Automatic Toll Gate System Using Advanced RFID and GSM Technology

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ABSTRACT: Most Electronic Toll Collection (ETC) systems around the world are implemented by DSRC (Dedicated Short Range Communication) technology. The concept proposed is of 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.
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KEYWORDS: Radio Frequency Identification, Global System for Mobile communication, Peripheral Interface Controller.

I.INTRODUCTION

Any structure, building or system needs maintenance and rehabilitation, which are of course costly. Highways and roads are also not an exception. From the very past, the construction, extension, maintenance and operating costs of highways, roads, bridges and tunnels were collected directly or indirectly[1]. In the old indirect method[2], the expenses are compensated either by the tax payment for fuel or by budget allocation of the national income. The shortcoming of this method is that a number of taxpayers, who do not use any of the roads and carriageways, 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. The other three main reasons why tolling, or road pricing, is implemented are the The advances in the technologies related to wireless communication has led to the emergence of several engineering designs to aid the human requirements. Today on one side the importance for secured access is growing in several fields and on the other side with technology advancements the RFID cards and readers are becoming low cost. Both these aspects are the primary reasons for rapidly growing RFID based authentication system. Today, several wireless technologies are used for building wireless networks. Among them the 2.4GHz wireless network is most widely deployed and used. The wide usage of 2.4 GHz wireless communication indicates that this infrastructure can give near real time responses and makes suitable for crucial industrial systems. Global system for mobile communication is that it is an international standard. If you travel in parts of the world, GSM is the only type of cellular service available.

Implementing mobile communication based health monitoring via short message service (SMS). Simple wireless control device to achieve the targets, or use the GSM network technology to achieve. Nevertheless, the functions of these devices are too simple to prevent the vehicle theft crimes from happening, furthermore, their burglarproof methods are not only character. 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. So in order to stop all these problems and inconvenience, we introduce an automated or a more convenient way of collecting the toll and traffic management. It's called Electronic Toll Gate Stations using RFID Technology.

II.RELATED WORKS

Jones.A.K and Hoare.R.R (1986) had proposed the toll collection or tax collection is the one of the source for the Government and maintenance of Road.
This paper of tax payment system will be an advantage for the government and this system will be monitoring the vehicles which are crossing the gates. This is the first system has been implemented then only accidents has been reduced.

Bean Michal (1994) had proposed the system of tool collection established in England and Wales from about 1986 in responded to the need for better road way. The trusts were ultimate response for the maintenance and improvement of most of the main roads in England.

Don.F (1990) had proposed this system he used the technique of tax collecting system which is the earliest system for tax collecting and here advantage of this system is to collect the tax ordered by the processor and the demerits is of the higher time consumption. The authors present a high-rate lossless wireless sensing the platform.

Edwin.G(2000)had proposed this technique in street by road side commercial store and done by user but not for public .Then after it become good result and implemented in to highway roads.

Finkenzeller.K (2012) had proposed his technique was implemented for reducing time to waiting in toll gate. And also it is very secured. Data feed system also having to use store customer data's.

Gabriel.N and Mitraszewska.I (2010) had proposed the technique implemented here is RFID Based Payment System to reduce the time consumption and easy access of the system, here the money transfer can be done by this method.

Hitachi.S (2011) had proposed the processor implemented here ARM -7 Processor by the ARM-7 the processing of the details of the vehicle has been developed and the time taken is reduced to a great extent.

Jerry.L and Barbara.C (2005) had proposed the technique used is of Smart Card Based Toll Gate Automated System which enables the user to access the system, toll booth in less time and a maximum of human effort is needed.Data produced from wireless sensor network deployments lacked the measurement quality and data set richness associated with previous cable-based test programs, thereby limiting the perceived role of wireless sensors in advanced structural health monitoring.

King Seong Leong (2005) had proposed the technique implemented is of Laser Technology by this technique the process time has been reduced to an higher extent. To construct an historic vibration database, periodic real-time transmissionof vibration measurements would be required, but only at a very low duty-cycle. Limiting the use of the radio transceiver, which accounts for the largest power consumption of the device, reduces the average current consumption to a level that is sustainable with a combination of AA batteries and a piezoelectric generator.

III.PROPOSED METHOD

The proposed method is to provide a fast and safe environment for toll collection and to automatically control the vehicle movements at the toll stations. The Capacitive Sensor used here to sense the vehicle size.IR sensor is used to detect the vehicle and the Gate models are used here to open and close while the vehicle is entering or exit in the Toll Tax unit. The RFID reader is used to read the tag of the vehicles. The Vehicle information is stored in the microcontroller based on the TAG number.

