

# ELECTRONIC TOLL COLLECTION USING AUTOMATIC NUMBER PLATE RECOGNITION

P. Anuja<sup>1</sup>, R. Anusha<sup>2</sup>, Dharshini Modia<sup>3</sup>, D.Muruga Radha Devi<sup>4</sup>

**Abstract**— The Electronic Toll Collection(ETC) aims to eliminate the delay on toll roads by cashless tolling and it is rapidly becoming the most innovative technology for the commuters who pass through the toll plaza.This paper focuses on ETC system using Automated Number Plate Recognition(ANPR) technology. The developed android application helps to recharge the account and deduce money. The Automated Number Plate is used for detecting crime through intelligence monitoring. This technology has many advantages such as automatic toll collection,improvement in highway efficiency,Low fuel consumption,highly reliable,modular architecture and it compares with records on database so as to come up with specific information like vehicles owner,address etc.It successfully detects and recognize the vehicle number plate on real images using Optical Character Recognition(OCR) method.

**Keywords**— Electronic Toll Collection, Automatic Number Plate Recognition, Optical Character Recognition.

## I INTRODUCTION

The novelty of transport has become one of the essential signs of the urban modernization level, but it also causes serious problems concerning transport system. Due to automation, minimum human interference is required and this provides the facility so that the time and energy can be saved and efficiency can be improved. With the revolution in communication and embedded systems Electronic Toll Collection(ETC), the new era of intelligent transportation systems(ITS)has been started. Many toll authorities have searched for ways to improve the toll collection process. Considering current scenario the number of vehicles passing through a specific toll booth are substantially high, hence there is a need for alternate solution for the highway toll collection method which should be more opportune, cost effective and more efficient than traditional methods. We can collect the toll electronically by various methods like ETC using laser technology, RFID, Barcode technology and GPS. The proposed ANPR system will provide the better solutions to the toll collection and will deal with the problems arising due to traditional toll collection methods. When vehicle passes through toll automatically, it also sends notification to the registered user via SMS and E-mail which provides best security. Since ANPR are fast, easy and reliable it can recognize the number plates of vehicle upto 200km/hr. This terminology is used to detect and disrupt criminality at Local, Force, Regional and National level including tackling travelling criminals, Organised crime groups and Terrorists.

The most challenging task faced by the user is waiting in the toll plaza since manual work consumes more time and payment methods are not easier. It leads to wastage of fuel by waiting as well as precious time to a great extent which leads to traffic congestion on the express way paving a way for air pollutants. This long time wait often results in drivers getting irritated that leads to verbal spats over people and toll attendants .Collecting the tolls and maintaining the records of different vehicles and transaction of money is a laborious process.

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<sup>1</sup> Department of Information Technology Sri Sairam Institute of Technology Chennai, Tamilnadu

<sup>2</sup> Department of Information Technology Sri Sairam Institute of Technology Chennai, Tamilnadu

<sup>3</sup> Department of Information Technology Sri Sairam Institute of Technology Chennai, Tamilnadu

<sup>4</sup> Department of Information Technology Sri Sairam Institute of Technology Chennai, Tamilnadu

The payment in cash becomes more difficult for collecting, transferring and managing purpose since Trickster and Burglary are serious scenarios of this manual payment method revealed during survey. It enriches the information pool of the paper where the online transactions are more secured than this manual methods for toll collection.

## II. RELATED WORKS

Electronic Toll Collection using Barcode Reader where a Barcode will be placed on the car and Barcode reader will read the bar code and the toll will be directly deducted from the prepaid account.[1] Automatic Toll Gate System uses Capacitive Sensor to sense the vehicle size and IR sensor to detect the unique ID. They use RFID and TAG attached to the vehicle which is used to read the vehicle details and stores the information in the microcontroller based on TAG number.[2]

Automated toll collection uses GPS navigation technology with a toll tag which is mounted in a vehicle is equipped with a GPS sensor.[5] Fast tag is used for enabling automatic deduction of toll charges. FAST tag is linked to the prepaid account from which the toll amount is detected. The tag employs RFID technology and is affixed on the vehicle's windscreen after the tag account is active.[3] In the technique using GSM, Radio Frequency Identification is used and includes the RFID tag reader, which in coordination with each other can be used to detect the vehicle identity. The IR Transceiver is used for detecting the presence of the vehicle at different locations which will act as the gate pass to the toll plaza.

