



Image Processing Based Automatic Toll Booth in Indian Conditions

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Abstract: In this research paper we examine the image and the respective information will be processing based toll collection system and how to make more efficient and perfect. On any toll both the vehicle has to stop for paying the toll. We are trying to develop a system that would pay the toll automatically and reduce the queue at the toll booth. In this system camera is used for capturing the image of the vehicle number plate. The captured image would be converted into the text using ANPR and the toll would be cut from the customer's account and then open the gate. Moreover in our system if a vehicle is stolen and an entry is being made in the central database by the police then if the vehicle passes through the toll both then silent alarm would buzz which would indicate the operator at the toll booth that the vehicle is a stolen vehicle. For the identification of the vehicles, the information of the vehicles is already stored on the central database. So captured number will be sent to the server received at the toll.

Keywords: OCR, ANPR, IPTB, One Time Password, Notification.

I. INTRODUCTION

The purpose of this paper is collecting the toll according to vehicles and builds the real time application which recognizes vehicles licenses number plate at entry gate. Automatic toll collection is considered as one of the intelligent transport systems. It is aimed at making toll taxation more efficient, reliable, and safe and environment friendly. In the past, customer would have to wait at the toll booth to pay the collector, creating traffic congestion, pollution and of course of a lot of frustration. Today Automatic toll collection successfully removes unnecessary traffic delays; keep an eye on any car that might not be correctly registered. Automated toll collection is fast becoming a globally accepted of toll collection.

IPTB system is used as a system for fast and efficient collection of toll at the toll plazas. This is possible as the vehicles passing through the toll plaza do not need to stop to pay toll and the payment automatically takes place from the account of the user.

This automatic system used the technology of ANPR. Hence this system works very fast with the best results. This new toll system depends on four components.

- AVI (automatic vehicle identification): Automatic vehicle identification systems are used for the purpose of effective control. License plate recognition (LPR) is a form of automatic vehicle identification. It is an image processing technology used to identify vehicles

by only their license plates. Real time LPR plays a major role in automatic monitoring of traffic rules and maintaining law enforcement on public roads. Since every vehicle carries a unique license plate, no external cards, tags or transmitters are required.

- AVC (Automatic Vehicle Classification): In IPAT (image processing automatic toll) system, AVC automatically verifies the classifications of vehicles. Because the vehicle is already classified at the time of registration.
- Traffic Controller System: Traffic controller system is a computer system which manages the traffic in a single row or line by using Traffic signals and sensors.
- Central Server: For more security and maintain records of each toll and customers Central server is required. A central server stores the data which comes from different toll plaza. A local computer of every toll plaza is connected to a central server through Internet. The consumer / owner has to register in a central server and deposit money in their account. AVI and AVC totally depend on the vehicle license number plate.

The benefits for the motorists include:

1. Less or shorter queues at toll plazas by increasing toll booth service Turnaround rates.
2. Faster and more efficient service (no exchanging toll fees by hand);
3. The ability to make payments by keeping a balance on the register account.



4. The use of prepaid toll statements (no need to request for receipts)

Other general advantages for the motorists include fuel savings and reduced mobile emissions by reducing or eliminating deceleration, waiting time, and acceleration. Meanwhile, for the toll operators, the benefits include:

1. Lowered toll collection costs.
2. Better audit control by centralizing user accounts.
3. Expand capacity without building more infrastructures.

II. SYSTEM DESIGN

A. System Architecture-

The process starts when a sensor detects the presence of a vehicle and signals the system camera to record an image of the passing vehicle.

The image is passed on to a computer where software running, on the computer extracts the license plate number from the image. LPN (License plate number) can then be verified in a central database. If number valid for this system then LPN recorded in a database with other information such as vehicle number, time, balance, personal details. License plate numbers can also be further processed and be used to control other systems such as raising a gate. These toll systems are generally composed of four main components:

- Sensor used for vehicle detection
- LPR Camera for capturing images.
- Computer with TOLL and Image processing software
- Gate controlled system.

