

Intelligent Toll Path System Using GPS and GSM

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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 PIC Microcontroller, IR transmitter and receiver, 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.

Keywords: IR Transceiver; Global System for Mobile Communication; Global Processing System; Programmable interface Controller 16f877a; Ignition Control;

I. INTRODUCTION

Automation means to reduce the activities of human labour. This means the process handled by the humans will be carried out by the machines once it is programmed such a way that it reduces more amount of time and it decreases the possibility of risk factor. Overview of the toll booth system in late 90s is, around 90th century the toll plazas were controlled manually. Those system requires two people for opening and closing of the gate and another two are for reception of the money also data keeping etc.

Later on, in the year of 1995 the development of Express Highway Systems introduced semi-automatic toll plazas were constructed in which data is stored in computers and operation of gate is automatic. Two persons are required for single toll plaza. Later on, the upcoming project aims in developing the human less toll plazas.

Electronic toll collection is a technology that allows the electronic collection of toll payments. The system has been overviewed by research scholars and applied in various highways and tunnels. It can observe, if the car is registered or not registered and then alert the officers of toll payment violations and debits and participating accounts.

The notable advantage of this technology is the opportunity to reduce the traffic congestion in toll plaza during festive seasons. Also this is a method by which to control complaints from motorists relevant to the inconveniences associated with manually making payments at the tollbooths. Another obvious advantage, this method recognizes the benefit of the toll booth operators.

II. ANTERIOR WORK

The system developed in this study is multitasking system which can be used as toll as a toll path system also it can also be used for vehicle tracking system. The system which is currently running in our country follows each and every vehicle has to wait for them in a queue manner and the person who is responsible for collecting the toll charge has to collect the toll charge in a fast manner. Due to that things it occurs more errors such as manual calculation, Fuel loss and also more delays. so the system which followed now has more errors.

A.NFC Based Toll Plaza System

NFC stands for Near Field Communication. In this method there is a tag placed in vehicle which contains information like vehicle number. the signal continuously passed in the toll gate once the vehicle crossed the toll gate it automatically breaks the signal, suddenly it reads the information from NFC tags and then proceed the toll collection process automatically. After that it sends the acknowledgement to the user. The entire are Processed by ASP.Net

Drawbacks

- ❖ Need more time to Processing
- ❖ More expensive.
- ❖ Short Range communication.

III. PROPOSED APPROACH

Presently, the operating system which we have with us on turnpikes devours less than 3 minutes of result in period to proceed to complete collection process for one vehicle. But our proposed system takes only 30 seconds to proceed their entire collection process also it having additional

advantages that the vehicles moving the same speed without a stop in the toll gate.

In this proposed methodology is highly recommended to reduce the time consumes for the operation due to these advantages, it indirectly produced two or more additional features such as to reduce the fuel consumption because the vehicle never stops in the toll path area also that the component which used in these systems is already installed in the maximum vehicles (GPS Tracking Unit).

The central predominant of this system is to provide a quick and safe conservation manner for toll tax collection and to manage the movement of vehicles in toll stations by Global Positioning System and Global System for Mobile Communications automatically. In this project are having three modules,

- ❖ **Vehicle section:** It consists of Global Positioning System receiver, Global System for Mobile Communications modem and IR receiver and Ignition Control.
- ❖ **Toll Path Section:** It consists of Infra-Red Transmitter, PIC 16f877a.
- ❖ **Central Management Section:** It includes GSM modem interfaced with PC.

PIC microcontroller(16F877A): Programmable interface controller is the central predominant of this system. The fundamental operation behind the controller is to provide transmission between user and vehicle section. Also it interfaced into Infra-red transmitter in toll unit for transfuse the Infra-Red signal to the IR receiver in vehicle section in order to identify the presence of vehicle in that particular location.

GPS Receiver: GPS stands for Global Positioning System. The GPS modem will receive the longitude and latitude positions from the satellite which is used to locate the travelling vehicle.

GSM Modem: GSM is the abbreviation for Global System for Mobile communication. The positions acquired by the GPS receiver will be transmitted to the central management system. From this system, a reply signal or message will be issued once the signal has been matched.

IR Transmitter and Receiver: Infra-Red Signals are used to detect the vehicles which enter the toll gate.

A. TOLL PATH SECTION



Fig.1. Block Diagram of Intelligent TollPath (Toll Path Section)

