Instinctive Traffic and Toll Plaza Management with Computer Vision and Image Processing using MATLAB

K.Rajalashmi[1], R.Aravind Chalapathy[2], B.Rokithvijay[3], P.Sathish Kumar[4]
Electrical and Electronics Engineering, Bannari Amman Institute of Technology, Sathyamangalam, India
[1]rajalashmik@bitsathy.ac.in
Corresponding author email: rajalashmik@bitsathy.ac.in

Abstract— In the present competitive world, people don't have time to ride their bike, drive their car carefully by following appropriate traffic rules and discipline to avoid any casualty. Everyone is in a hurry to reach their destination prior to what they expect, so the issues commence from there. This leads to many traffic problems, rules violation and create cumbersome among the public. On the other hand, even though there are many innovations emerging in this current world, time gets spoiled due to the toll plaza, where it hardly takes any minutes or sometimes it even takes a whole day to pass through. These regular issues are happening due to the manual process that being held. In this project, an image processing and compute vision is introduced, so that if any individual violate the traffic rules (rough driving, over speed, not in a proper lane, not keeping left of the road, one way, tripling on bike, no helmet, fastening the seat belt etc…) a PDF is generated and either mail to the respective individual or sent post, so that he/she should aid the penalty rely upon the negotiation within one month. Equivalently, in Toll Plaza a smart card encrypted with image processing will be given to each individual which is accessible in a certain particular locality. It decodes the registration number, it has to be linked with the Aadhaar card, so that by using this smart card the individual can either pay with the payment card (credit, debit card) or can recharge the smart card and paid accordingly. A bill is sent to the respective individual by means of either one way, two way billing method or manually. This is automatically processed and henceforth saves the time.

Keywords— Traffic rules; violations; Image processing; smart card; Aadhaar card; Toll plaza; payment card.

I. Introduction

The Important cause of pollution is slow moving traffic due to pedestrians crossing the road just about anywhere. Noise pollution comes mainly from motorcycle and automobile traffic. There are many other cities who also suffer from the same issue. Traffic in such populated cities causes many complications to the public. Since it is busy world, people are in a hurry to their workplace to reach on time, everyone is engaged with their own priorities. So this results in unnecessary traffic jams, casualties, violating the rules. These issues not only disturb physically, but also affects mentally by stress, tension, blood pressure, tiredness, depression and frustration, etc [1].

Government has taken action against this ruthless behavior of the public which results in high number accidents, health issues in the upcoming generation. This need to be considered so important, by implementing certain decrees. Implementation of these traffic laws can bring down the road accidents considerable. These laws are compulsory by dealing out Challans in the name of the lawbreakers, which will motivate them to internalize the law. Penalty payment and legal hassles are always effective punishments. So rely upon the negotiations the penalty is demanded. The traffic violations are prioritized and the penalty is claimed accordingly.

Major offenses in traffic rules includes Driving by a minor (aged below 18), Letting an unlicensed fellow to drive, Driving bikes/ two wheelers without wearing a helmet, Driving without fastening the seat belts, Negligent Driving, Hazardous or hasty (over the speed limit) driving, Not driving in the proper lane, Driving in the center and not keeping to left side of the road, Driving against One Way, Tripling on bikes and Stopping at pedestrian from crossing or crossing a Stop Line (Zebra Cross). These offenses should be punished allegedly. But it is a tedious process to monitor all these violations manually by the traffic policemen [2].

India is not only busy country and over populated or polluted country, in spite of all this; it is one of the developing countries with advanced technology and innovations. So to reduce the cumbersome of the traffic policemen to look after the offensive issues, it can be technologies by using emerging automation like image processing and compute vision. This automation helps in suspecting the offending individual and it will automatically generate a PDF and either sent through a mail or by post. The respective individual should pay the sentence within one month.

On the other hand another major complication faced by the public people is passing through the toll plaza. A toll road, also known as a turnpike or toll way, is a public or private road for which a fee is assessed for passage.

