

Research Paper

ONLINE REMUNERATION SYSTEM AT TOLL BOOTH AUTOMATION

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Day by day India's population is swarming and undoubtedly it is second highest population in the world. If population increases day by day automatically number of vehicles will be increased so much it is very much desperate to keep track of each vehicle for traffic management. Automatic number plate recognition is used to collecting toll amount without man power, and it allows following traffic rules. Online remuneration system at tollbooth automation is unique. Automatic number plate recognition algorithm does not detect the number plate if dust accumulated on it. This can be overcome by using online remuneration system at tollbooth automation. In existing system toll collection of vehicle is done manually till the completion of each vehicles transaction, rest of the vehicles have to wait this leads to a more traffic, wastage of time and its prone to human errors. The proposed paper suggests an automated way of high way toll collection based on the number plate of the vehicle when it passes through a toll collection booth. It detects vehicle number and compare with vehicular database. That determines the status of the vehicle and if vehicle is owned, it deducts the toll amount from the owners account and send message to the owners mobile. In case of theft, the particular block listed vehicle will not be allowed to pass through toll gate. A corresponding message will be sent to owner's mobile and highway patrol. A Copy of all this transaction stored in web server and distributed to all server. This information stored between host system and testing equipment for data transfer. This project enhances the performance of the system up to maximum extent possible with less efforts and use of computational resources.

Keywords: License plate, Canny edge detection, ANPR, Non maximal suppression, Morphological image, GSM

INTRODUCTION

Day by day India's population is swarming and undoubtedly it is second highest population in the world. Vehicular density increases along

with population. So it is very much desperate to keep track of each vehicle for traffic management. If vehicular density increases rapidly even though it is necessary to follow

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but it is difficult to achieve with large vehicular density. Hence in order to automate all these process enhanced version of system is required.

In existing system toll collection of vehicle is done by human beings. Till the completion of each vehicle transaction, rests of the vehicles have to wait. This leads to a more traffic, waste of time and it's prone to human errors. Many systems exist to avoid this problem in that automated number plate recognition is also one that is given below.

AUTOMATED NUMBER PLATE RECOGNITION

Many algorithms came for existing each algorithm having its own success and drawbacks. Automated number plate recognition is based on the optical character recognition software it is valid for less traffic management. If vehicular density is more there is chance of failure of the system. Currently usage of number of vehicles is increasing day by day using automated number plate recognition technique is very difficult to keep track of each vehicle.

Automated number plate recognition technique is quite difficult for tracking of vehicle when vehicles of having same color, body structure. If dust accumulated on the license plate then it's challenging work to extract license plate using automated license plate algorithm. This algorithm mainly used for speeding cars, less traffic zone, provides security system in registered areas. Due to all these conditions it is necessary to implement new technology in order to avoid all the problems happened in automated number plate recognition algorithm. This can be tracing

out in proposed system "online remuneration system at tollbooth In order to detect license plate number from the captured image it undergoes following steps:

1. Image acquisition
2. Pre-processing
3. Edge detection
4. Character segmentation
5. Character recognition and matching with database.

The proposed system is to deal with the problem in toll collection in highways. Manually or human intervention makes system very much prone to mistakes, inefficient and consumes more time. The proposed system suggests an automated way of highway toll collection based on the number plate of the vehicle. Input image or original image is captured from the high resolution camera. Input image is send to the system for plate detection. License plate detection consists of following steps. First is capturing image from camera. Captured image is input to the processing step. It filters out the input image and eliminates any noise present in the system. This process helps to remove the background noise as much as possible. And it saves the processing time as much as possible. If original image colored image then it converted in to white image it undergoes further process. Third step is to find edge detection canny edge detection algorithm is used. This algorithm is unique and efficient. The output of this process produces character and numbers. Using neural network technology segmentation of characters is done. Recognition of character and matching with database that produces license plate number of captured image. That consists of

software part. Pic18f13k50 microcontroller, LCD, GSM module and Sensor is connected to the system. With the help of microcontroller, when vehicle passes through toll both automatically amount is detected from owners account and corresponding message is sent to the owner's mobile by using GSM module. Security system is also provided. In case of theft, the particular blacklisted vehicle will not allow passing through tollbooth and it sends corresponding message to the owners mobile as well as police station. When vehicle passing through tollbooth its owner account having low balance then particular vehicle have to pay by cash method and pass the toll booth. Until completion of all these transaction remaining vehicle must be in queue. All these transaction is stored in web server and it helps to establish wireless network between host system and testing equipment for data transfer. Along with these feature one more additional character is Co2 percentage of each vehicle can be known by using MQ-7 sensor. This entire process user can receive a message by using GSM module. The contents of message will be as follows:

