An Automatic Embedded Toll Plaza With Sensor Obstacle Detection Using GPS And GPRS

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Abstract- *Transportation has emerged as a dominant part of India. Toll plazas play a crucial role in maintaining the road transportation. At present, manual toll collection is most widely used collection method in India. It significantly requires a toll collector or attendant. Due to manual intervention, the processing time at toll plazas is highest. The project has been designed for the automation in toll tax payment using GPS and GSM Technology. Automation of toll plaza has been experimented using combination of Microcontroller, Global positioning system, Global system for Mobile. Implementation of automation in toll plaza enhances the monitoring of vehicles that are travelling in predestined routes. This project aims in designing a system, which automatically identifies the vehicle that advance towards the toll plazas and observes the vehicle number and the time of arrival. If matches exist between vehicle data and GPS data, then predetermined amount is automatically taken from the user account. It passes this information to avoid the Traffic congestion at toll plazas and helps in consuming less amount of fuel. The necessity for vehicles to stop or slow down for toll fee payment results in traffic congestion and reduces fuel efficiency. Hence, a system that enables road users to pay the toll fees without stopping or slowing down was proposed and developed.*

Keywords- automatic payment, IOT, ultrasonic sensor, GPS, GSM, alert message.

I. INTRODUCTION

As we all know that transportation is the backbone of any country's economy. Improvement in transportation systems result into the good lifestyle in which we achieve extraordinary freedom for movement, immense trade in manufactured goods and services, as well as higher rate of employment levels and social mobility. In fact, the economic condition of a nation has been closely related to efficient ways of transportation. Increasing number of vehicles on the road, result into number of problems such as congestion, accident rate, air pollution and many other. All economic activities for different tasks use different methods of transportation. For this reason, increasing transportation is an immediate impact on productivity of nation and the economy. Reducing the cost of transporting resource at production sites and transport completed goods to markets is one of the important key factors in economic competition. Electronic toll collection is atechnology allows the automated electronic collection of tollcosts. As it is studied by researchers and also applied in various expressways, bridges, and tunnels require such a process of electronic toll collection. ETC is capable of determining if the vehicle is registered or not, and then informing the management center about to process violations, debits, and participating accounts .The most excellent advantage of this ETC system is that it is capable of eliminate congestion in toll plaza, especially during those seasons when traffic seems to be higher than normal.

II. LITERATURESURVEY

This will provide all the review of the literature of the "Smart Toll Plaza" system. This will include all the information survey and market survey. The shortcoming of this method is that a number of tax payers, who do not use any of the roads and carriage ways, have to pay extra money. However, in the other system, called direct method, the tolls are taken directly from the drivers passing that road or street. There are millions of drivers passing through Toll Gate Stations every day. The conventional or the traditional way of collecting the toll from the vehicle owners or the drivers is to stop the car by the Toll Gate Stations and then pay the amount to the toll collector, standing (or perhaps sitting!) By the side of the toll booth, after which the gate is opened either mechanically or electronically for the driver to get through the toll station. It causes long quos of vehicle, no checking for overloaded vehicles, manual operation traffic problem.

III. EXISITING SYSTEM

Now a day's most of the tolls will be operated manually. Manual testing requires more time, is very limited and checking relevance of search of operation is difficult. Due to this there is lots of problem will occurring such as heavy traffic, passing over loaded vehicles etc. Booth operator's corruption or collusion with a road user is harder to check. To

avoid such problems the Electronic toll is necessary. In previous method RFID technology was used, in this system sensors were placed above roads and vehicles get charged, sensors identifies 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.

A. Manual toll collection: This technique is not a technical method. It requires a toll collector or attendant. The toll collector himself classifies the vehicle, collects the toll, dispense the change, and provide receipt to the vehicle owner. All this process is time consuming due to manual intervention. Sometimes, when vehicle comes to booth, toll is charged manually by simply providing just receipt in which no description about vehicle is given, only toll tax amount is present. In this case, what happens, if a heavy vehicle comes to toll booth, Operator charges some amount greater than toll amount of light vehicle but receipt is provided for light vehicle.Thus manual collection can provide loss to the owner of booth .

B. Barcodes This method brings our attention to a new technology for an electronic toll collection. In this system, barcodes are mounted on the number plate of vehicles. The information related to that vehicle is embedded on the barcode. Barcodes are read by the barcode scanners present at toll booths. Thus this method reduces the efforts of human authority. Data information are also easily exchanged between toll authority and vehicle owner, hence providing a more efficient toll collection by less traffic and less possible human errors. But Optical systems at toll booth proved to have poor reading reliability especially when faced with inclement weather and dirty vehicles.

