GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES
NON-STOP TOLLING SYSTEM USING IMAGE PROCESSING

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ABSTRACT
Modern amenities, fast data transfer and minimum delay have now become the basic requirements of all the services. This has now come in a large way in transport services also. One such service offered to transport system is toll collection. Initially toll collection was manual but now due to development in various fields it is slowly moving towards automation. The system discussed in this paper is a full automated toll collection system. Number plate recognition is used increasingly nowadays for automatic toll collection, secure parking and law enforcement. Open Road Tolling uses video evidence to identify vehicle usage of a toll facility without the use of toll booths for toll collection without having to stop or even slow down to pay the toll. The application utilizes image processing and pattern recognition methods for Open Road Tolling. This paper presents Open Road Tolling (ORT) using number plate recognition. The proposed Number Plate Recognition (NPR) techniques consist of two modules: histogram based number plate localization and number plate recognition using template matching. This approach has an advantage of being simple & faster. This has come up in a large way in foreign countries, but not in India to that extent here it is still at the level of idea.

Keywords- *ORT, NPR, Localization, Template Matching.*

I.   INTRODUCTION

In India Mumbai city has a population of about 23 million. Every day 12 million commute to work . Everyday about 18, 00,000 vehicles run on the roads [7]. It is very difficult to keep a track of each vehicle for purpose of traffic law enforcement and traffic management. Open road toll collection is conducted through either the use of automatic number plate recognition or transponders [1]. Transponders require road side units to collect the information. As each vehicle has a unique license number, which is written on its number plate .The license plate number can be used to retrieve more information about the vehicle and its owner, which can be used for further processing. Such an automated system should be small in size, portable and be able to process data at sufficient rate. The systems usually use infrared lighting which enables the camera to capture pictures during the day as well as at night. The best thing about it is that the cameras can take pictures when the car is moving at highway speeds. The existing application utilizes image processing and pattern recognition methods for Open Road Tolling as its software side and the hardware side is supported with high end camera systems.

This paper presents Open Road Tolling (ORT) using number plate recognition as the main input module. The proposed Number Plate Recognition (NPR) techniques consist of two modules: histogram based number plate localization and number plate recognition using template matching. The number recognized by the detection system after required pre-processing is used for many functions such as toll collection, information system, notice module, security & police information system etc. These features are the main high lights of this paper.

II.   LITERATURE REVIEW
INTRODUCTION
A literature review is done for various papers which are essential to know the previously available techniques and their significance and limitations. It also includes the various supporting papers for the proposed technique and their advantages.

BACKGROUND WORK
Shan Du, Mahmoud Ibrahim, Mohamed Shehata ,and Wael Badawy, Proposed, Automatic license plate recognition (ALPR) is the extraction of vehicle license plate information from an image or a sequence of images. The extracted information can be used with or without a database in many applications, such as electronic payment systems (toll payment, parking fee payment), and freeway and arterial monitoring systems for traffic surveillance. The ALPR uses either a color, black and white, or infrared camera to take images. The quality of the acquired images is a major

factor in the success of the ALPR. ALPR as a real life application has to quickly and successfully process license plates under different environmental conditions, such as indoors, outdoors, day or night time. It should also be generalized to process license plates from different nations, provinces, or states.

These plates usually contain different colors, are written in different languages, and use different fonts; some plates may have a single color background and others have background images.

The license plates can be partially occluded by dirt, lighting, and towing accessories on the car. In this paper, we present a comprehensive review of the state-of-the-art techniques for ALPR. We categorize different ALPR techniques according to the features they used for each stage, and compare them in terms of pros, cons, recognition accuracy, and processing speed. Future forecasts of ALPR are given at the end.

Lekhana G.C, M.Tech; R.Srikantaswamy, Professor License plate recognition uses image processing and character recognition approaches to identify vehicles by automatically reading their license plates. In this work an intelligent real time On Line License Plate Recognition System which caters to the need for intelligent traffic management system, in order to cope up with constantly increasing traffic on today's roads has been developed. License plate recognition (LPR) algorithms in im-ages or videos are generally composed of four processing steps, namely, Image acquisition, License plate detection and extrac-tion, Character segmentation, is done through fusion of spectral analysis and connected component analysis, and Character rec-ognition is done using support vector machines.

Louka Dlagnekov , Department of Computer Science & Engineering UC San DiegoLa Jolla, CA 92093-0114 License Plate Recognition (LPR) is a fairly well explored problem with many successful solutions. Though most of these solutions are reasonably fast, there can be increased benefits to making them even faster, such as multiple recognition stages in video frames in a real-time video stream for improved accuracy. The goal of this project is to evaluate how well object detection methods used in text extraction and face detection apply to the problem of LPR. A strong classifier is trained by the AdaBoost algorithm and is used to classify parts of an image within a search window as either license plate or non-license plate.

