, i.e., Character Segmentation.
(e) Optical Character Recognition, i.e., OCR.

OCR Model

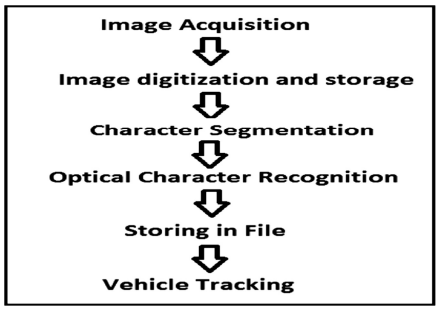

Fig. 1. Process of extracting text from an image

These operations are used to remove the noise from the images. To identify a vehicle a unique identification number is given to the vehicle which is provide to each vehicle as a number plate and it is applied on the front as well as backside of the vehicle which is vehicles unique ID. For example, HR51AX8052: which is the car number plate number which shows its detail as, i.e., First two letters shows their state code and the second two numbers show their district code and the third two letters are model of the vehicle type and at the end the end four digits are provided to the vehicle which is unique ID for the vehicle. By using this number, we can retrieve the detail of the vehicle. The RTO i.e. district-level Regional Transport Office is provide this number to each and every vehicle. The scheme of numbering has some advantages [11, 12], i.e., it shows the state and district registration of the vehicle and during police investigation in case of road accident or the vehicle related crimes if the witness read the number of the vehicle it will be helpful for the investigators to reach the criminal easily.

Hence, the remaining part of this work is organized as: Sect. 2 discusses about used methodology in this work. Further, Sect. 3 discusses our proposed method in detail. Further, some applications of registered vehicle number plate are discussed in Sect. 4. Then several applications of using OCR are discussed in Sect. 5. In last, Sect. 6 will conclude this work in brief with some future work.

2 Methodology Used

In this technology we are working on the CCTV footage [11], i.e., closed circuit Television with provide us an input image. The CCTV footage must be clear to see to the input image contrast must be clear and number must be formatted.

The process to detect a number plate the following steps are followed as (refer Fig. 2):

Fig. 2. Block diagram

i. Input an Image of the vehicle from camera
ii. RGB to grey Scale
iii. Detect Licensed number plate from image
iv. Character segmentation
v. Character recognition
vi. Display vehicle number
vii. Comparing Number with database
viii. Punished if suspected

A. **Image Acquisition:** The Closed Circuit Television (CCTV) camera is used to capture the image. The sensor is used to spot the image and actions of the vehicle. The captured image is passed from the recognition process, to make sure the detail or the investigation or detection process [10].
B. **Image Digitizing and Storing:** The image digitizing means to store the image in the format in which, the computer can read the image for the process. This is used to store the image in the form of bits.
C. **Character Segmentation:** This means thinning is applied to the number plate to read each pixel of the image. Character Segmentation means slicing the image to read each character from the image of the number plate. It is two types, i.e., horizontal segmentation or vertical segmentation. In Horizontal segmentation, the unnecessary or unwanted part of the image is removed of the image and Vertical segmentation is used to separate the each pixel of the image.
D. **Optical Character Recognition:** Optical Character Recognition (OCR) is the technique used to take out the text from the image. By using OCR the text from the number plate is extracted to detect the details from the database. Optical Character Recognition (OCR) is the process of converting the handwritten text or scanned text into machine or computer readable form OCR is used in various purposes passport ID, bank statements, programmed receipts, big business cards etc. It is similar with the image digitizing in which the image text is electrically search, store, and edit easily. The Artificial Intelligence and the computer vision are more focused by the OCR technique.
E. **Storing in File:** At the last, the scanned text from the image is stored in the text format file.

F. **Vehicle Tracking:** The vehicle tracking means to follow the path of the vehicle from which it is going from various traffics signals to sense the path of the particular course by scanned the image from the different cameras at different routes.

Hence, this section discusses about our methodology used with Optical Character Recognition (OCR). Now, next section will discuss about our proposed method in detail.

