

Automated Toll Booth System

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Abstract: *As we all aware that development of a country depends upon its basic infrastructure. An express highway, for physical movement, is one of them. But we experience a long queue at each toll plazas on expressway which wastes a lot of journey time, fuel and emissions of co2. In this research project we will examine the image of the number plate & class of vehicle, the respective information will be processed for toll collection system, to make more efficient and perfect. As of now, at each 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.*

For the purpose of auto system, the image of the vehicle number plate and its class is important. In this system a high resolution 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.

At the same time, while passing the vehicle through the toll plaza, a tracking system will be activated for the theft vehicles. If the vehicle is stolen and an entry is being made in the central database by the police, a silent alarm would buzz which would indicate the operator at the toll booth that the vehicle is a stolen vehicle.

For the identification, the information of the vehicles, registered against the number plate, stored on the central database, through the RTO will be used for verification. So for this purpose the captured number will be sent to the server received at the toll.

Keywords: *AVI, AVC, IPBAT, ALPR, SVM, ANPR, IPBT & OTPN.*

1. AIM OF PROJECT

The main purpose of this project is to collect the correct toll value, according to vehicle's class, automatically on arrival of the vehicle at toll booth. It is needed to build a real time application, which recognizes reliable, safe and environment friendly. At present, customers have to wait at the toll booth, for long time, to pay the collector. Automated toll system would successfully remove unnecessary traffic delays; keep an eye on any car that might not be correctly registered or number plates exchanged for theft purpose. Automated toll collection is fast becoming a globally accepted for toll collection.

The IPBT system is used as a system for fast and efficient collection of toll at the toll plazas. This is possible as the vehicles toll plaza does not need to stop to pay toll and the payment automatically takes place from the account of the user. This automatic system used is the technology of ANPR. Hence this system works very fast with the best results. This new toll system depends on four components.

1. AVI (automatic vehicle identification): Automatic vehicle identification systems are used for the purpose of effective AVC (Automatic Vehicle Classification).

2. Image processing based vehicle classification system, automatically verifies the class of the vehicle entering the toll booth.

Central Server: For more security and to the maintain records of each toll and customer, Central server is required.

1.1. Driver / Customer Benefits Include

- i. No or shorter queues at toll plazas by increasing toll booth service turnaround rates.
- ii. Faster and more efficient service.
- iii. The facility to make payments by keeping a balance on the bank account.
- iv. The summary of prepaid toll statements, SMS on mobile & mail. (no need to request for receipts)
- v. 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:

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

2. WORK TO BE CARRIED OUT

This project focus could give us the segmentation algorithm that was based on tagging the pixel cluster and a region growing approach. Shan Du, Mahmoud Ibrahim, Mohamed Shehata, Wael Badawy [3] presents a comprehensive review of the state-of-the-art techniques for ALPR (“Automatic Number Plate Recognition”).

“Number Plate Recognition used in Different Countries Using an Improved Segmentation”.

In this research two fastest algorithms [Edge Finding Method](#) and [Window Filtering Method](#) for the better development of the number plate detection system.

A rare image of a vehicle is captured and processed using algorithms and detection of stolen vehicles performed. Number plate extraction is done using a [Sobel filter](#), [morphological operations](#) and connected component Analysis. [Character segmentation](#) is done by using connected component and vertical projection analysis.

Character recognition is carried out using a Support Vector machine (SVM). ANPR system is very much useful in applications like, automated traffic surveillance and tracking system, automated highway/parking toll collection systems, automation of petrol stations, traveling time monitoring. In this the introduction of number plate segmentation, feature extraction, recognition of character based on [Neural Network](#) and [syntax checking analysis](#) of recognized characters is described.

3. STRUCTURE OF THE SYSTEM

3.1. 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 is valid for this system then LPN recorded in a database with other

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information such as vehicle number, time, balance, personal details. License plate numbers can also be further processed and used to control other systems such as raising a gate.

These toll systems are generally composed of four main components: Sensor used for vehicle identification, LPR Camera for capturing images, Computer with TOLL, Image processing software and Gate controlled system.