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Proposed system
The system should be capable to recognize a license plate number . the recognition should be performed in almost the real time , watching the car passing at low speed in front of video recording device . License plate is recognized from video to identify the vehicle for the payment.
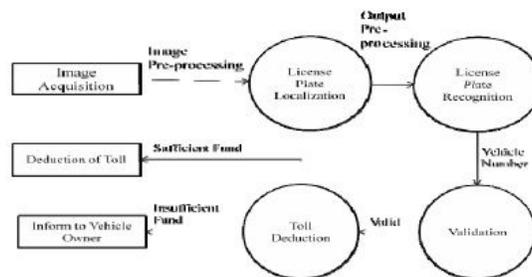

Figure 1. Proposed Frameeork for Open Road Tolling(ORT)

Figure 1 show shows proposed framework for ORT . open road tolling requires License plate number to collect toll. proposed system consist of four modules Image acquisition , License plate localization , License plate recognition and toll collection.

Image acquisition :

TO get good quality image infrared camera can be used as show in figure 2 to get image day time as well as in night or tolling tunnel can be used with proper lighting condition to avoid bad weather condition as shown in figure 3

Figure 3. License plate capturing in Tolling Tunnel (Image
courtesy of Google Images)

License Plate Localization:

Histogram based license plate algorithm is used to localize license plate as it is simple and faster.

License Plate Recognition:

Once License plate is localized license number is recognized by using template matching method . India license plate. Format (AA 11 BB 2222) in the given Table 1.

TABLE1. INDIAN LICENSE PLATE FORMAT

AA	11	BB	2222
State Code (two letters)	District Code (two numbers)	Optional if Last number 9999up(two Letters	Unique License Plate Number (four numbers)

These standard format and validation can be used in number plate recognition algorithm while checking numbers using template matching .If we match,, we decide weather we should consider it as letter are number according to their position in standard format .

Toll collection:

License plate re-registration

In our proposed system customer can register with the toll agency . They provide the number plate and jurisdiction , the category of vehicle , toll facility(s), and pay the toll using credit card or any online method . This can be done by cell phone. When th vehicle passes through the toll zone , the pre paid plate is identified , and no further processing is required

License plate Post-registration:

customer may register with toll agency after using the road way. An acceptable time interval or grace period for

payment is clearly stated . when the vehicle passes through the toll zone , the plate is identified and the transaction allocated for post billing.

subsequently the customer contact toll agency by telephone and internet . They provide the vehicle plate number , the vehicle category , the toll facility and pay the toll using a various payment mode. propose framework for license

plate detection is given in figure 4 which consist of two main module which are License plate localization and License plate recognition
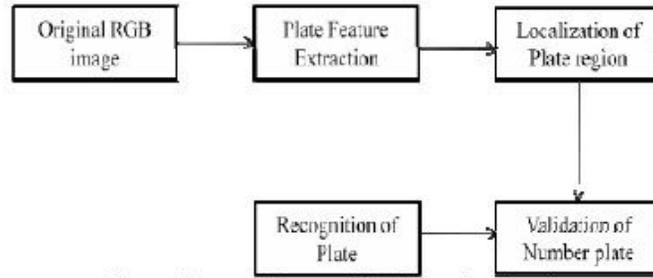

Figure4.ProposedframeworkforLicenseplatedetection

Design and implementation

License Plate Localization:

Proposed system uses histogram based license plate localization will be done as it is simple and faster for the image size more than 700x700 pixel. All the operations are performed on gray scale image to get faster result. Horizontal and vertical edge detection will be use for locating license plate. Figure shows steps used for License plate detection.
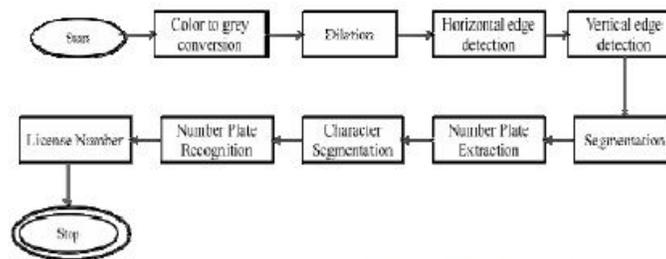

Figure 5. Proposed method for License Plate Detection

Color to Grey image conversion :

Proposed algorithm is independent of colors in image. It converts color image to grey image for further processing. Figure 6 is original image and Figure 7 is output image after grey image conversion.