B. VEHICLE SECTION

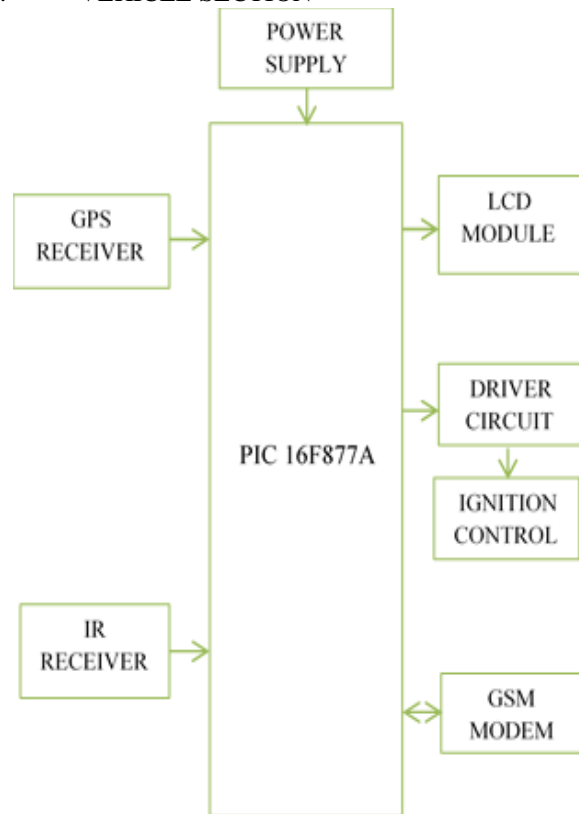


Fig.2. Block Diagram of Intelligent TollPath (Vehicle Section)

C. CENTRAL MANAGEMENT SECTION

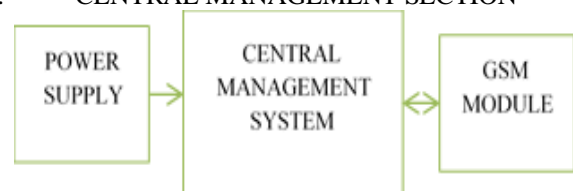


Fig.3. Block Diagram of Intelligent TollPath (Central Management Section)

Driver Circuit: The driver circuit is used to interface the PIC controller and the ignition control system.

Ignition Control: An ignition system is used to generate the fuel mixture for engine ignition. This Ignition control will be able to stop or control this fuel generation which ignites the engine. This happens only if the owner of the vehicle has insufficient balance to proceed.

Central Database System: The Central Database System is used to store the data of the vehicle that has already been registered.

The operation of intelligent toll path is defined below:

Initially, when we ignite the vehicle, the GPS will trigger the system and check the account of the owner. If sufficient balance is available, the vehicle will proceed further. If not, the ignition will automatically stop. The GPS modem will get the latitude and longitude data from

the satellite and stores the information in the PIC controller. The controller will detect the incoming vehicles with the help of IR receiver simultaneously. This acquired information will be transmitted to the Toll tax unit via IR transmitter. Finally, the received data will be sent to the management Centre.

The management system will again verify the received data with already stored data and vehicle ID with the help of GPS. If the data matched, then concern amount will be deduced from the bank account of the vehicle owner. If insufficient amount is detected from the account, the management centre will send a warning message which will stop the vehicle immediately. An authentication message indicating the reason for the vehicle control will be sent.

IV. EXPERIMENTAL RESULTS

The central predominant of this system is to provide a quick and safe conservation manner. The demo model of Intelligent toll path is shown below, and followed by the prototype of Intelligent toll path shown:

Step 1: The PIC Microcontroller checks the status of IR receiver and if the vehicle enters toll tax unit the IR receiver receives the signal from IR transmitter in Toll tax unit.

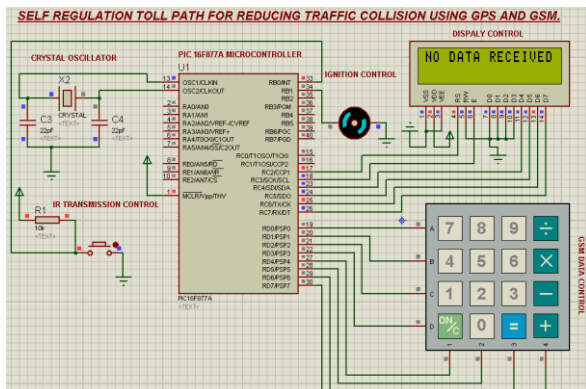


Fig. 4. Receiving signal from toll IR transmitter.

Step 2: The GPS modem receives latitude and longitude of earth from satellite and fed to PIC Microcontroller.

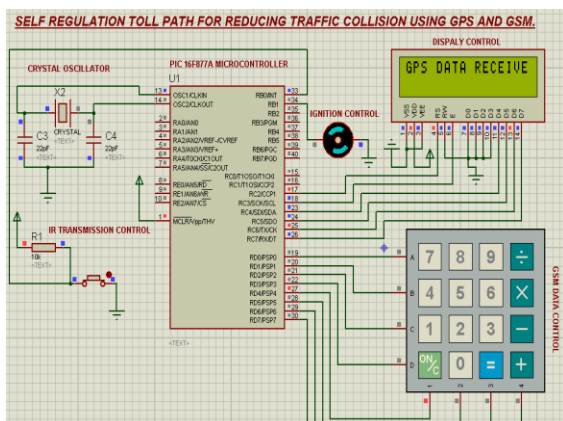


Fig. 5. Getting information from GPS

Step 3: The PIC Microcontroller sends message about vehicle ID and current location to Management centre