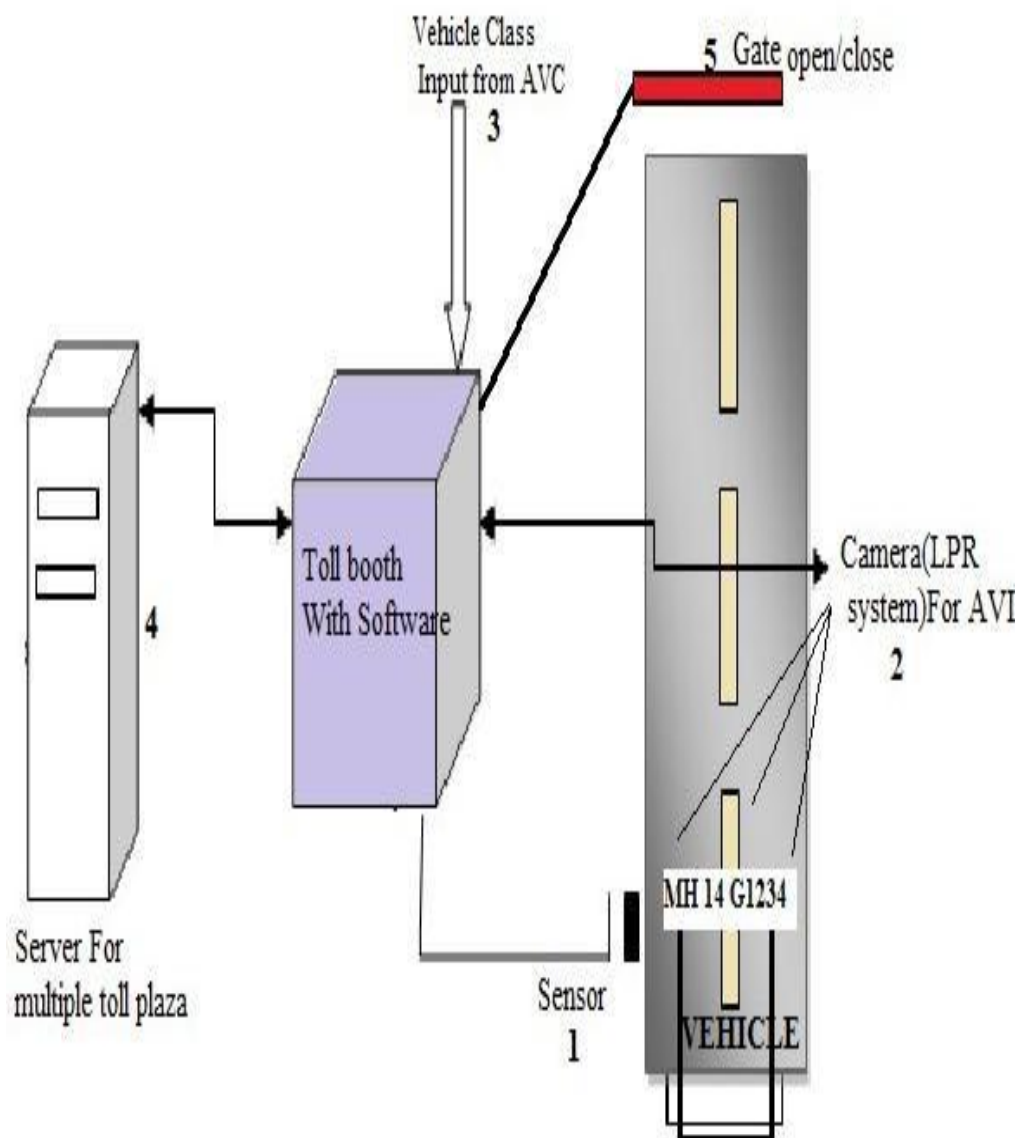


Fig1. Structure of the System

3.2. ANPR (Automatic License Plate Recognition) System

The algorithm proposed is 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 as shows in fig 3.