There are many toll plazas presents in India which is used to permit the people across ever parts of the country ensure the eligibility to pass through their outer habitat. It is a form of road pricing typically implemented to help recoup the cost of road construction and maintenance. This toll plaza causes cumbersome to the public as they need to curb their vehicles

for a while to make the entry and provide entry pass. Sometimes during occasions, if the actual count of the vehicles exceeds to pass through it causes traffic jam, the crowd, some nuisance to the public which make them feel annoyed. Since people are crossing the toll plaza on a regular basis for many purposes, mainly job, trade and others; it is very difficult for these peoples to cross the toll plaza every day [3]. This provokes various problems and even results in a job call off, trade poor transportations etc.

To reduce these issues for the welfare of the people, this image processing and compute vision is very much useful and hence it compete this dispute. This is not possible manually as it is a very tedious process for man power and hence it is fully automated.

2. The Billing System
2.1 The method used to pay bills at toll plazas

People whosoever passing through the toll way regularly can be provided with a smart card which is encrypted with image processing and linked with the individual's Aadhaar card. The smart card can also be recharged regularly like paytm, Google pay application's wallet or the smart card can be synchronized with the payment card (credit card, debit card). Whenever you were about to cross the toll way, you just need to show the card to the machine, it automatically senses and authenticate the registration number of the vehicle and check whether the smart card is recharged or it automatically retrieve the sufficient amount from the payment card and send the bill respectively. There are three ways of billing system, namely one way billing method, two way billing method and manual billing method.

2.2 Documents and bill generation system

The respective bill will be sent to their mail address as a PDF. This is automatically processed and henceforth saves the time. Since technology is attaining the next level of generation in all aspects, using this automation (image processing, compute vision), can reduce the cumbersome faced by the innocent public [4]. By using this technology, not a single individual could move forward against the law and disobey. This decreases many accidents, incidents, troublesome, etc. It leads a peaceful and harmonious life in the society. Similarly, people need not wait for so long to cross a single toll way, the public can move simultaneously as it ensures that the image processing will process the images rapidly and access soon which reflects a comfort zone and tireless environment. So in this project, we apply the innovative technology – image processing to traffic rules and toll plaza and results in better outcomes.

3. Block diagram

The block diagram explains the overall process of this invention, it comprises of the main system consists of MATLAB, Computer Vision, Servers, etc., It mainly operates for two systems, Traffic violation system and Toll plaza. First system deals with all kinds of traffic violations that will lead to accidents and other illegal activities. The system identifies all kinds of negotiations and violations. This automatically generates a PDF for every month for each and every vehicle owner if they did any such kind of violations, then the penalty will be charged according to that.
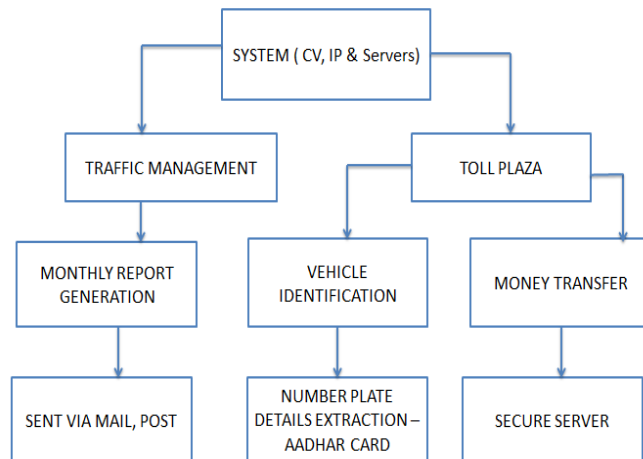

Figure 1. Block Diagram for the proposed system

The next system deals with Toll plaza, during peak hours and festival seasons the traffic at toll plazas will be more so this system automatically charges money without causing any kind of traffic.

