

# AUTOMATED SMART TOLL GATES

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**ABSTRACT--“CARDLESS and CASHLESS” tollgates are the major objective of our paper. The major problems which people are facing in toll gates are unnecessary waiting time, it is estimated that almost 15 crore vehicle uses NHAI in India and if average idle time of each vehicle will be 5-10 minutes. The other problems faced are chaos caused due to exact change in money, wastage of man power. Our paper is a simple and innovative idea to overcome all the above mentioned problems .Our concept emphasis on two aspects. First, we have tried in reducing the unnecessary waiting time in tollgates and secondly we have concentrated in moving towards cashless transaction (E-transaction). To achieve the mentioned objective we have used simple digital image processing programing. Followed by a database, GPS. The other component used will be a High resolution cameras and a mobile application software to create a platform to link with all the components and interact with the user. In our concept, every car’s number is linked with corresponding two or three mobile number for e-wallet or for online transaction. These information will be maintained in a database. Before starting the journey the user should set the current location and destination in the mobile application. By using the GPS it shows the number of tolls in between destination and current location and the user should select whether the journey is single or double. Based on the user choice the database gets updated. Each phone number in database will be linked with their respective bank accounts. When a car is nearing to the toll gate at 500 metre before the toll, a camera will be placed. It takes the car number as input and by image processing it is converted into digital data and it checks for the number in database and checks for journey details and bank account. There may be two cases. CASE 1: If any of the above is not specified, like journey detail is not provided or bank balance is less, it gives an alert message in a LED sign board at 500 meter before toll gate showing the car number to take leftmost lane for manual cash transaction. CASE 2: If all the information are specified and when car moves near toll gate the other camera present near toll gate will recognizes the car and corresponding toll gate amount will be taken from the bank account of the particular phone number which is linked with car and the barrier opens automatically. So in case 2 the car driver doesn’t have to stop the car in toll gates. Since there is**

**no need of unnecessary waiting time the travel time will be reduced and above mentioned problems like exact change in money, wastage of human power can be solved. In this paper we have tried to cover all most all possible cases. Each case will have a different solutions.**

**Keywords—image processing ,GPS(Global Positioning System), Electronic transaction.**

## I. INTRODUCTION

In this modern fast moving world vehicles have become an integrated part of life. One cannot imagine their work without an easy mode of transport .The major problem faced by the car drivers in highways are tollgates. It is estimated that around 15 crore Indian vehicles are using toll gates every day, if an average waiting time of a single vehicle is 5 minutes ,then it leads to a vast wastage of time. Time is the most valuable commodity. Waiting in toll gates is an utter waste of time. Moreover everything is being digitalized and we are moving towards DIGITAL INDIA but still the toll gates in India uses traditional old method which involves in manual cash transaction.

## PROBLEMS CAUSED DUE TO MANUAL TRANSACTION IN TOLL GATES

Few problems are listed below

- Manual cash transaction leads to wastage of time. Every car should stop in toll gates and wait for receipt.
- Wastage of papers for every bill.
- Problems caused due to exact change of money.
- Wastage of human power in every toll gates.
- Unnecessary lane problem and fights with employee.

## COMPONENTS REQUIRED

- High resolution cameras
- Data base management system

- Application software for mobile or computers
- Image processing software
- Huge LED sign board
- Transceiver

### HIGH RESOLUTION CAMERAS

Few requirement for picture capture

- Shutter speed should be very high-1\1000 of a second can be used to avoid blurring.
- Night vision camera facility
- High lightning should be maintained near the areas in camera.

Retro reflecting plates can be used to increase the contrast for better image processing result Usually infrared illumination camera are used for this process. Two cameras should be used for a single toll gate. High resolution cameras with high shutter speed are used, so that it can operate well on high speed vehicle. It is necessary that good lighting should be provided at the places of camera, So that they can operate very well even in low lights. It would be better if a speed breaker is used to slow down the vehicle. Cameras play a major role in this process. The angle and placement of camera should be decided with care, it should be placed in such a way to cover all the vehicle. First camera is placed at 500 meter before the toll gates. The first camera takes the vehicle number as a picture and this act as an input for the digital image processing .The second camera is placed near the toll gate barrier. When the vehicle approaches near the toll gate it is captured by the second camera. This image is again processed and vehicle number is extracted, this is given as input to database for further action.

### DATA BASE MANAGEMENT SYSTEM

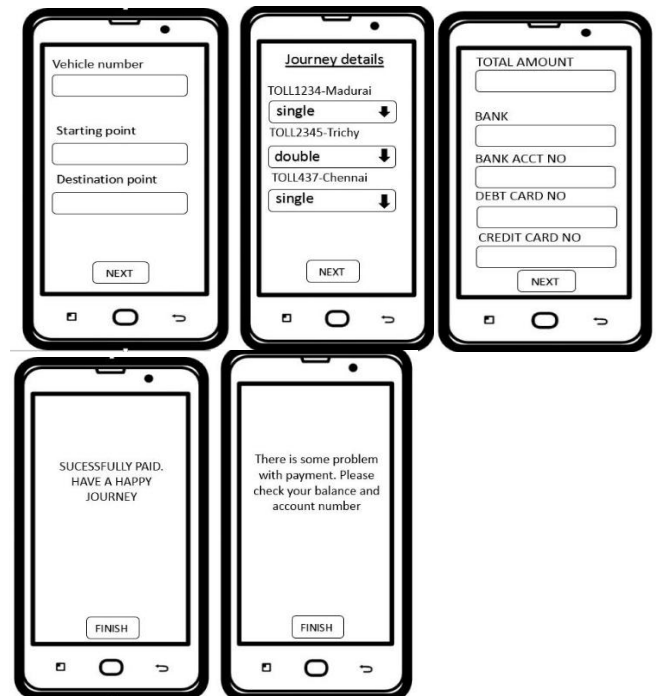
- Database plays a major role in the concept. The vehicle number act as the primary key for database. The input of database is a number of the vehicle which is extracted by the image processing and the other input is from the application software from the phone. The database consist of the details of the vehicle along with the corresponding details like journey of the vehicle, payment details. The output of database is fed into computer and it makes the barricade work accordingly based on the details specified. The details of emergency vehicle like ambulance and police vehicle will also be given in database in prior. Each toll gate has a unique number. The table in the data base will something like the below table.