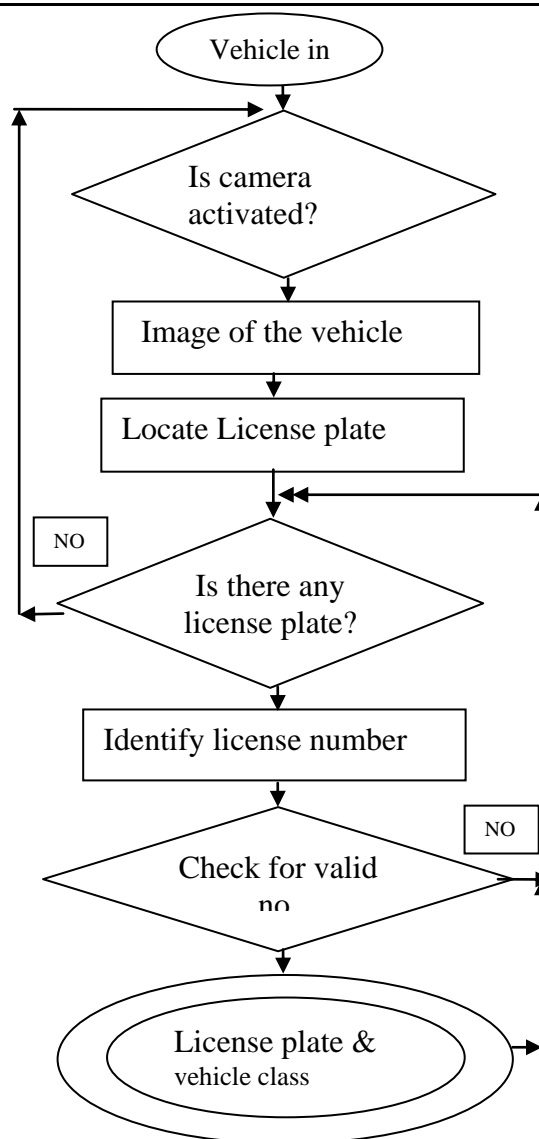


Fig2. ANPR Flow



Fig3. High Resolution digital camera

3.3. Template Matching Rule for Indian Number Plate

The Indian number plates following the new format can be off lengths 8, 9 or 10. Format of the registration is as shown below.

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 .

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.

4. COMPUTERIZED TOLL COLLECTION SYSTEM: SOFTWARE

4.1. Login with OTP (One Time Password) Security

In proposed system, toll operator point of view, provision of login with an 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.

4.2. Toll Operating Software

When vehicle enter in the toll plaza then toll software automatically start. Shows in fig 4 in these application firstly get vehicle license 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 license number in stolen vehicle database.