3 Proposed Method

At this time there is not any system is existing, which automatically scanned the moving vehicle. We have to check manually from the different-different CCTV cameras from different-different locations of the traffics signals from every area from where it is passing. A sensor is used which is automatically scanned the image to detect the vehicle from different locations and digital camera is used which is keep ready to detect the image (e.g., refer Fig. 3) After detecting the image we compare the image with different images which are captured at different locations at different places to detect the path from which the vehicle is passing through (for output, refer Fig. 4). This technology is work on the basis of 60–70% match of the images. By which it provide the result on the basis of different images of same vehicle number plate (the complete process can be looked into Fig. 5). The number plate is helpful in stolen vehicles, parking organization, toll plazas and constrained zones. The reason for converting image to text is to overcome the problems like-multiplicity of plate formats, dissimilar scales, rotations and Non-uniform clarification conditions caused during image possession.

Fig. 3. Captured number plate

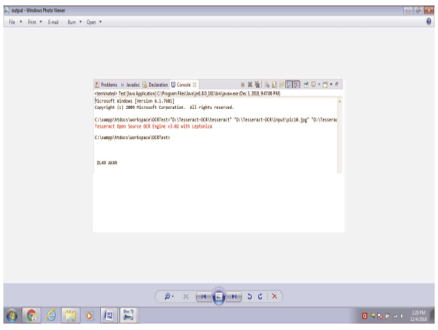

Fig. 4. Output of extract number plate

Some Challenges: Problem occur during capturing the image occur are- poor resolution of the image capturing camera, blurry imaging because of vehicle in motion and poor lighting in the particular area from where the vehicle is moving. Low contrast of light, over-exposure reflection and shadow of the image.

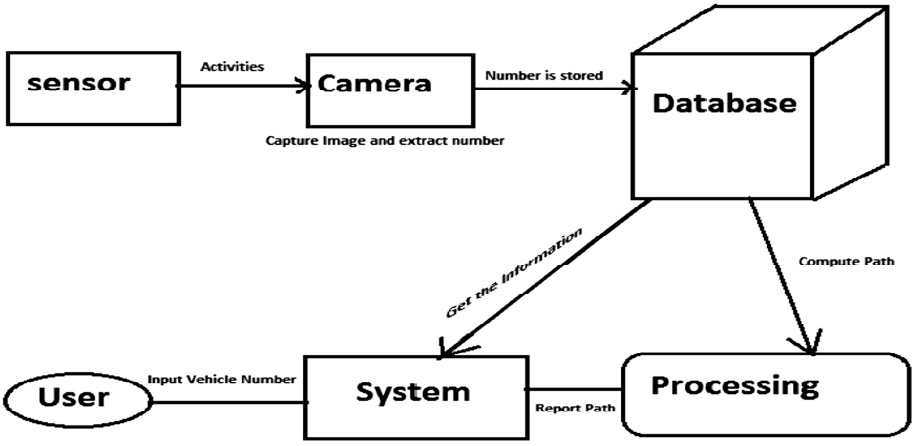

Fig. 5. Procedure for extracting number plate

Hence, this section discusses about our proposed method in detail. Now, next section will discuss several applications of registered vehicle number plate in detail.

4 Some Applications

Some of the applications of registered vehicle number plate are as follows:

(a) **Parking Security:** Parking automation and parking security works with Character Recognition System as follows:

- ticketless parking,
- parking admission computerization,
- vehicle position direction,
- car robbery avoidance, "lost ticket" deception,
- scam by changing tickets,
- Partially or fully computerized payment process.

(b) **Entrance Control:** Entrance Control is the mechanism in which the security is based in the restricted areas where the entry in the particular area or zone is based on the personal identification of the person to increase the security like in military areas, government areas, and highly authorized or private areas.

- License plate recognition brings computerization of vehicle admittance control management,
- providing increased security,
- Car pool supervision for logistics,
- Security guide support,
- Event logging, event management,
- Keeping access diary possibilities for analysis and data mining.