## III PROPOSED SYSTEM ARCHITECTURE AND WORKING PRINCIPLE

Android is an open source and linux based operating system for mobile devices such as smart phones and tablet computers. Android was developed by the Open Handset Alliance, led by Google, and other companies Toll payment has always been a cumbersome process resulting in long queues. For making payments, users can top up the payment for toll via their pre-paid phone balance, post-paid phone account, credit cards, net banking. In case if there is more than one occupant in a vehicle with an app in the phone then all the riders will get indication to opt for payment, whoever clicks first will be able to pay the toll and in case no one clicks to pay then the toll amount will be deducted from the oldest registered number. Users can use both mobile phones and tablets for such transactions by downloading a mobile application on Android, iOS and BlackBerry platforms and to avail the app facility, users will have to download the application to their phones or tablets and fill in their details. The servers at the toll plaza will be able to detect the application from a distance of 200 metres of the toll gate and will deduct the toll from the account. Soon, commuters may have the option of paying toll from their mobile phone accounts without stopping at toll plaza. The owner receives an SMS message on their mobile about the details of the payment and there is no need for him to stop the vehicle. Vehicles passing through the toll gate will be stored in the database.

This system provides benefits to the clients as well as to the Toll Collection Company. Here the payment is done automatically using Android Application and car license plate number is recognized by Automatic Number Plate Recognition. The system also contains some additional facilities where one can edit the details if necessary. Mobile phones have become the preferred mode of transaction for the younger generation, and younger people use digital wallets more than traditional banking. It also helps to find out a vehicle number of times it pass through the toll gate in a day. Through this process of toll collection it will save time, effort and man power.

### A . *Electronic Toll Collection (ETC)*

Electronic Toll Collection (ETC) is the latest method for collecting tolls since it improves the speed and efficiency of traffic flow and save drivers time. Most ETC lanes are less expensive to build and operate than traditional toll collection methods. The mobile application proposed here deals with the Toll collection management system and the users in a user friendly manner. The users can download and sign up the application by creating an account. They can register their trip by entering the travel details which includes source, destination, date of journey, vehicle numberplate (which is taken as their unique id) etc. This helps to maintain clear information about the travel details of the user. Payments can be done by using the Mobile wallet that can be recharged through online transaction systems. Once these informations are submitted, they get stored in the toll database. When the user approaches the toll booth the ANPR recognizes the license plate and checks the details about the vehicle stored in the database and the availability of the amount in the wallet and the money is deducted from the mobile wallet automatically. The unregistered users are not allowed to pass through the toll boom where the maintained database doesn't match with the ANPR recognized vehicle. When the amount is deduced the registered user will get the notification about their vehicle which passes through the toll. This

improves the security of the vehicle which helps to notify the police if respective vehicle has been involved in any malpractice issues. With the addition of these facilities it also helps the user to save his trips during offline with the help of GPS system. He can also record his trips and find details about the nearby Hospitals, Markets, Petrol bunks, ATM, Mechanic shops, Restaurants which are essential during travel and these details can also be saved temporarily in offline.

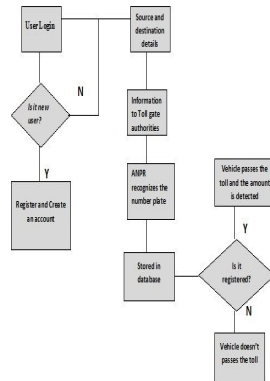


Figure 1. Architecture diagram of the system

*B. Automated Number Plate Recognition(ANPR)*

The Automated Number Plate Recognition(ANPR) system uses Optical Character Recognition on images to read the vehicle registration plates and it works by tracking vehicles travel time between two fixed points and calculates the average speed.

Unique ID is issued for every vehicle which is the car number itself. All users are registered to the Toll Collection Company. ANPR is fixed at the automatic gate which is connected to database. As a vehicle approaches the camera the software takes a series of 'snapshots' and stores them in a file. When the number plate is of sufficient size for the OCR software the frame is scanned and the registration number is converted to ASCII code and held in a list. This continues for a series of images according to the speed and position of the vehicle. The list is scanned for similarities and a 'favourite' selected to retain. The system would typically scan and compare 10-15 images, with 5 being considered the minimum for high accuracy. This is the principle at which the software is working, some systems only take one image at a certain position.