C. Automatic Number Plate Recognition Automatic number plate recognition is a mass surveillance method that uses optical character recognition on images to read vehicle registration plates. They can use existing closed-circuit television or road-rule enforcement cameras, or ones specifically designed for the task. They are used by various police forces as a method of ETC system on pay-per-use roads and to catalog the movements of traffic or individuals.

IV. PROPOSED SYSTEM

This will provide all the review of the literature of the "Smart Toll Plaza" system. This will include all the information survey and market survey. The shortcoming of this method is that a number of tax payers, who do not use any of the roads and carriage ways, have to pay extra money. However, in the other system, called direct method, the tolls are taken directly from the drivers passing that road or street. There are millions of drivers passing through Toll Gate Stations every day. The conventional or the traditional way of collecting the toll from the vehicle owners or the drivers is to stop the car by the Toll Gate Stations and then pay the amount to the toll collector, standing (or perhaps sitting!) By the side of the toll booth, after which the gate is opened either mechanically or electronically for the driver to get through the toll station. It causes long quos of vehicle, no checking for overloaded vehicles, manual operation traffic problem. The functional concept of a manual toll system is simple: the motorist takes a ticket at the entrance to the motorway and presents it at the tollbooth at the exit. Ticketing and toll barriers can also be placed on each section of motorway. With technological progress, these systems have evolved towards electronic toll collection, allowing traffic to flow more smoothly and improving service to both users and operators. System consists of Automatic Toll Collection Centre, control gates and on-board units. In our daily life we are seeing toll gate. We are going to pay certain amount to the government in form of tax through this toll gate. We can see this toll gates being placed in some national high ways etc., So in order to pay tax we are normally going to pay in form of cash, but instead of that as the technology is growing we can make use of smart card which is nothing but like a memory card in which we are going to store the details of particular person and certain amount. The main objective is to pay the toll gate tax using smart card. Smart card must be recharged with some amount and whenever a person wants to pay the toll gate tax, he needs to insert his smart card and deduct amount using keypad. By using this kind of projects there is no need to carry the amount in form of cash and so we can have security as well. These electronic toll Collection systems are a combination of completely automated toll collection systems (requiring no manual operation of toll barriers or collection of tolls) and semi-automatic lanes. Various traffic and payment data are collected and stored by the system as vehicles pass through. The different technologies involved are logically integrated with each other but remain flexible for upgrades. They also include sophisticated video/image capturing equipment for full-time violation enforcement.

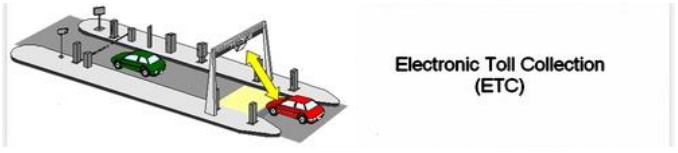


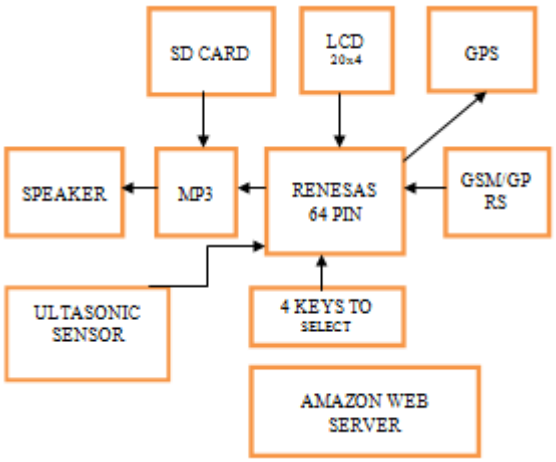
Fig: 4.1 Automated Toll Collection System

Objectives of proposed system:

1. The project has been designed for the automation in toll tax payment using GPS and GSM technology.

2. This developed system present a different approach for highway toll collection which eliminates travel delays and constructions of expensive gantries or toll booths.
3. This project provides fast driver-assistance system (DAS) that detects obstacles and warns the driver in advance of possible collisions in a congested traffic environment using ultrasonic sensor.
4. To manage the project strategically, administratively, legally, technically and commercially providing services of central ETC system.
5. This includes toll transaction clearing house operations, helpdesk support and setting up of call centers for incident management and intelligent transport systems among others.
6. A model has been used for toll plazas with different number of lanes to study the financial value of the benefits due to the ETC deployment.
7. It is also used to study the effect of the traffic flow on the total benefits and recommendation has been made with respect to the time for the ETC deployment.

