RFID Based computerize Payment of Toll Tax at Toll Plazas and Vehicle Tracking

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Abstract: The automated toll collection system using passive Radio Frequency Identification (RFID) tag emerges as a convincing solution to the manual toll collection method employed at tollgates. Time and efficiency are a matter of priority of present day. In order to overcome the major issues of vehicle congestion and time consumption RFID technology is used. The proposed RFID system transmits a particular ID code as soon as it reaches near the toll station. On receiving the code, processor checks the received code and compares it with the stored code, if the code matches the gates open else they remain closed disallowing the vehicle to pass and the implementation of Toll Gate Automation which is a step towards improving the Tracking & monitoring of vehicles, traveling in predetermined routes. We focus on use of radio frequency identification (RFID) technology for electronic toll collection system and automatic vehicle tracking.

Keywords: Toll Tax, Toll Booths, Automation, RFID, Sensor, Transmitter, Receiver.

1. INTRODUCTION

With the increase in the number of vehicles on road, the task of traffic management becomes more complex. It is hard to keep & maintain the details of the each vehicle, which is running on the road. Also in case of hit –and-run or carrying of illegal goods over inter-state cross boarder or road-robbery cases, the police may not trace the culprits very easily, as the vehicle details are not monitored continuously.[2]. Currently the toll payment system is manual; the drivers are made to use a manual system by which payment is done by cash by hand method to pass across the toll plaza gate. Manual process is very time consuming, the drivers have to wait in row for long time for crossing the toll plaza. During their wait, time and fuel of vehicle is highly consumed. With the introduction of Automatic Toll Tax System the problem of unnecessary fuel consumption will be drastically reduced. Where drivers will not have to wait for cash payment or get a token to cross the toll plaza.

Hence we propose a new automatic system using RFID technology. Suppose The Cargo Company wants to send a message to its On-road vehicle to stop delivering the goods to customer, policeman want to stop a vehicle which is smuggling some illegal goods or city transports want to track each buses details such as departure and arrival time on bus terminal, number of round trips it has undergone in a single day. All this is possible by the use of automated toll gates. This system is intended to help the RTO, Police Department, Public Transport and Cargo Companies to track the vehicles. This system comprises of Toll Gate office having personal computer connected with the receiver and the software to run the "Automation of Toll Gate "system. To implement this system, every vehicle must be fitted with a remote transmitter, hidden behind the number plate of the vehicle. The transmitter continuously sends the number of vehicle on which it is mounted, in coded form. When a vehicle enters the zone of toll office, the sensors fitted on either side of the road, sense and send the signal to the toll office control unit. This micro controller based control unit activates the number plate sensor, which in results receives the number of the entering vehicle [capturing the signal sent by vehicle's remote transmitter] and sends it to computer.

The computer scans its centralized database and displays the details of that vehicle with the current time and date. The details can be: registration number and model number with vehicle's body color, owner's name and address, date of registration, current status-clear or in black listed etc. If the vehicle records show that its current status is clear, then the gate will be opened automatically. Otherwise, the gate will not open and the vehicle owner can be called for further enquiry.

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Frequency Identification (RFID) is an automatic identification technology which uses Radio Frequencies to identify objects remotely. The system does the job of detecting and accounting for vehicles as they pass through tollgate using RFID as the identification technology. The system is a great asset in the transport industry. It reduces the common problems in accounting for the transportation of goods from point to point. This can be the approach that focuses on how radio frequency identification technology can be used to solve problems faced by public at the tollbooths in metro cities. There are, however, disturbing obstacles in the way of widely spread radio frequency identification network deployment. From the proposed systems point of view, this highlights and wipes out the problem of data capturing, storage and retrieval and how event, condition and action rules developed for active databases can help us in managing the huge number of events generated each day at every toll booth in the city. It also highlights how the collected data can be used to complete the toll tax money transfer from the bank account of the person in order to provide better customer service.