3.1 Image processing system

The below image describes about the procedure of image processing for the traffic rules violation and Automated toll plaza system. The input image is directly taken from the image processing camera for the character Recognition that helps to process the image to detect the number plate [5]. Preprocessing helps to enhance the image for further process this leads to feature Extraction. The normal image is converted to grayscale image after proper enhancement for the edge detection to extract the characters from the image. The classification and decision take place for accurate access of data from the extracted image that then generates reports. Post processing work leads to auto correction and error detection for high accuracy in results [6].
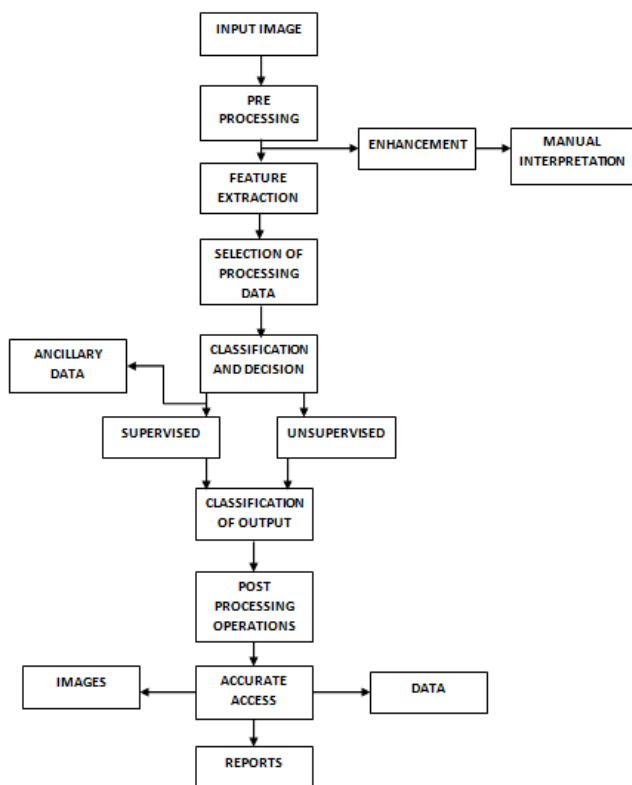
Figure 2. Flowchart for Image processing
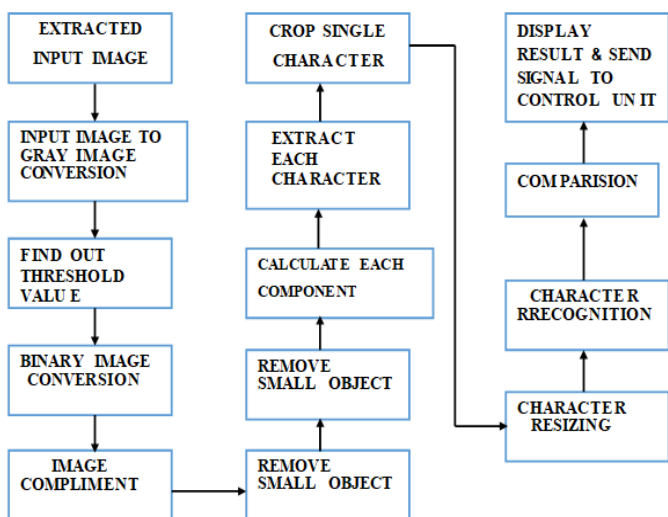
3.2 Procedure for Number Plate Identification

Figure 3. Number Plate recognition system

The above image describes the procedure for number plate detail extraction from the image captured. The extracted input image is processed for grayscale image for edge detection and to enhance the image. The threshold value of the image will be identified after the grayscale conversion for binary value conversion. The small undetectable and waste objects from the image will be removed in the further

process. The size and shape of each and every object will be calculated and measured, after this will be done before character recognition. The actual process of comparison process the extraction of each character will be done. Single character will be cropped and extracted at a time, resizing of images for image extraction and character identification will be processed. Then the result will be sent as a signal to control unit.

3.3 Over view of Exsisting system

For the detection of moving vehicles, high-performance fiber optic sensors are used. A typical installation is an interface device with a transmitter (LED), receiver (photo detector), light guide cable (feeder) and fiber optic sensor. As the vehicle passes through the sensors, the signal levels obtained from the sensors change [7]. The output signals from the fiber optic sensors are transmitted to a signal processing and data evaluation unit consisting of an algorithm, which calculates the axle count, the axle spacing, the length of the vehicle and the vehicle classes based on the time, distance formula and the amount of micro is bending.