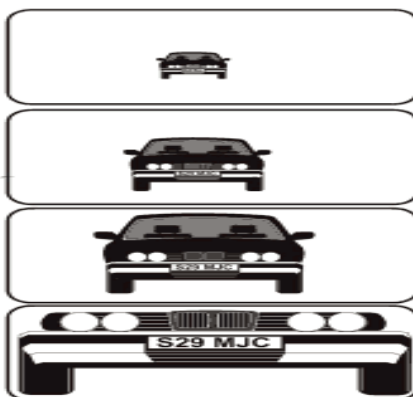


Figure 2 Image capturing using ANPR

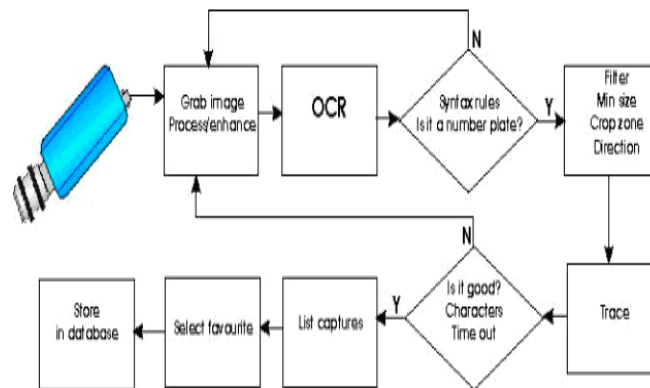


Figure 3. Block diagram for ANPR

Taking advantage of the retro-reflective characteristics of number plates, the illumination from the illuminator will be reflected directly back to the camera. Thus only infrared light will be seen without any visible light or other reflections or refractions. The picture will of course be black with no detail except for the number plate. The OCR software then takes care of converting the image to usable code.

Once it has been recognized, the server to which it is assumed to be connected check whether there is enough balance in the wallet. After reading the data, the car number which is given as ID must be searched from the database and it retrieves the user information. After the confirmation the appropriate amount will be deducted from the user's wallet and the information alert will be sent as SMS to the user within a second.

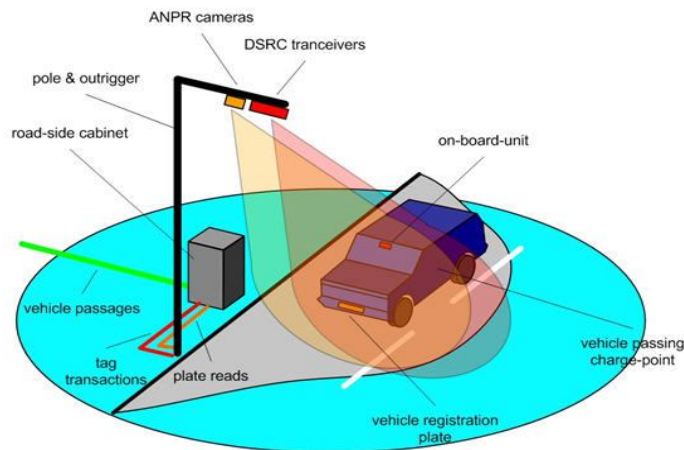


Figure 4. Automatic Number Plate Recognition(ANPR)

#### ANPR hardware

Our ANPR Hardware range consists of Processors (both fixed and mobile), Video Capture Cards, Relay Cards, Cameras and LED Signs and sometimes LED Signs and Modems. Road Pixel also offer a range of Mobile ANPR Processors that have been designed to provide flexible and reliable ANPR on the move.

Unlike many other systems which require specialist platforms and additional video processing boards, the ANPR Recognition Engine will run on a standard Windows based PC. Up to four lanes of high speed traffic can be processed with one Video Frame Grabber / Capture Card, more for situations where the traffic is moving

more slowly such as car park entrances / exits. The speed and behaviour of the traffic should always be considered when designing a system.

Connected to the Video Capture Cards are specialised ANPR RoadWolf Infrared Video Cameras which are used to capture number plates. Where traffic lanes are wider than 3m, or when vehicles can approach a barrier from more than one angle, RoadWolf HD ANPR cameras can be used – or alternatively multiple analogue cameras can be connected to each lane. Additional colour overview cameras can be added to each lane to capture a general picture of the car, showing make, model etc.



Figure 5 Hardware components of ANPR

## V CONCLUSION

The proposed system we use automatic number plate recognition system (ANPR). With the help of this ANPR we can reduce the human interaction in the entire toll collection process and improve the security level of the system. It helps to reduce the traffic congestion and save time which helps to user reach their destination without wastage of time and fuel. It reduces the effort of the toll authorities and promotes the system with the fair policy of toll collection which can be followed. The cash security level can be increased with the help of online payment systems. This technology will be used in different toll booths across the country where the traffic can be controlled easily and management of time can be effectively handled. It helps in the digitization technique and serves to be user friendly.

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