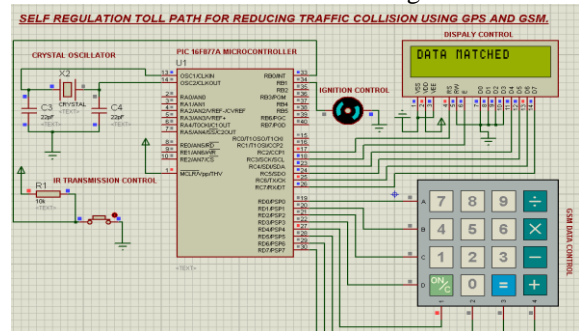


Fig. 6. Processing the acquired GPS data.

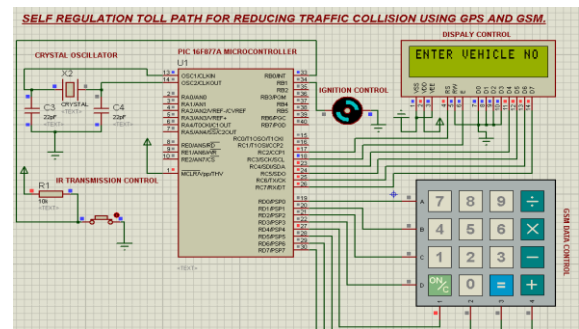


Fig. 7. Sending information to management centre.

Step 4: In management centre after processing the charges will be applied for that vehicle and amount will be reduced from the vehicle owner account.

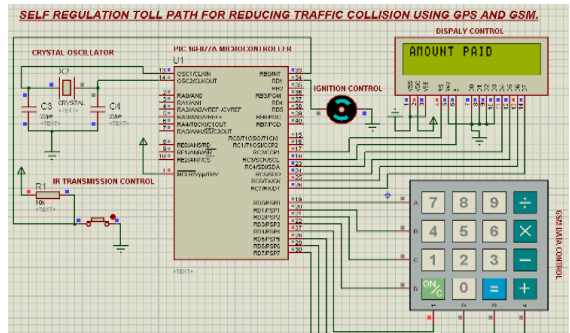


Fig. 8. Detection of amount from user; final output.

Step 5: If the account of vehicle 's owner accounts insufficient means Management centre send message to vehicle using GSM and also instruct to stop the vehicle.

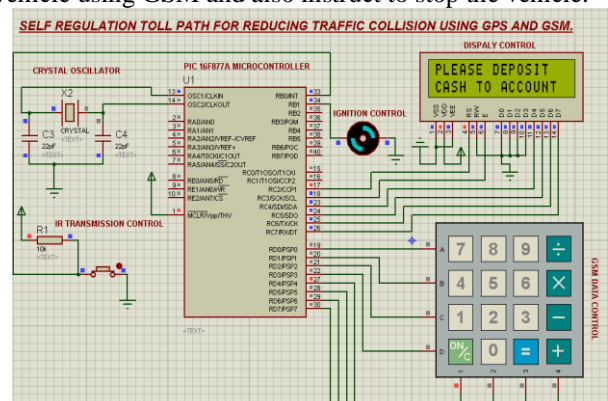


Fig. 9. Insufficient amount intimation.

The Prototype output of Intelligent toll path are shown below:



Fig. 10. Vehicle Section Prototype

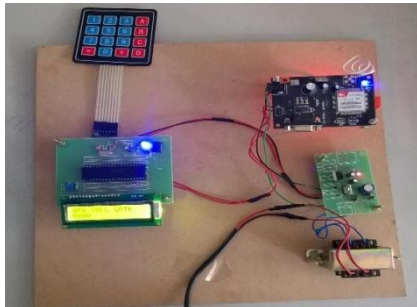


Fig. 11. Management section Prototype

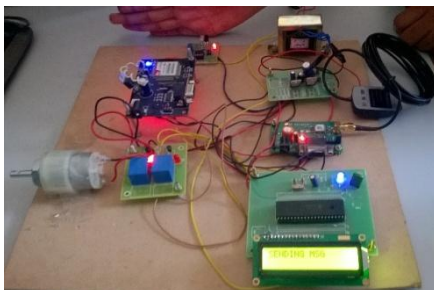


Fig. 12. IR Signal Received



Fig. 13. Payment Acknowledgement

V. CONCLUSION

This proposal of Intelligent toll gate virtually implemented in this project base on the techniques such as global system for mobile communication, Infra-red Transceiver, Global positioning System.

By using this system, we will be able to avoid fuel loss, money loss, reduced time consumption, reduce traffic congestion also able to trace the car immediately during theft occurs.

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BIOGRAPHY



Anandaraj received the B.E. degree in Electronics and Communication Engineering from Paavai Engineering College, Namakkal, Tamilnadu, India and Post Graduate degree in Embedded Systems from Bannari Amman Institute of Technology. His research and academic interests include Communication Engineering and Embedded Systems.