V. ARCHITECTURE



5.1: System Architecture

In this project the microcontroller will be placed in vehicle unit and also has a GPS receiver and GSM unit. When driver enters toll gate mp3 module will give voice information about private toll gate. The driver enters destination to be reached using key selection so the module in vehicle unit takes the present GPS location when vehicle starts (start point) and sends server (toll collection unit) and the selected destination is also sent to server unit via GPRS. The predetermined amount is deducted automatically from user account when he exits from the toll gate. Automatic Toll Collection lanes improve the speed and efficiency of traffic flow, save drivers time and also results of better flow, congestion is reduced, fuel economy is improved, and pollution is reduced. This system was developed using a Renesas microcontroller. Different modules such as GPS module, speaker and wireless modules were incorporated and integrated with the microcontroller to perform a few specific functions. In general, the system utilized GPS coordinates to detect whether a vehicle passed through predefined locations in the database and the travel details were recorded. This developed system presents a different approach for highway toll collection which eliminates travel delays and construction of expensive gantries or toll booths.

VI. IMPLEMENTATION

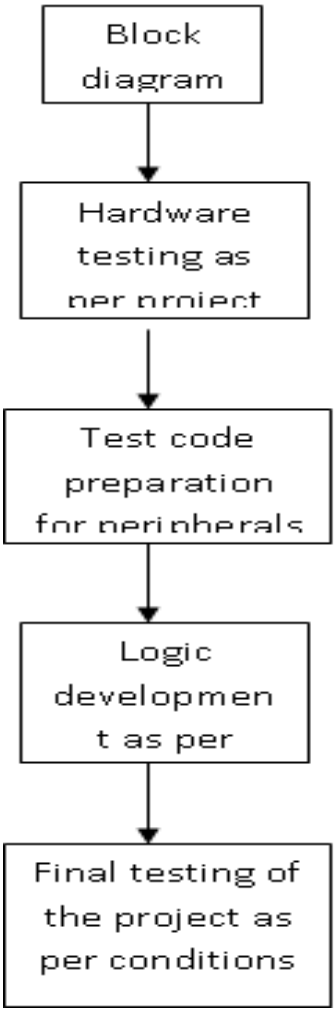
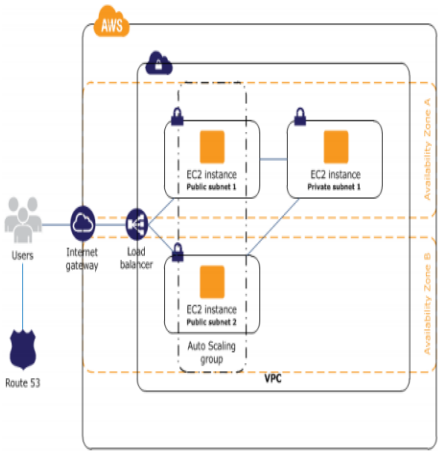


Fig 6.1: Flow Diagram

A prototype module will be developed for the project. It includes individual PCB boards for all interfaces according to the block diagrams. Every PCB will be inter-connected with jumper wires. LCD is used to display the information. When driver enters toll gate mp3 module will give voice information about private toll gate. The predetermined amount is deducted automatically from user account when he exits from the toll

gate. The driver enters destination to be reached using key selection .so the module in vehicle unit takes the present GPS location when vehicle starts (start point) and sends server (toll collection unit) and the selected destination is also sent to server unit via GPRS. There is no necessity to slow or stop the vehicle. In this project the microcontroller will be placed in vehicle unit and also has a GPS receiver and GSM unit. When driver enters toll gate mp3 module will give voice information about private toll gate. The driver enters destination to be reached using key selection so the module in vehicle unit takes the present GPS location when vehicle starts (start point) and sends server (toll collection unit) and the selected destination is also sent to server unit via GPRS. The predetermined amount is deducted automatically from user account when he exits from the toll gate. Automatic Toll Collection lanes improve the speed and efficiency of traffic flow, save drivers time and also results of better flow, congestion is reduced, fuel economy is improved, and pollution is reduced. This system was developed using a Renesas microcontroller. Different modules such as GPS module, speaker and wireless modules were incorporated and integrated with the microcontroller to perform a few specific functions. In general, the system utilized GPS coordinates to detect whether a vehicle passed through predefined locations in the database and the travel details were recorded. The Renesas microcontrollers with wireless modules were configured as a toll company cloud server to allow online access of travel logs. This developed system presents a different approach for highway toll collection which eliminates travel delays and construction of expensive gantries or toll booths.