1. Vehicle Number.
2. Status of the vehicle.
3. Balance amount in prepaid card
4. Amount detected.

This paper overcomes the disadvantage existing in "Automatic Parking Lot and Theft Detection through Image processing" proposed by "Md.Towhid Chowdhury, Ebad Zahir" this paper consist of more advanced feature it helps the driver to save the time. This paper mainly works on Automotive Parking lot and theft detection. It provides the information

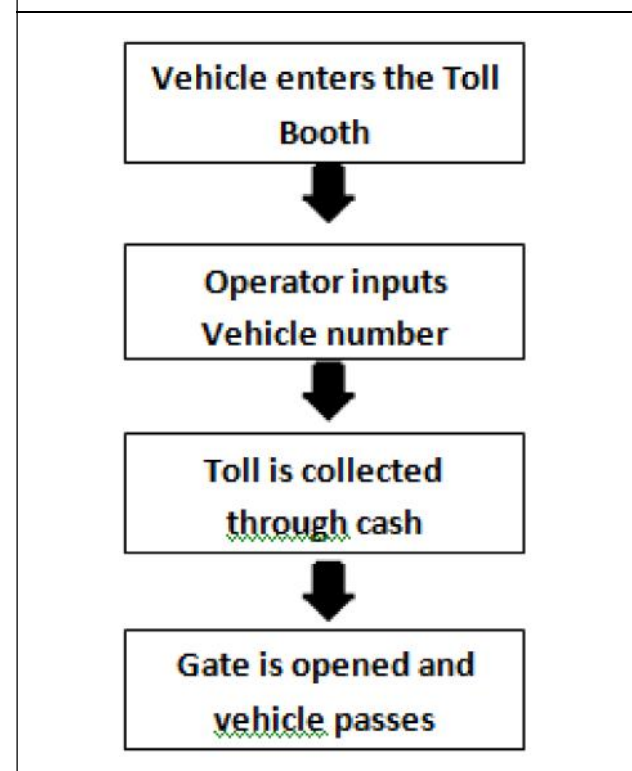
tom owner about parking car and also prevents theft of the car. This is completely based on image processing.

License plate of the vehicle detected automatically by using MAT LAB software.

EXISTING SYSTEM

At present, toll payment in India is manual and drivers are using pay by cash method to cross the toll booth. The flowchart for existing system is shown above.

Figure 1: Flowchart for Existing System



The disadvantages of the existing system are as follows:

- It is time consuming and drivers have to wait for long time for crossing the booth.
- Fuel of the vehicles is unnecessarily consumed.
- This process is leads to human mistakes.

Figure 2: Toll Collection Centre in India



PROPOSED SYSTEM

It performs following steps

Image Acquisition

Refers to the original image that is acquired from a high resolution camera. The image shown below is the input image we have used in our project.

Figure 3: Flowchart for Existing System



Pre-processing

It is process used to eliminate noise present in the image and find the location of number plate. It mainly consists of the filter which removes the unwanted information present in the image. By doing this it is very easy to find out the position of number plate. So that it helps to save the time in further processing steps. All these process can be easily done by using simple mat lab functions.

This algorithm does not depend on the color images. Color image is combination of different colors. Suppose color image is fed as input image pre-processing algorithm does not exist. It works only gray scale image. Gray scale image consist only white color image. So that it converts colored image in to a gray scale image. In pre-processing step itself half of the works done. Result of pre-processing is proceed for further processing steps.

The pre-processed image is shown below:

Figure 4: Gray Scale Image



Edge Detection

The algorithm is used to find edges of an object in the image. Edges mainly occur at the boundaries. Advantages of finding edges at the boundaries result reduction in quantity of data and eliminating useless information or noise. So we get very less data when compared with previous one. The output of this process is used for further process. John canny invented this process in 1986.