(c) **Road-Tolling:** In this the particular use of the road or highway is concerned where we can pay per of the roads during a journey. It helps to find the location of a particular vehicle and also useful to measure the journey time.

- By sinking travel time,
- Jamming and improve roadways quality,
- Reduces fraud related to non-attendance,
- Makes charging valuable,
- Reduces mandatory manpower to process events of exceptions.

(d) **Border Control:** It is helpful in the border areas which may be under the military or the army's team where the security need is very high to reduce the crime or for the investigation purpose.

- In opposition to terrorism,
- unlawful cross border traffic,
- Smuggling and against the law activities.

(e) **Journey Time Measurement:** Journey time measurement is used during the travelling from various routes and the number of the vehicle is noted down on every route to measure the time or during any accidental case the investigation may be easily detect of the particular vehicle.

- Feeding back information to road users to boost traffic security,
- Selection efficient law enforcement,
- Optimizing traffic routes,
- Dropping costs and time, etc.

(f) **By Law Enforcement:** Law Enforcement is useful to find the stolen vehicle or to detect vehicle which breaks the traffic rules or for over speed vehicle purposes.

- Red-light enforcement
- In excess of speed charging
- Automobile lane control.

For example, Intelligent Transport System (ITS), we can say this application as ITS because here we track the vehicle and by using its number plate we can find the persons whole detail and its vehicle also. This makes the Regional Transport Office (RTO) system more intelligent and beneficial for the public. By using this traffic monitoring it can be handled.

Hence, this section discusses about several applications of registered vehicle number in detail. Now, next section will discuss about Optical Character Recognition applications.

5 Optical Character Recognition Applications

OCR (Optical Character Recognition) is vast use technology in today's life. It is used to scan the document text which is recognized by the computers. It is document management technology which is the smart way to manage or use the document text of the image for the security use or to save the record for the database in the companies or offices.

(a) Banking: In bank, OCR is used in the check with no participation of the people. In this the check is inserted in the machine and the text on it is scanned automatically and the given amount is deposited in the account. The use of OCR is fairly used in the handwritten checks and manually conformation.
(b) Industry: In the legal industry, the digitized paper is frequently used to reduce the use of paper. In order to reduce paper or space the elimination of paper documents, files, records are scanned by the computer insert or saved in the computer database with great security and long-time use of the data and information easily which is managed or processed by a particular person or persons access control.
(c) Healthcare: Healthcare professions are also use the OCR technology in hospitals to save the patients records. They also have the volume of records of files of patients records like their insurance, personal information. To keep this with them they also make use of the electronic document scan to keep the document save in digitally with the help of computers.
(d) Digital Signature: OCR is used in many fields as its support best result in their applications and has many benefits like in education, finance, and government sectors. Digital Signature is one of its basic applications as we use it in many works or as our identification purposes. Digital Signature is the electronic signature in which a particular person's signatures are scanned using the computer to verify the originality.

Hence, this section discusses about Optical Character Recognition applications in brief. Now next section will conclude this work with some future work in brief.

6 Conclusion and Future Work

We have checked and evaluated the OCR technology on the vehicle number plates to detect the text from the number plates for the security purpose and identification of the vehicle owner. Some of the issues are there during OCR technology used on the vehicles are proper format of the number plate of the vehicle, noise on the image and camera pixel clarity etc., which effects the effectiveness of the OCR technology. This software is implemented in JAVA and My-SQL is used for the database storage and the Tresseract is used as OCR to detect the text from the image. Hence, now some of the applications are:

- Lodge identity Check-In
- Tax-Free Shopping
- Self-Service convenience Meter Reading

- Receipt rules Scanning
- Scan Your Top-Up Codes

There is some condition for this software to work:

- Automobile shield should be white and according to rule given by government of India.
- Picture should be clear.

In last, some limitations of our work are: the downside in this is to read the characters with less intelligently. In some cases, the software reads the text from the number plate with wrong way but still it gives the right identification of the vehicle's owner detail. It may be due to the pixel ambiguity of the camera or due to the ineffective light towards the camera.

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