Based on that number the Tax amount for that vehicle will automatically transfer to the toll gate system. And that cost information will be sent through GSM modem to a mobile phone of the owner. The status of the vehicle will be displayed in the LCD. The main objective behind this proposal is to create a suitable Automatic Toll Gate System to be implemented. This system uses IR technology, making it very vulnerable to failure. Other than that, users also have to

bear the high cost of owning the two-piece tag required for this system. However, this proposed system requires major changes in the infrastructure of the existing toll roads.
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III.SYSTEM ARCHITECTURE
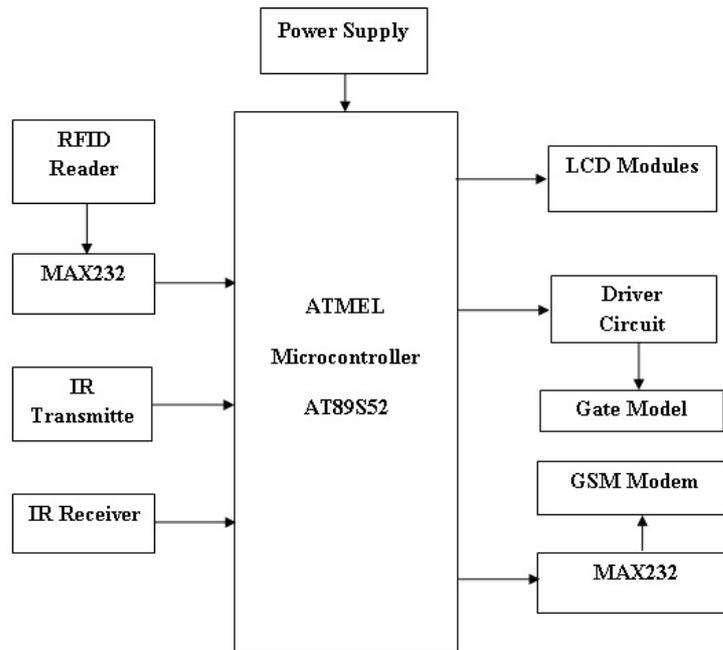
Fig. 1 Architecture of Proposed System

Fig. 1 shows the architecture of the proposed system. When the vehicle is going to enter into the toll plaza, the first aim is to detect the type & no. of the vehicle. For that purpose, it has to first pass through the IR transmitter - receiver gate. Then we have here the RFID system. In this system the tag is detected by the RFID reader & the data is matched with the database provided at every toll booth. When further vehicle is going towards the Load cell plate it has to pass through the IR transmitter - receiver gate.The RFID data is stored on tags which respond to the reader by transforming the energy of radio frequency queries from the reader (or transceiver), and sending back the information they enclose. A computer hosting a specific RFID application pilots the reader and processes the data it sends. The ability of RFID to read objects in motion and out of the line-of-sight is its major advantage. The tags can be read under harsh conditions of temperature, chemicals and high pressure.

RFID has the potential to change an organization's ability to get real time information on the location of asserting and even personnel. The use of RFID technology reduces operational costs by reducing the need for human operators in systems that collect information and revenue collection. In manufacturing, a tagged product or part can be traced and this gives better visibility and the bottlenecks in automated manufacturing processes can be easily identified.The technology can also be used in toll collection at toll gates and this enables the tracking of vehicles as well as the goods they carry, in real time. Location tests prove that RFID is the best technology for tracking items in motion. The technology enables remote storage and retrieval of data and this is why developments towards wireless identification point towards low-bandwidth systems like RFID.

IV. CIRCUIT MODULES OF THE PROPOSED SYSTEM

RFID SYSTEM : An antenna used to scan the cards and an transceiver with a decoder to interpret the data. Transponder - the RFID tag are available in which the data has been programmed with information. The scanning antenna puts out radio-frequency signals in a relatively short range.

RFID TAG : An RFID tag is a microchip combined with an antenna in a compact package; the packaging is structured to allow the RFID tag to be attached to an object to be tracked. "RFID" stands for Radio Frequency Identification.The tag's antenna picks up signals from an RFID reader or scanner and then returns the signal, usually with some additional data (like a unique serial number or other customized information). RFID tags can be very small - the size of a large rice grain. Others may be the size of a small paperback book.

IR TRANSMITTER AND RECEIVER : The IR Transmitter Receiver gate we are using in our project to detect the exact location & position of the vehicle on the load cell plate. Because one problem with load cell plate is that it is unable to weigh the moving object.The IR transmitter is continuously emitting the IR rays towards the IR receiver. When the vehicle is going to come across the gate the rays are deflected from the vehicle & IR receiver doesn't get any signal.Here for IR transmitter we are using IR LED's. The IR transmitter we may design in our home by just connecting desired value of resistance in +ve arm & another is grounded. The IR receiver has three pins i.e. 5V supply, GND. Line, signal line.