This process mainly converts gray scale image to binary image. It mainly works on binary images. It removes the background noise and detects the edges with the help of gradients. This process is very unique and results accurate results. Canny algorithm is

unique process. It is having many advantages over other algorithms discussed. This algorithm gives efficient results in our project.

Advantages of canny edge detection algorithm:

- The availability of detecting real edge point is maximum and detecting of imaginary edge point is minimum. Hence it is having strong detection capability.
- It produces limited and accurate responses.
- It filters out the noise present in the image.
- Output of this process results reduce in data.
- Detected edges are very similar to the real edges.

The process of shaping and enhancing the edges of an image is called Edge detection. In this process canny edge detection algorithm is used. Algorithm runs in following steps.

Smoothing: Smoothing is the process to filter out any noise in the input image before finding the edges.

Finding Gradients: Removing the noise from the image then switch to the determine the edge strength by considering the gradients of the image. For estimating gradients along x-direction and y-direction is as follows.

$$|G| = |Gx| + |Gy|$$

Finding Edge Direction: After finding the gradients then it is easy to detect edge direction by using formula.

$$THETA = \tan(Gy/Gx)$$

Nonmaximalsuppression: Once detecting the edge direction it trace along the edge that results successive zeros and ones zeros

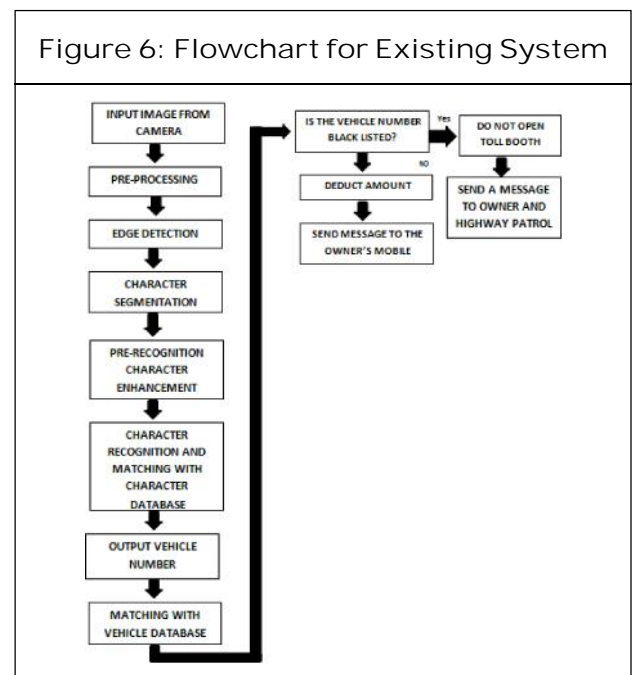
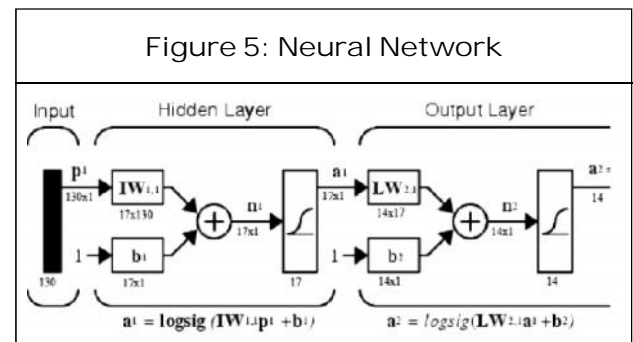
considered as not an edge then suppress those pixel value that results non maximal suppression.

Character Segmentation

Character segmentation is done from scanning method. Rectifying process is done from one side to another side. During scanning it removes black color background and reflects only the characters and letters. Resizing is done that results segmented character.