2. BACKGROUND AND RELATED WORK

R. M. Hushangabade, S.V. Dhopte[1] proposed that the system is a great asset in the transport industry. It reduces the common problems in accounting for the transportation of goods from point to point. The RFID Automatic tollgate system designed could automatically detect the identities of the vehicles and performed the billing in accordance to the identity of each vehicle as prerecorded in the database. The system could automatically inform the owners of the vehicles. These were the major achievements met in the paper, among other objectives also achieved which include tracking of the vehicles and remote database connection.S.Nandhini1, P.Premkumar[2] proposed that proposed of the automatic toll tax payment system and the amount transaction information sends to the cell phone of the motorists through the GSM modem technology.

It is an innovative technology for expressway network automatic toll collection solution. In this paper, the frame composing and working flow of the system is described and data information is also easily exchanged between the motorists and toll authorities, thereby enabling a more efficient toll collection by reducing traffic and eliminating possible human errors.Cao QuocHuy[3] focused on a Line follower robot is a mobile machine that can detect and follow line which is drawn on the floor.Siuli Roy, Somprakash Bandyopadhyay1 Munmun Das ,Suvadip Batabyal , Sankhadeep Pal[4] proposed to design as mart and fully automatic system that will detect the congestion in real time, and subsequently manage it efficiently to ensure smooth traffic flow with the use of Active RFID devices.Khalid Al-Khateeb, Jaiz A. Y. Johari proposed that RFIDtraffic control avoids problems that usually arise with standard traffic control systems, especially those related to image processing and beam interruption techniques.

3. RESEARCH METHODOLOGY

In this paper, what I have tried to put forward is the radio frequency identification toll system based on Radio Frequency Identification Technology. It can achieve the collection of charges without stopping the vehicle running in high speed for a very long time. Also authentication of the vehicle can be done by browsing the data stored in the central database and comparing it with the unique ID given to each vehicle. The concrete operations are as follows: It is required to install hardware equipment at each highway toll station, namely, reader, controller, data transmission unit, remote non-contact charging machines, bank payment gateway and other facilities in the control room of toll station, installing structure for mounting of reader mechanism and installing alarms and other devices is to realize automatically that the tag is passed in the region of the magnetic field produced by the RFID module and a beep sound is produced signaling its detection.

The RFID module needs to be configured with certain communication parameters. This can be done using the given Specific instructions and can be achieved by using the Dummy Prototype Application or an independent developed application. Each vehicle will be provided with an RFID tag containing a unique ID. This tag will continuously emit RF signals. When the vehicle will reach at the toll booth the RF receiver will detect these RF signals. The signals areamplified and are passed to microcontroller. This microcontroller will display the id on a displaying device which will be provided in tool-station.
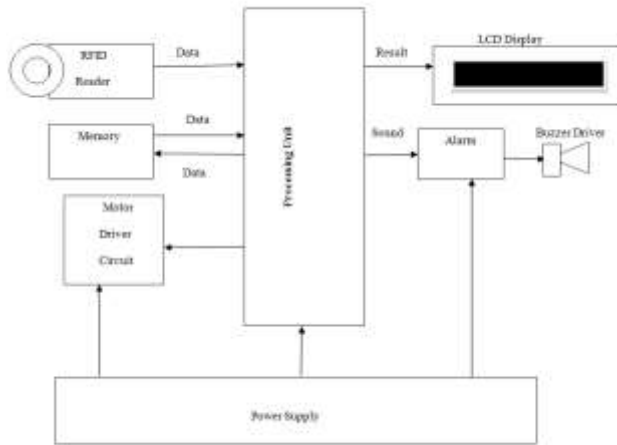
Fig: Basic Block Diagram of Automatic Toll Tax System

Flow of System:-

- Vehicle comes to a toll plaza.
- System will check the details of vehicle.
- There will be an automatic payment made by the system with the registered details.
-

When the vehicle is going to enter into the toll plaza, the first aim is to validate the vehicle for its authenticity. For that purpose it has to first pass through the IR Transmitter -Receiver gate. Then we have here the RFID system. The system will automatically detect a tag which is stuck to the front glass of the vehicle the (windshield). This gathered data will be compared with a database stored in the system. If the data is matched with the stored data automatically system will act and takes money from his registered account.