An IR curtain is essentially an infrared transmitter and receiver. These curtains provide the vehicle with a clear profile as it passes through it. However, due to the varying speed of the vehicle passing the gate, the whole profile of the vehicle cannot be obtained by using only one strip of IR curtain. It is therefore important to know the vehicle's speed. We calculate the vehicle's speed using the distance between the curtains and the time. We can determine the correct vehicle profile with the speed of the known vehicle and the frequency of the known pulses [8].

4. Algorithm

This image deals with the Algorithm of this invention. The Input image will be taken from the Camera, the two reference points $\Delta A1$, $\Delta R1$ taken for the comparison. The actual data $\Delta A1$, the reference data or stored data for reference $\Delta R1$ used for Number plate comparison. $\Delta A2$, $\Delta R2$ also the actual and reference data's which is used for Traffic Violations.

Condition 1, $\Delta A1 == \Delta R1$: Whenever the condition is true, then the image will be processed under image processing for the number plate identification and character recognition, after this the data will be matched precisely with the reference data for detail extraction. The details will be used for money detection at toll plaza's. The money will be detected after matching the number plate details with the Aadhaar card details during pre fetch.
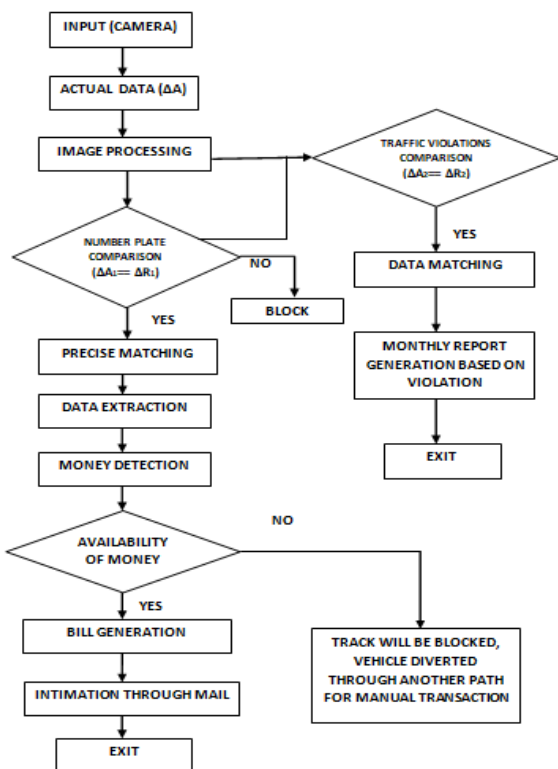
Figure 4. Algorithm for the proposed system

Then the next condition called Availability of money will be checked, if true, then the money will be detected from their account or with a toll recharge card. If the condition goes false, the gate will be automatically locked. The vehicle is then diverted to another path where the manual transaction takes place. The bill will be sent through mail or post based on user convenience.

Condition 2, $\Delta A1 \neq \Delta R1$: If the condition goes false, then the gate will be automatically blocked and diverted in another path.

Condition 3, $\Delta A2 == \Delta R2$: This condition states about the traffic violations such as (rough driving, over speed, not in a proper lane, not keeping left of the road, one way, tripling on the bike, no helmet, fastening the seat belt, etc.,) Data matching will be processed for number plate identification, then based on the violations, monthly report will be generated and the penalty will be detected. It will be sent through mail and post based on their convenience.

Condition 3, $\Delta A2 \neq \Delta R2$: If the condition goes false, then the user follows all the traffic rules properly then the condition terminates.