6.2: EC2 Configuration Diagram

VII. RESULTS

The project has been designed for the automation in toll tax payment using GPS and GSM technology. This developed system present a different approach for highway toll collection which eliminates travel delays and constructions of expensive gantries or toll booths. This project provides fast driver-assistance system (DAS) that detects obstacles and warns the driver in advance of possible collisions in a congested traffic environment using ultrasonic sensor. To manage the project strategically, administratively, legally, technically and commercially providing services of central ETC system. This includes toll transaction clearing house operations, helpdesk support and setting up of call centers for incident management and intelligent transport systems among others. A model has been used for toll plazas with different number of lanes to study the financial value of the benefits due to the ETC deployment. It is also used to study the effect of the traffic flow on the total benefits and recommendation has been made with respect to the time for the ETC deployment.

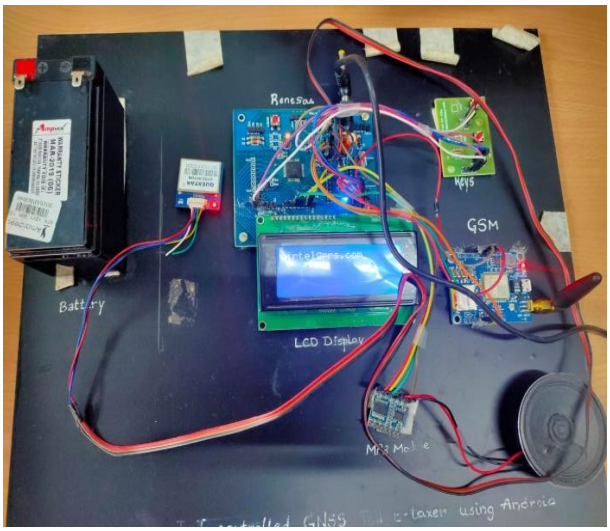


Fig:7.1Toll Plaza Working Model

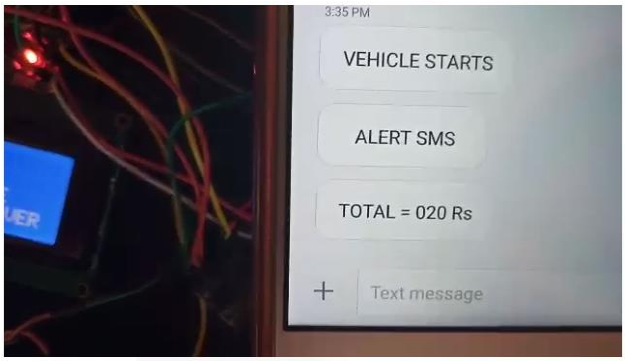


Fig:7.2 Messages Received in Mobile

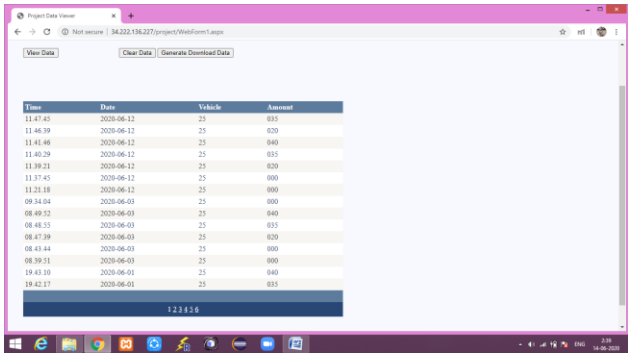


Fig:7.3 Amazon Web Server

VIII. CONCLUSION

The above mentioned technologies are future electronic toll collect systems and have different attributes, pros and cons. For many years DSRC systems have been preferred, due to their simplicity of operation, need road side equipment typically mounted on a gantry, with electronic tags in the vehicles which may be read only, read write or smart card based. The proposed system based on a combination of mobile communication technology (GSM) and a satellite based global positioning system (GPS). An innovative log on unit OBU, which automatically calculate the amount of charge due and take in to account, depends on the type of the vehicle. It will also act like a platform for vehicle identification and prove effective in tracking stolen vehicles. With regard to future expansion and development, the satellite-based toll collection system will be a better solution, especially with regard to flexibility when it comes to extending toll collection to every road category and in terms of cost efficiency in an implementation operation.

IX. ACKNOWLEDGEMENT

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