Character Recognition and Matching with Database

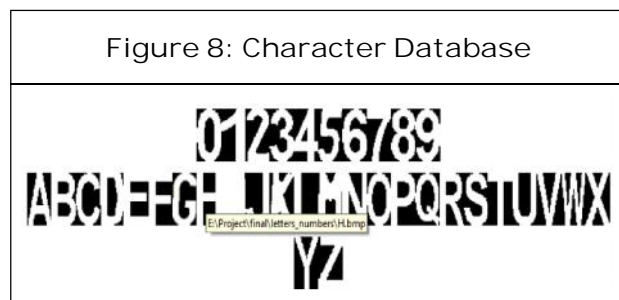
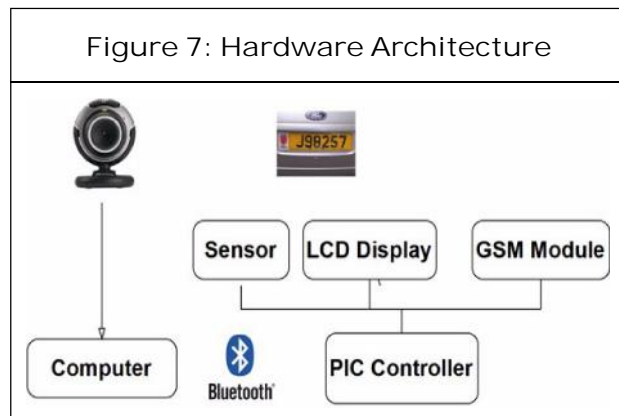
In character recognition size of an image is modified to 42*24 pixels. All numbers assigned



from zero to nine and all letters from A to Z it is assigned from 10 to 35 that of database. The entered number gives related number or character that results license plate number.

HARDWARE ARCHITECTURE

As shown below hardware architecture of proposed system. Initially image is capture from high resolution camera that image is send to the computer. Hardware connection is made in such way that it is integrated with sensor, LCD display, GSM Module and PIC controller. These two parts can be interconnected through Bluetooth wireless connection ,when image is received in computer pic controller (18F13k50) detect the license plate and find the status of the vehicle, Balance amount in prepared card, Amount detected of that particular vehicle and display all information on LCD display, also send a message to the owners mobile using GSM module. This consists of hardware architecture.



RESULTS

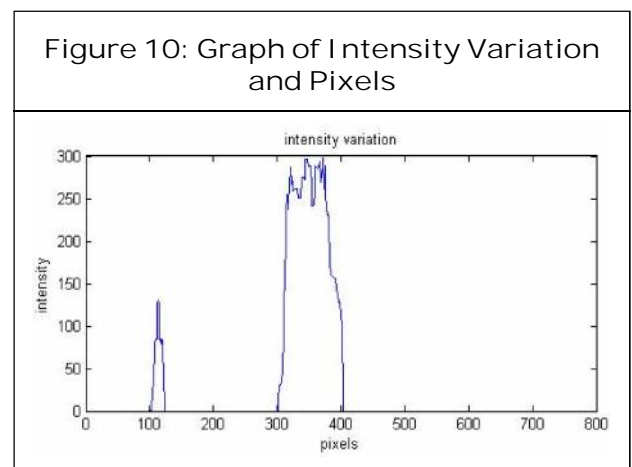
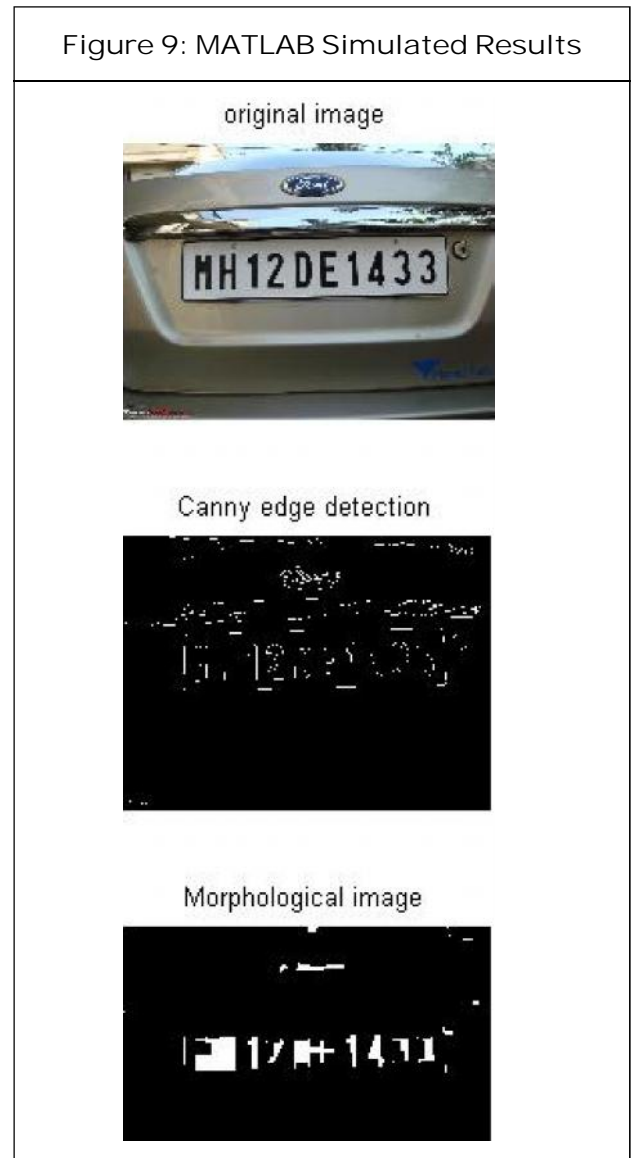