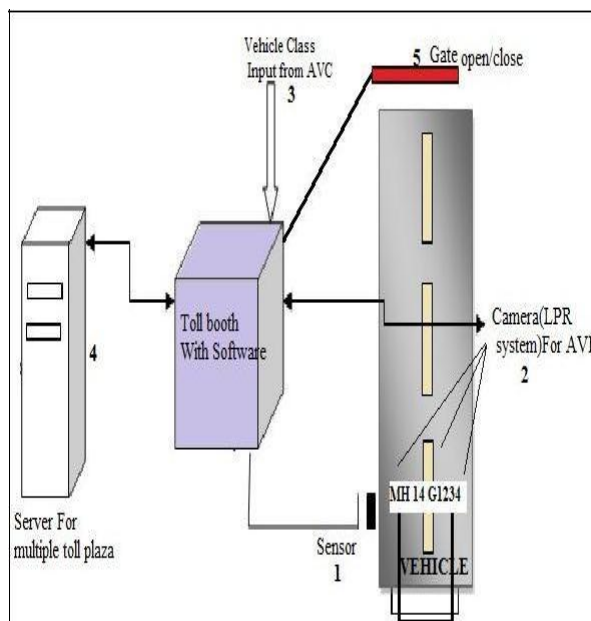


Fig. 1 System Design

III. WORKING

The algorithm proposed in designed to recognize license plates of vehicles automatically. Input of the system is the image of a vehicle captured by a camera. The captured image taken from 4-5 meters away is processed through the license plate extractor with giving its output to segmentation part. The segmentation part separates the characters individually.

And finally recognition part recognizes the characters giving the result as the plate number. For better performance of image to text conversion high resolution camera is required.

High resolution Camera: captures the license plates flawlessly in any weather condition and up to speeds of 120 mph shows in fig 3.

AA 11 BB 1111

Where AA is the two letter state code; 11 is the two digit district code; 1111 is the unique license plate number and BB are the optional alphabets if the 9999 numbers are used up [1]. Using Validation and assumptions in string checking improves the accuracy of template matching. For example vehicle number is "OR 11 XX 1111". If O matches with 0 (zero) but in predefined format first two field fixed for the character. Hence zero replace by O, similarly for B and 8, **2 and Z**.

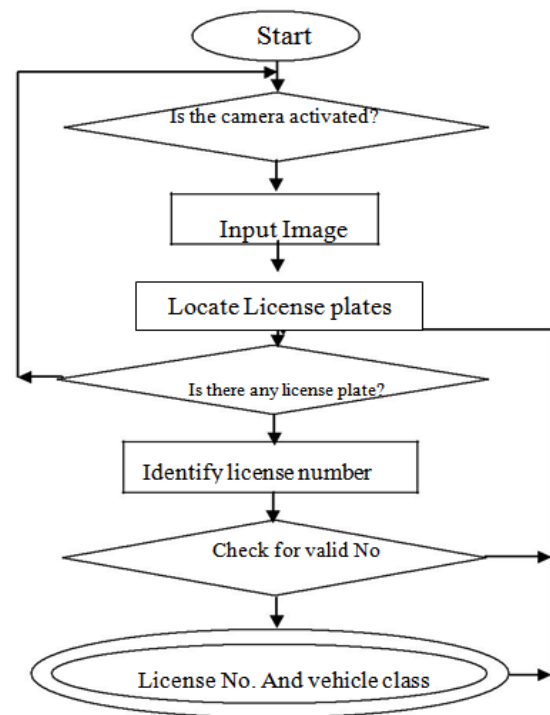


Fig. 2 ANPR Flow



Fig. 3 High resolution camera

IV. SOFTWARE AND SECURITY

A. Login with OTP (one time password) security:

In proposed system as toll operator point of view provide OTP system. OTP is a password that is valid for only one login session. OTP generation algorithms typically make use of randomness. Any toll workers knows ID and password but when enter the private details for login then generate OTP and send to the toll operator register mobile and then login with OTP, ID and password. If all the details match then operator can login to the toll system.

B. Toll operating software:

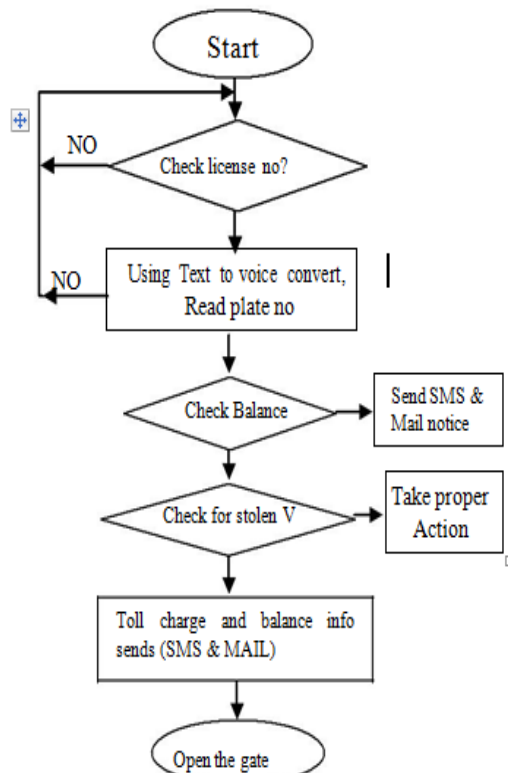


Fig 4: Flow of Main Toll Operating software

When vehicle enter in the toll plaza then toll software automatically start. Shows in fig 4 in these applications firstly get vehicle licence plate number. Then check if number is valid for these system then using TTV(text to voice) read number in a speaker for driver confirmation. Also check the balance in customer account and same time check licence number in stolen vehicle database