4. SYSTEM IMPLEMENTATION

Receiving end

This system is designed to automatically open the toll gate whenever there is registered vehicle with in the Toll Gate Zone. The figure below shows the receiver end of the system.
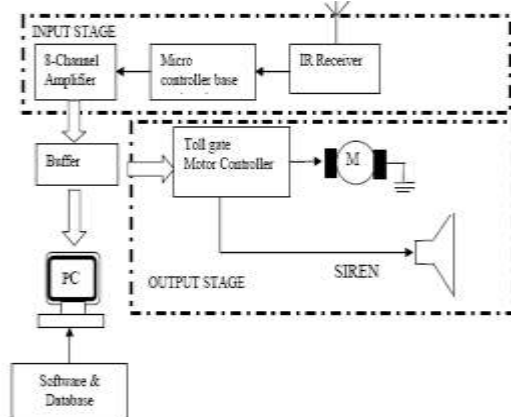

Fig: Receiver end of automation of toll gate.

The infrared signal (which contains the vehicle's registration number in RC-5) transmitted by the moving vehicle is received by the IR receiver. TheRC-5 coded vehicle registration number is decoded using micro-controller IC. The micro controller IC inherits a smart RC-5 decoder program, which is capable of decoding all the RC-5 signals. This ICs ends the decoded signal to the driver stage. channel amplifier provides the amplification to the 8channel received IR signal.
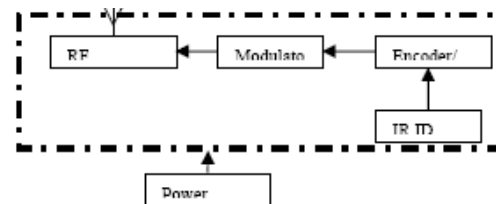
Transmitting End

Fig: Transmitter end automation of toll gate.

IR ID chip is the heart of the IR transmitter, as it contains the vehicle's registration number. Every IR transmitter fitted besides the number plate, is implanted with one IR ID chip which stores the vehicle's registration number. This output is further encoded for security reason. After the encoding, theRC-5 encoded signal is fed to the multiplexer, this in result sends the encoded signal to the modulator for frequency modulation to prepare the signal for transmission. Every vehicle which moves on the road has this RF transmitter besides its number plate. This transmitter continuously transmits the radiofrequency signal towards its moving direction through the antenna.

5. APPLICATIONS AND DEVELOPMENTS

This system can be use to keep track of certain important details of the vehicle such as time of arrival and departure of the vehicle, number of roundtrips each vehicle has made, the route taken between source and destination and can be used to trace the stolen vehicle.

• This can be extended to handle more number of vehicles, as the number of registered users may increase.

• The present set up in most countries is that, only one vehicle passes the toll gate at given time and the vehicles enter the tollgate in a queue. Sophisticated setup can be built where in two or more vehicles can enter a toll gate at a time and still the system recognizes the valid users and differentiates the vehicles which are entering the toll gate parallels. This increases the complexity of the entire system but at the same time increases the traffic handling capacity and saves time.

• The ID of the vehicle can be made more sophisticated to increase the security and reducing the risk of tampering.

• The toll operators collect money only from the un-registered users and hence the amount of liquid cash collected in the tollgate is lesser. This reduces the risk of losing more money in case of theft of the toll collecting office on the highway.

• GPS receivers can be used to get the current geographical position of the vehicles. Various sensors can be used to monitor critical parameters like engine oil level, temperature level etc.

6. CONCLUSION

In this paper focus"Automation of Toll Gate and Vehicle Tracking" using micro controller and RFID technology has been presented. By adapting this technology, various applications like Traffic Management Process, Vehicle Movement Tracking and Stolen Vehicle Detection could be implemented. The proposed system will be an automated model which will give a guarantee on collected funds will have some transparency. As the system is developed with the help of some high end applications which provides easy and fast processing.

7. FUTURE ENHANCEMENT

Vehicle number plate recognition and Aadhar card Linked with Vehicle Number and driving license :

A vehicle's number/license plate recognition algorithm is based on the very elementary technique of Templates matching. The algorithm takes an input image of the number plate (number plate should be dominant in the image) and after filtering the image, it performs region based operations. Then it tries to capture the characters regions in a processed binary image and with the aid of template matching outputs the string of number plate characters.

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