Figure 11: Output of Canny Edge Detection

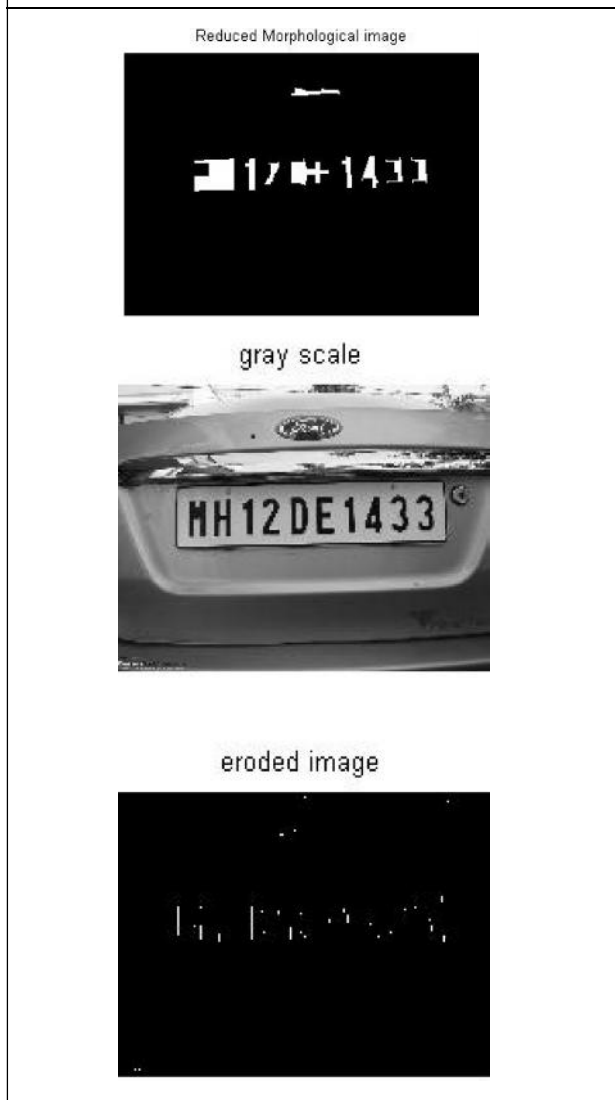
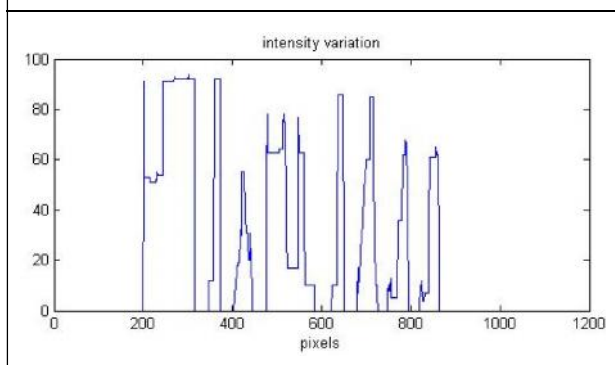