5. Result

The MATLAB simulation which is performed to identify the number plate accurately without any flaws over the recognition. The execution time for the overall process is 43 seconds for a single vehicle but parallel operation is possible for many number of vehicles. The output for the overall execution is given below
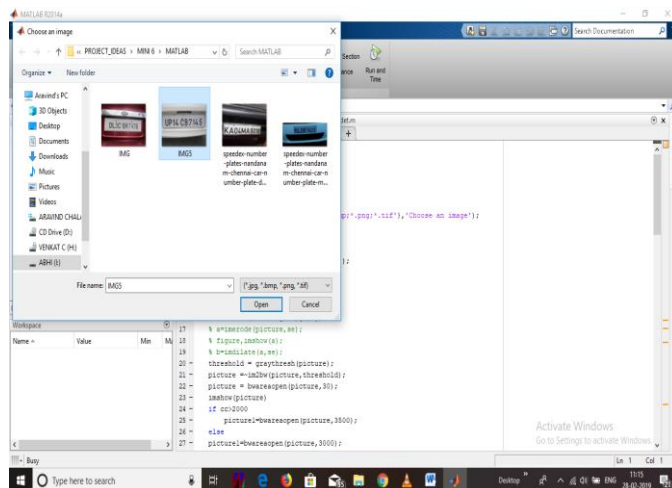

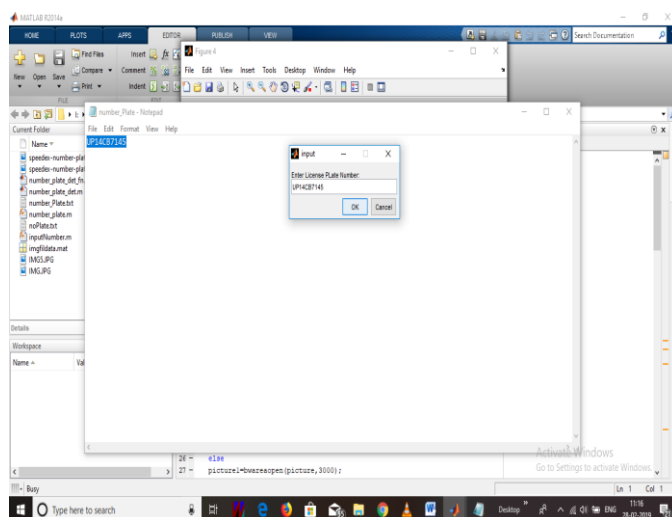Figure 5. Image Input for the Image Processing

Figure 6. Prompt Display for Plate Number Verification

Both the images describes about the input image extraction and prompt display for getting the input from the user. The image will be selected or directly injected from the camera for image processing to identify the number plate, then the prompt display will help the user for manual identification for the driver or owner's details. The automatic process is allowed to process all the vehicles passing through the toll plaza or under the traffic signals all over the city.
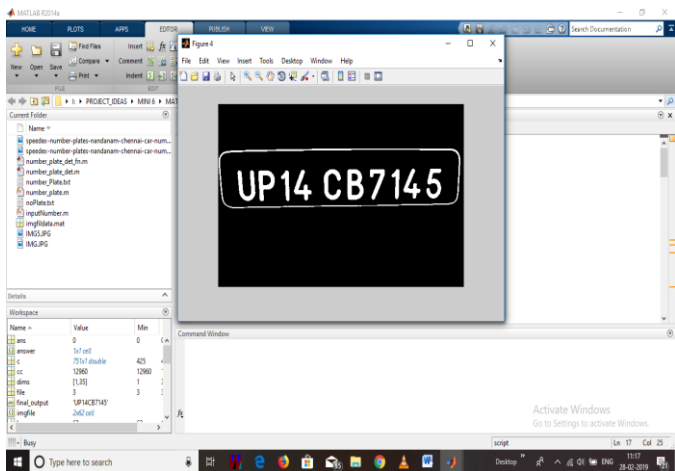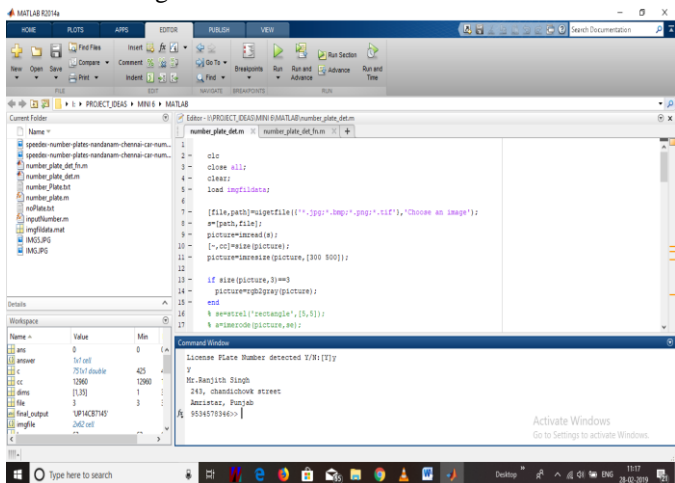
Figure 7. Number Plate Identification