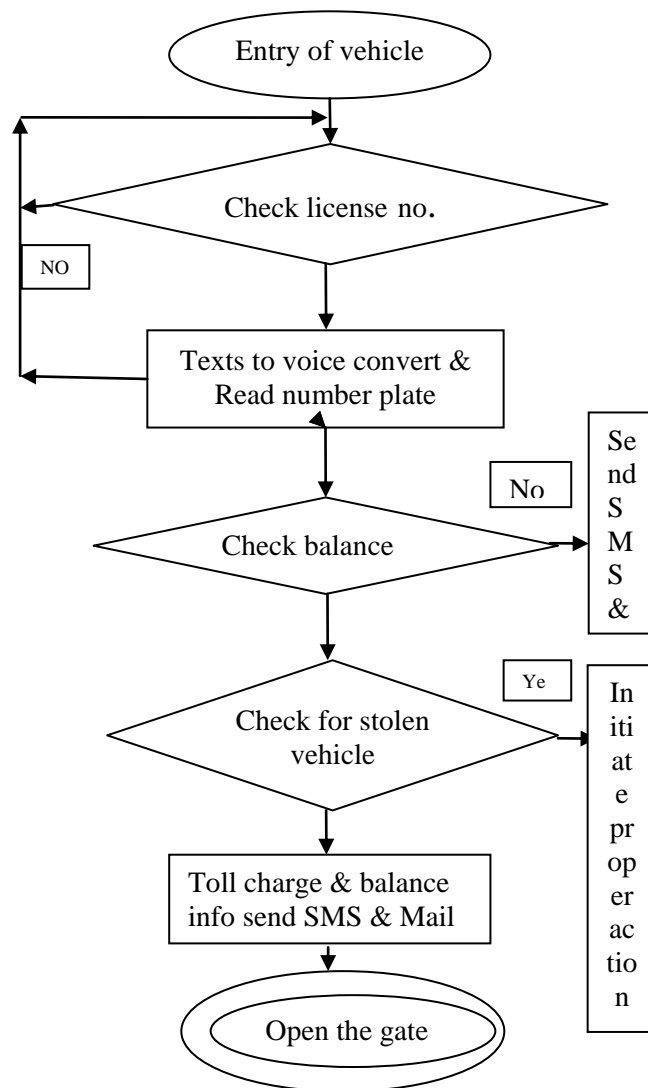


Fig4. Flow of Main Toll operating soft ware

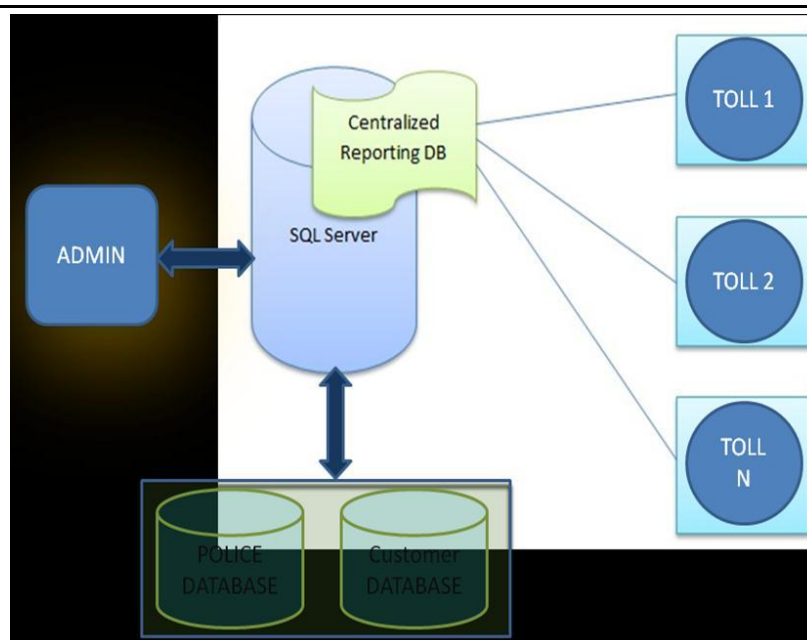


Fig5. Database view with multiple tolls

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.

- 1) The admin database contains details of central database administrator and also the details of all toll booths under Construction Company.
- 2) 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, then 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.

- 3) 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, license 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.

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Following are the snapshots of designed screens:

1. Login with Central Server or Different Tollbooths

Wellcome ..

Enter Login Details

TYPE: TOLLBOOTH

Login ID: TOLLBOOTH

Password: *****

SEND RESET

PASSWORD PROTECTION

OTP: 6282 LOGIN

Loading

Fig6. Login Window

2. Main Automatic and Semi automatic toll operating form:

MAIN FORM

Toll System Fare Add Member Exit

GSM PORT SETTING

Port Name: COM3 Connect

Account Number: 104

Owner Name: Govinda Patilwal

Address: Nashik

Mobile No: 121

Vehicle Number: MH15 DV1977

PASSING: chopda

Balance: 2100

Date Time: 23-03-2013 18:46:57

Type: 4-Wheeler

PAY

Passed Vehicle

vehicle_no	per_name	veh_charge
MH15 DV2332	gopal	13...
MH15 DV5327	ABC	19... 50
MH15 DV6811	XYZ	19... 50
MH15 DV2222	PQR	19... 50
MH15 DV4444	SVT	19... 50
MH15 DV1977	Govinda P...	19... 50

Example SMS - Hi Govinda Patilwal Toll charge RS-150for Vehicle No MH15 DV1977 And Remaining Balance is 1950

Start Capture Extract

Fig7. Main Module

5. CONCLUSION

Thus a system used as an Automated Toll collection booth, based on image processing saves the time at toll booth, minimizes the fuel consumption during the iddel condition of the vehicle. In turn we can save the environment from emission of extra carbon monoxide (co2). Hence we can save our country.

Also it serves in providing the tracking system for theft vehicle which is secured 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 on each vehicle.

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