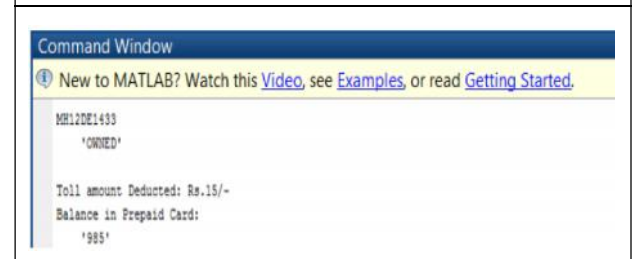
Figure 12: Graph of Intensity Variation and Pixels with Different Dimensions



MATLAB Simulation Result

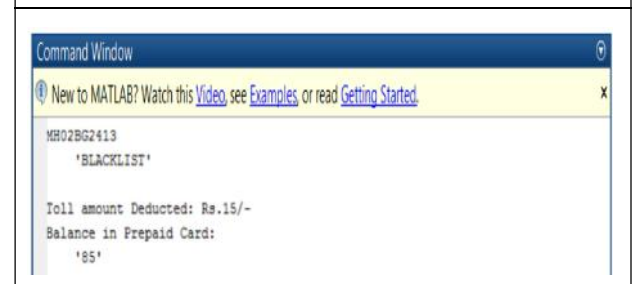
The above image, output of image processing which is carried out using MATLAB. In this image the vehicle is blacklisted, toll amount collected, and balance amount in the owner’s prepaid card is shown. In this case a message will be sent simultaneously to both Highway patrol and the owner of the respective vehicle.

Figure 13: MATLAB Output for Owned Vehicle Number



The above image, output of image processing which is carried out using Mat lab. In this image the vehicle is owned, Toll amount collected, and balance amount in the owners prepaid card is shown. In this case a message will be sent only to the owner of the vehicle.

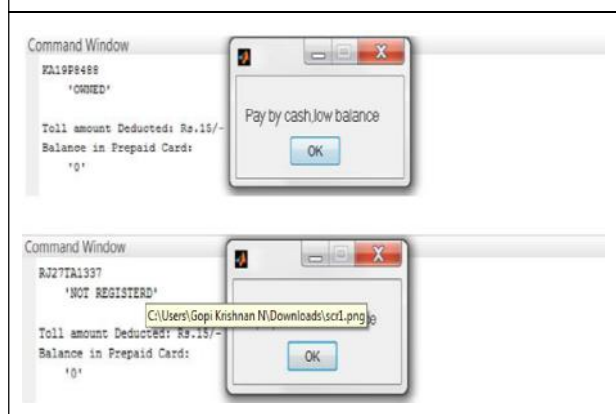
Figure 14: MATLAB Output for Blacklisted Vehicle Number



In the above image there are two cases:

- In the first case the vehicle is owned but due to insufficient balance in the prepaid card it has been overridden to pay by cash method.
- In the second case the vehicle is owned built its not registered for a prepaid card

Figure 15: MATLAB Output for Owned Vehicle But Low Balance and Not Registered Scenarios



therefore the system is overridden to pay by cash method.

In all the above mentioned cases, the status of the vehicle, the balance amount in the prepaid card and the vehicle owner's number is found out by comparing the vehicle number with a database.

CONCLUSION

This project focuses on the processing of the vehicle image acquired from the camera and extracting the region of interest from which the final number, in alpha numeric form, is obtained. This number is compared with data base and toll is deducted from the prepaid card account. A corresponding message is sent to the mobile of owner.

In case of theft, the vehicle number would be block listed and if the respective vehicle approaches toll collection booth it can be found out and the vehicle can be withheld. With this we have added security feature to our system. This method is efficient if the vehicle number plates are standardized and also subjected proper lighting. This method is cost effective and can be integrated with the existing system

in India without much change. This method also reduces the waiting time and hence avoids long queues of vehicles piled up at the toll collection centre hence we have proposed a technique to enhance the toll collection system with limited resources.

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*International Journal of Innovative
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