VEHICLE NUMBER	TOLL GATES	JOURNEY DETAILS	PAYMENT DETAILS
TN XX AA XXXX	1.TOLL123 2.TOLL231 3.TOLL234	1.DOUBLE 2.DOUBLE 3.SINGLE	1.PAID 2.PAID 3.PAID
TN XX BJ XXXX	1.TOLL124 2.TOLL432	1.SINGLE 2.DOUBLE	1.PAID 2.NOT PAID

This would be the table present in database

### APPLICATION SOFTWARE FOR MOBILE OR COMPUTER

This software acts as a platform which links the user with database and other components like GPS. This software would be similar to that of a ticket booking software. The software is the only way to update the vehicle status in database. It would requires few details like the vehicle number, starting point, destination point. On clicking next it shows the number of tolls along with location. This can be achieved with the help of GPS by which we can find the number of tolls between starting and end point. By selecting each toll, the user may give the journey details like Single or Double. Next page shows the type of payment like debt card, bank acct no, credit card etc. By providing all the details mentioned above, a row will be created in the database which consist of the details of the vehicle based on this the whole system operates.



This would be the schematic view of the software.

### IMAGE PROCESSING SOFTWARE

The image captured by the camera is taken as the input for image processing. The image is processed and vehicle license number is extracted. This vehicle number is the output of the image processing software and this output is taken as the input to the database. It compares the details in the database with the output of the image processing software and based on the result the toll gates gets operated in one of the ways. There are numerous way to extract text from a picture and video. We have tried to extract the number using MATLAB software. The picture is converted into greyscale and the number is extracted and stored in a text document. This content in the text file is used as a input to the database. By this database management performs various operation.

### TRANSCEIVER

It is combination of both transmitter and receiver. It can perform both send and receive data. It acts as the two communication system. The image captured by the camera is sent to the computer to perform signal processing which is then linked with the data base. The transceiver with following specification can be used

- Power supply : 1.9~3.6V
- IO port working voltage : 0~3.3v / 5v
- Transmitting rate : +7dB
- Transmission range : 250m in open area

The transceiver with these specification can be used.

### LED SIGN BOARDS

These sign boards should be placed at 300-400 metres away from toll gates. These sign boards are used to display the message whether the amount is paid or not. If a vehicle had got toll gate passing through online software then it displays the message PAID along with the vehicle number. So these vehicle can use any of the lanes in toll gates and doesn't have to stop in tollgates. This works with the details given in the database. If the vehicle haven't paid then the message shown will be.

CASE 1: If the amount is paid ----- "TN XX A XXXX  
PAID"

CASE 2: If amount is not paid ----- "TN XX A XXXX  
USE LEFT MOST LANE FOR MANUAL  
TRANSACTION"

These sign boards are placed at few distance from the toll gates because by seeing this the driver could make use of left lane for manual transaction by doing this we can avoid unnecessary lane change problems near toll gates.

### WORKING

When the vehicle approaches the toll gates, before 500 metre there will be a camera placed which extracts the number of the vehicle using image signal processing. This

extracted number is given as input to database and compares it with the table to obtain the details of vehicle like journey details. There might be few cases available

CASE 1: (Already paid using software)

If the driver had already paid the toll gate using the application software. Then the led board will show "PAID" and once again when the vehicle goes near the toll gate another camera placed near tollgate takes the picture of car and once again image processing is done to extract number and it gets compared with details of the database. Based on the details the barricade in tollgates are opened or closed. If everything is paid then barricade opens automatically. This can be achieved using microprocessor.

CASE 2: (Not paid)

If the driver haven't paid using software then the working will be completely different. The camera at 500 metre captures and checks for the details in data base, if no data is specified then the LED sign asks the driver to use "LEFT MOST LANE FOR MANUAL TRANSACTION". Left most lane is chosen for manual cash payment as like old method.

CASE 3 (For emergency vehicle)

Emergency vehicle like ambulance and police vehicle there will be always a separate row in data and moreover if the alphabet 'G' comes in the number plate then it treats those vehicle as paid vehicle.

### CONCLUSION

This idea can be used to resolve all the problems mentioned above. But there is also few constraints that must be followed. All the vehicle coming near the camera should slow down their speed. A good amount of a distance must be maintained between vehicle when the vehicle approaches the camera. The lighting condition should be maintained so that the cameras can work with quality. All the processed signal should be transmitted and received from data base at high speed. Once all these constraints are met, We would be able to make automatic toll gate possible.

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