Figure 6. Original Color Image   Figure 7. Grey Image

Dilation:

Number plate image may contain various shades and brightness. During RGB to grey conversion lighter edges, difference in colors, etc may get lost. Dilation helps to nullify these kinds of losses . figure 8 shows diluted image.

Figure 8. Dialated Image

Horizontal and vertical edge processing :

This step uses horizontal and vertical histogram which is column wise and row wise histogram. These histogram shows the sum of differences of gray values between connected pixels, row-wise and column-wise . In this step horizontal; histogram is calculated first . The algorithm traverses through each column. In each column, the algorithm starts from second pixel from top. Difference is calculated between second and first pixel. It checks with certain threshold if it exceeds the value it is added to the total sum of differences.

Then difference between third and second pixel is calculated. So on, it will over until end of column and calculates total sum of differences between between connected pixels. An array of column-wise sum is created at the end . Same process is used to find vertical histogram. In this process instead of processing columns, rows are processed.

Removing unwanted regions(segmentation)

Histogram is passed through low pass filter. A low pass histogram value indicates image contains les variation among

connected pixels. As the number plate contains plain background with letters and numbers in it the difference in connected pixels, edges of the letters and numbers is very high. Therefore number plate may have high horizontal and vertical histogram values. These areas can be removed out by using dynamic threshold. Figure 11 shows the output of segmentation and Figure 12 is final output of License plate localization step.

License Plate Recognition Segmentation:

1.Filter the noise level presents present in the image.

2.Clip the plate area in such a way that only numbers of plate area extracted.

3.Seperate each character from the plate.

Number identification

1.Create the template file from the stored template images.

2.Resize image obtained from segmentation to the size of template.(24*42)

3.Compare each character with the templates.

4.Store the best matched character.

Save to file in given format

1.Open a text file in write mode.

2.Store the character obtained from the number identification process to text file in given format.

Display License plate number

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Template used for character recognition
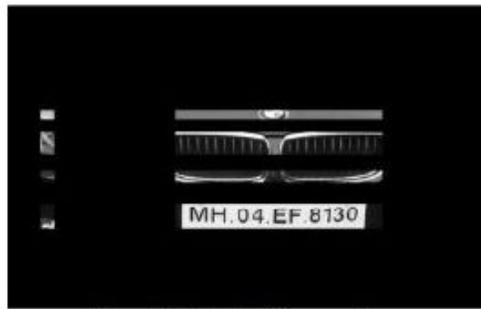
Figure11. Output of Segmentation

Figure12. Detected License Plate

Following template are used to recognize license plate number . 50 template of size 24*42 are used which are given below . Output of the character recognition is shown in figure. Distorted part present in the result is removed from the output and finally number extracted from image displayed .

Figure 13 Templates used for License Plate Recognition

Toll Collection

Proposed Open Road Tolling (ORT) is a toll collection method that takes a photo of a vehicles license plate as it travels through tolling location. It then recognizes number plate and collect toll accordingly.

III. RESULTS AND ANALYSIS

Running command in remote desktop :

The given output screen is the LX Terminal of raspberry pi that is viewed by using remote desktop connection. In the LX Terminal we can see the steps that are running once the program starts running. Initially sensor value will be low once the sensor goes to high value the camera which is interfaced with the raspberry pi will be activated.

This describes once an intrusion occurs the sensor will activate the camera. The camera will capture and store the image and the image is processed using image processing by localizing the number plate. Once the number is processed the cash is debited from the respected owner.

Image processing flow :

The captured image is send to image processing block . Initially the number plate from the vehicle is localization is taken place in order to get the ASCII character .Once the number plate is localization is been done then segmentation of character take place . In this segmentation we use two types of segmentation: 1. Horizontal segmentation 2. Vertical segmentation. First we have performed vertical segmentation on the number plate then the characters are vertically segmented. After performing vertical segmentation we have to perform horizontal segmentation by doing this we get character from the plate. Then we have to recognize the characters we should perform feature extraction which is the basic concept to recognize the character. The feature extraction is a process of transformation of data from a bitmap representation into a form of descriptors, which are more suitable for computers. The recognition of character should be invariant towards the user font type, or deformations caused by a skew. In addition, all instances of the same character should have a similar description. A description of the character is a vector of numeral values, so called descriptors or patterns.

Data base is stored in spread sheet:

Once the IR signal get breaks in receiver end , the camera capture's the image of the moving object and localize the number plate and number is processed . The vehicle number is checked with the data base present in the server and identifies the owner of the vehicle . After identifying the detail ,Raspberry pi board stores the detail of the owner in a live spread sheet in order to cross verify the detail if there is any issue .

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