

## Automated Toll Collection Using Satellite Navigation

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### ABSTRACT:

Recently, most developments are done in the field of the Expressways Network Toll Collection. Most electronic toll collection are implemented by DSRC (dedicated short-range communication) technology. In recent years in ETC development GPS global positioning system technique took place DSRC (dedicated short-range communication) technique. However a new generation of electronic toll collection is rapidly developed to replace dedicated short-range communication based electronic toll collection system. Global positioning system technology has become the new trend for road charging system, which implements electronic toll collection system based on positioning and Global System for MCT(Mobile communication technologies). In this paper the flow of the system are described the design of GPS (Global positioning system) based ETC (Electronic toll collection) system are discussed.

**Keywords:** Global positioning system, Dedicated short range communication, Electronic toll collection, Mobile communication

### I. INTRODUCTION

Since from decades maintain and cost of road-ways are collected in direct manner or indirect manner in the older era the cost incurred were compensated either by tax payment on fuel or by budget allocation from national income disadvantage of this tax collection was tax payers had to pay for roads which was not at all use by them that means they have to pay extra money. However in other method, tolls are directly taken from the drivers passing road/street. Many benefits are it is a source of the capital generation, then management of traffic jam problem, firm request management

### II. EXISISTING SYSTEM

Since from decades cost of construction, extension, maintenance and, roads, bridges and tunnels were collected through tolls for Revenue Generation. In previous method RFID technology was used ,in this system sensors were placed above roads and vehicles get charged ,sensors identifies the chassis number & number plates of vehicle through sensors and details send to server after that server further processed and toll is collected but this technology has some risks. Basically RFID technology is based on image processing technique. in which number plates and chassis numbers are scanned as a image afterwards further processing on that image is done and remaining task get finished regarding toll collection of particular vehicle. but problem with this system is that if due to mud or any other reason number plate or chassis number of vehicle get covered and not visible properly then sensors cannot be detect it properly so that it rises a problem while identifying the vehicle and but oblivious toll collection also can not completed. In our proposed system we eliminate this problem by using GPS technology.

### III. PROPOSED SYSTEM

Purpose of the proposed system is to do the tasks remotely on the client machine through server.The aim is to develop Toll Collection System on express highway in such a way that, so the user have no need to keep money with him to pay toll and without the vehicle even having to slow down or stop at a toll.

### IV. SYSTEM ARCHITECTURE

The system architecture of GPS-based ETC system is illustrated in Fig. 1, which includes five key parts of unit: interfacing hardware device, manual toll collection team, control unit, Transaction management unit and the money Payment Center. The working process of GPS-based ETC system is described as follows procedure:

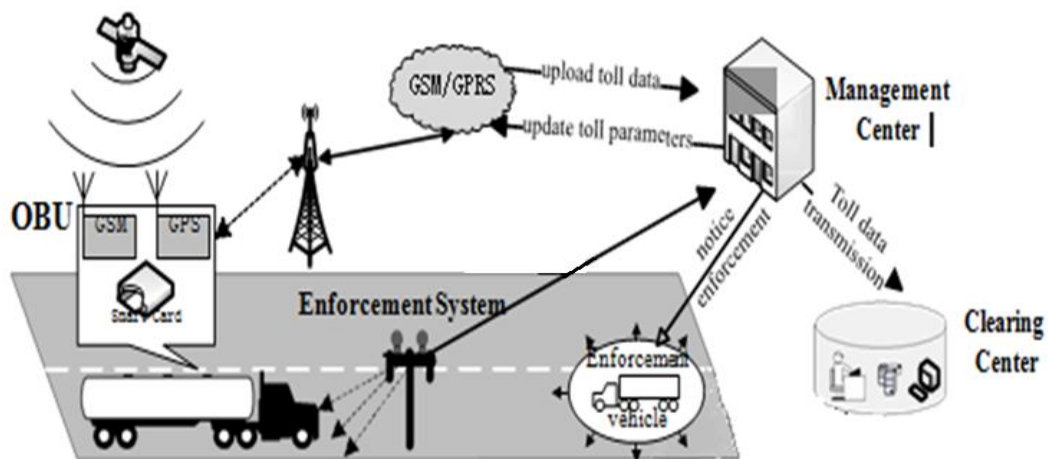


Fig. 1 Architecture of GPS-based ETC system.

Drivers go to the money payment center registers and installs interfacing hardware device and applies for pre-paid card or post-paid card.

When vehicle moves into the toll area, interfacing hardware device checks current vehicle's position coordinate from GPS with the virtual toll node coordinate, kept in the storage of interfacing hardware device. After logistic determining, the interfacing hardware device sets up wireless communication channel through GSM module.

Interfacing hardware device sends transaction message to control system by the GSM module through mobile network.

After auditing to control system saves toll data and sends back transaction information to the Interfacing hardware device.

The Interfacing hardware device receives and displays the transaction result then it is working properly. If there is an error in transaction the result either there is a problem in the interfacing device or may be installation not properly done.

When the vehicle crosses the charging zone, if the Interfacing hardware device has abnormal state or the vehicle doesn't install an Interfacing hardware device the violation will be processed.

The transaction control unit clears all information according to toll data from control unit, and divides in road service providers.

The money Payment Center collects toll records and clearing data for account query.

Problem Setup and Notations

Input: Taking latitude and longitude through GPS

Output: Vehicle Location.

Result: Receiving message about deduction of balance.

I is a set of various vehicle types

$I = \{t_1, t_2, \dots, t_n\}$

V is a set of individual vehicles

$V = \{v_1, v_2, \dots, v_n\}$

P is a set of prepaid account for different users.

$P = \{b_1, b_2, \dots, b_n\}$

R is a set of fixed amount for different vehicles

$R = \{c_1, c_2, \dots, c_n\}$

Then,

•  $\forall I | V$  pay R cash from prepaid account P

## V. MODULE DESCRIPTION

- **Interfacing hardware device:** it includes several components, GSM module, people interface
- **GSM Module:** The interfacing hardware device and control system communicate each other through the dedicated VPN (Virtual private network) based on GSM/GPRS mobile communication network.

• **Peoples Interface:** showing the interfacing hardware device status, vehicle information, card residual amount etc. The working rules and laws of the interfacing hardware device is described as follows: The highway network is divided into a number of independent sections by their arrival, leaving it and optional interchange. Some points in sections are defined as virtual toll node and their coordinate are stored in the interfacing hardware device memory.

Manual toll collection team: If in Travelers account doesn't have sufficient balance for paying toll then that vehicles are stop by manual toll collection team and toll will collect. And have lower priority but in case of insufficient balance in account of traveler it has higher priority.

- **Control unit:** The control unit is the core part of the system and its functions includes as follows:
  - Can change the geographical scope of charging area like adds or deletes a toll road.
  - Set up toll payment rate of the road and digital map information, etc.
  - Collect and save toll information for clearing.
  - Have extended function such as vehicle movement, traffic management, immediate assistance, etc.
- **Transaction management unit:** The Transaction management units do the transactions of the amount to be charged from the vehicle.
- **Payment Service Center:** This center takes ETC users registration, and provides customer service.

## VI. CONCLUSION

So we concluded that the electronic automated toll collection technology idea of prepaying tolls having flexible features of charging zone and charging mode and also have better compatibility with intelligent transportation system ,Main objective of this electronic toll collection system are reduce traffic congestion, reduce waiting time, save fuel and increase highway capacity.

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