C. Improved Database system and Other Facilities:

In this research, Database plays a very important role. Database of new toll system is divided into mainly three parts:

1. Database Admin
2. Centralized database
3. Integrated database.

The central database is the heart of the whole database system. Figure.5 shows the entire database view of the new toll system. Firstly admin database contains details of central database administrator and also the details of all toll booths under Construction Company. Centralized database consist record of all tollbooths under that specific construction company. This central database will be managed by a central administrator. The customer has to be registered for this account to use this system. This account information is stored along with the RTO database. When the registered customer will pass through the specified toll booths them automatically toll-charge will deducted from customer's account. And Central database will update with this information at a same time. After charge applied to the vehicle, the customer will receive the information through sms on his mobile using GSM modem. The customer can see all his monthly or yearly transactions on his email account.

Integrated database connected to the central database of the system. Integrated database consist of Police database and RTO database. Police database contains all stolen vehicle records with their FIR number. This database will update automatically. RTO database includes all registered vehicles with details like vehicle owner, vehicle number, licence number, account ID, account balance, current charges, etc. Get vehicle information from RTO at customer account registration time and when vehicles number plate is captured then that number will match with customer database and police database. If the number plate is valid and no stolen vehicle record is found then automatically charges deducted from customers account and notify him through sms. All these records are maintained at corresponding toll-booth and central database of toll construction Company. These records can be seen by account ID, Customers name or number of the vehicle. All toll-booths records stored at central server and these records could be seen and printed by day, date, month, and year.

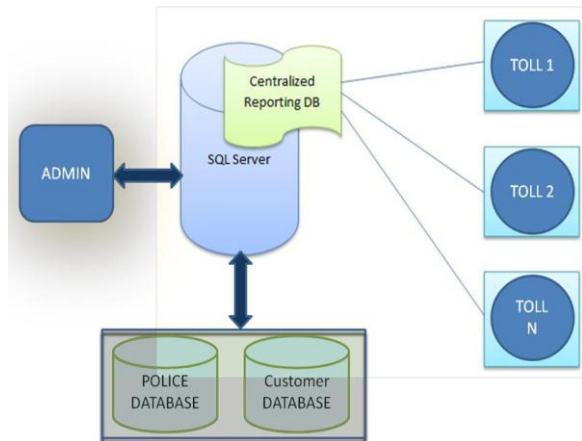


Fig 5- Database view with multiple tolls

Following are the snapshots of designed screens:

1. Login with central server or different tollbooths:



Fig 6: Login Window

2. Main Automatic and Semi automatic toll operating form:

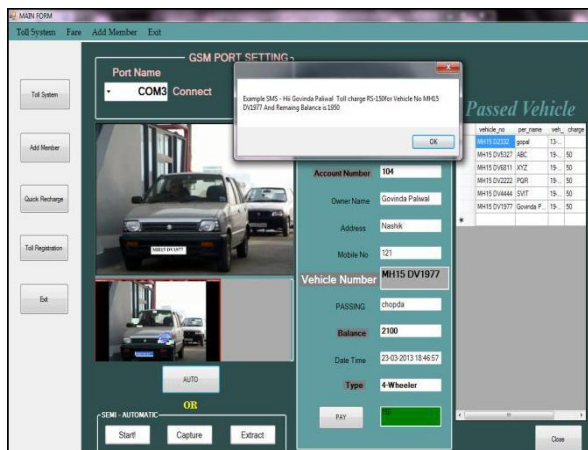


Fig 7: Main Module

V. FUTURE SCOPE

A. Toll Collection Application :-

Through the toll collection application we are making the toll collection possible from either mobile balance or bank account associated with registered number of the vehicle.

Features of the App

- User can get the detail of tax amount.
- User can pay the tax before actually passing through the toll booth.
- Irregularities of toll collection by the employees can be controlled.

B. Weapons detection using E-Nose :-

Using E-Nose weapon trafficking at remote areas or border area by the terrorists can be ceased or detected.

VI. CONCLUSION

Thus a system for Image Processing Based Automatic Toll Booth in Indian Condition which is secure and highly reliable can be obtained. It can be used to remove all drawbacks with the current system such as time and human effort and it also doesn't require any tag only required best quality camera and fixed font number plate.

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