GSM SERVICES : In radio spectrum is a limited resource shared by all users, a method must be devised to divide up the bandwidth among as many users as possible. The method chosen by GSM is a combination of Time- and Frequency-Division Multiple Access (TDMA/FDMA). The FDMA part involves the division by frequency of the (maximum) 25 MHz bandwidth into 124 carrier frequencies spaced 200 kHz apart. One or more carrier frequencies are assigned to each base station. Each of these carrier frequencies is then divided in time, using a TDMA scheme. The fundamental unit of time in this TDMA scheme is called a burst period and it lasts 15/26 ms (or approx. 0.577 ms). Eight burst periods are grouped into a TDMA frame (120/26 ms, or approx. 4.615 ms), which forms the basic unit for the definition of logical channels. One physical channel is one burst period per TDMA frame.

SWITCHING SYSTEM :
Message Center (MXE): The MXE is a node that provides integrated voice, fax, and data messaging. Specifically, the MXE handles short message service, cell broadcast, voice mail, fax mail, e-mail, and notification.

Mobile Service Node (MSN): The MSN is the node that handles the mobile intelligent network (IN) services.

Gateway Mobile Services Switching Center (GMSC): A gateway is a node used to interconnect two networks. The gateway is often implemented in an MSC. The MSC is then referred to as the GMSC.

GSM interworking unit (GIWU): The GIWU consists of both hardware and software that provides an interface to various networks for data communications. Through the GIWU, users can alternate between speech and data during the same call. The GIWU hardware equipment is physically located at the MSC/VLR.

V. RESULT AND DISCUSSION

Fig. 2 shows the circuit module of proposed system which comprises of ATMEL microcontroller, RFID reader, IR transmitter and receiver and GSM switching systems.
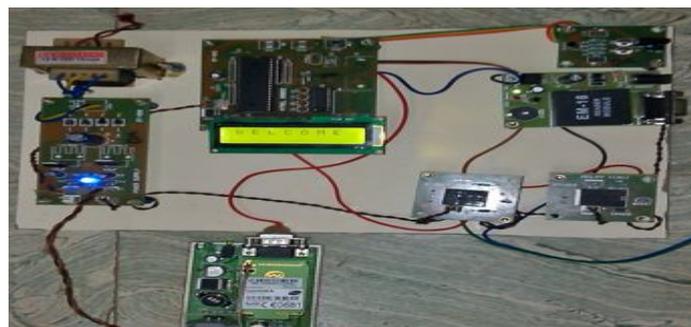
Fig. 2 Circuit module of Proposed System

The Circuit module of 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 open and close the gate as well as automatically emailing the owners of the vehicles. These were the major achievements met in the project, among other objectives also achieved, which include tracking of the vehicles and remote database connection. However the proper demonstration of some of the objectives did not yield to the wanted extent due to lack of resources.
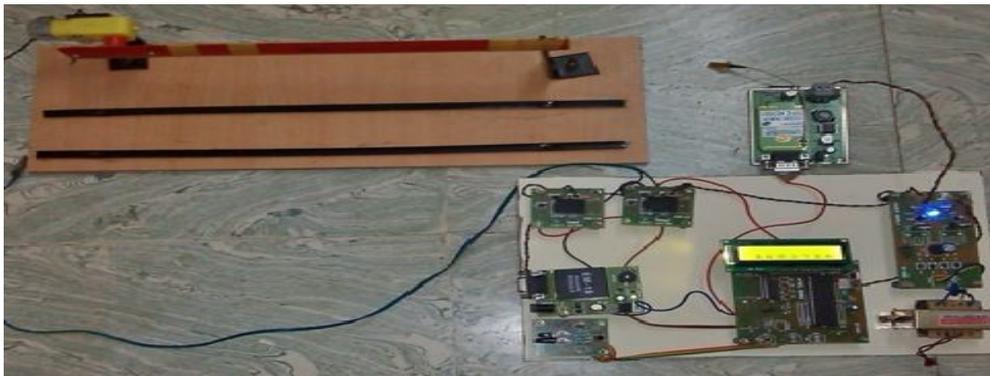
Fig. 3 Gate Module of Proposed system

Fig. 3 shows the gate module of proposed system where it comprises of 89C51 oscillator, IR Reciver, timer, visitor location register,GSM Switching systems, LCD and RFID reader. The RFID reader is used to read the tag of the vehicles. The Vehicle information is stored in our microcontroller based on the TAG number. Based on that number the Tax amount for that vehicle will automatically transferred to the toll gate system. And that cost information will be send through GSM modem to mobile phone of the owner. The status of the vehicle will be displayed in the LCD.

VI.CONCLUSION

The automation of toll plaza can have the best solution over money loss at toll plaza by reducing the manpower required for collection of money and also to reduce the traffic indirectly resulting in reduction of time at the toll plaza. In this project, the technique such as Radio Frequency Identification is introduced. This technique will include the RFID tag & reader, which in coordination with each other can be used to detect the vehicle identity.The IR Transreceiver is used for detecting the presence of the vehicle at different locations which will act as the gate pass to the toll plaza. By effectively utilizing these three techniques at different stages of this project is able to represent the automation in toll plaza which will reduce the complete processing time by few seconds, which is very important as well as it helps to reduce money leakage in a very cost effective manner.

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BIOGRAPHY

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