Figure 8. display of address and other required details

The final two images explains about the image processing for character recognition and to match the details which was already preloaded and given as a reference, the final image shows the output of the project, which provides the output for the user tried to fetch the details of the driver or about the owner manually.

6. Conclusion

An application software was designed in this system to detect the vehicle number plate using its number plate. The plate location is first extracted using morphological operation and the plate characters are separated by segmentation individually. Finally, the matching of the template is applied to the use of correlation for plate character recognition. The edge detection and minor object removal will be done for precise character identification. The project instinctive traffic and toll plaza management with computer vision and image processing using matlab will reduce the waiting time of passengers, fuel aconomy, pollution level and traffic violations all over the city,

importantly it reduces the man power required to monitor all these things.

Some of the problems:

- The number plate is broken.

- Images of blurry.

- The number plate does not correspond to the legal

- specification.

- Low character resolution.

- Poor vehicle platform maintenance. Similarity between

- some characters, O and D, 5 and S, 8 and B, E, O and 0, etc.

SUB COMPONENTS	ACCURACY	PERCENTAGE
EXTRACTION OF PLATE REGION	87/90	96%
CHARACTER RECOGNITION	84/90	93%

TABLE 2: TEST RESULT OF EXECUTION TIME

IMAGE QUALITY	AVERAGE EXECUTION TIME
480 X 640	45 SECONDS

Table 2. Process Time

Reference

[1]. J. A. Mayan, K. A. Deep, M. Kumar, L. Alvin and S. P. Reddy, "Number plate recognition using template comparison for various fonts in MATLAB," 2016 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC), Chennai, 2016, pp. 1-6. doi:10.1109/ICCIC.2016.7919542

[2]. P. Kulkarni, A. Khatri, P. Banga and K. Shah, "Automatic Number Plate Recognition (ANPR) system for Indian conditions," 2009 19th International Conference Radioelektronika, Bratislava, 2009, pp. 111-114. doi: 10.1109/RADIOELEK.2009.5158763

[3]. A. Beibut, K. Magzhan and K. Chingiz, "Effective algorithms and methods for automatic number plate recognition," 2014 IEEE 8th International Conference on Application of Information and Communication Technologies (AICT), Astana, 2014, pp. 1-4. doi: 10.1109/ICAICT.2014.7035951

[4]. B. Pechiammal and J. A. Renjith, "An efficient approach for automatic license plate recognition system," 2017 Third International Conference on Science Technology Engineering & Management (ICONSTEM), Chennai, 2017, pp. 121-129.

[5]. M. T. Qadri and M. Asif, "Automatic Number Plate Recognition System for Vehicle Identification Using Optical Character Recognition," 2009 International Conference on Education Technology and Computer, Singapore, 2009, pp. 335-338.

[6]. R. Islam, K. F. Sharif and S. Biswas, "Automatic vehicle number plate recognition using structured elements," 2015 IEEE Conference on Systems, Process and Control (ICSPC), Bandar Sunway, 2015, pp. 44-48.

[7]. R. Shreyas, B. V. P. Kumar, H. B. Adithya, B. Padmaja and M. P. Sunil, "Dynamic traffic rule violation monitoring system using automatic number plate recognition with SMS feedback," 2017 2nd International Conference on Telecommunication and Networks (TEL-NET), Noida, 2017, pp. 1-5.

[8]. A. Visvanathan and T. Chattopadhyay, "Car number plate recognition for smart building management," 2014 19th International Conference on Digital Signal Processing, Hong Kong, 2014, pp. 73-77.