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Review Article

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. To propose a concept of automatic toll tax payment system and the amount transaction information send 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 project, the frame composing and working flow of the system are the described data information are also easily exchanged between the motorists and toll authorities, thereby enabling a more efficient toll collection by reducing traffic and eliminating possible human errors.

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. In the older indirect method, the expenses are compensated either by tax payment on fuel or by budget allocation from the national income. The shortcoming of this method is that a number of tax payers, who do not use some 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 listed below. 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 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 world, GSM is 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

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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.

LITERATURE SURVEY

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 transmission of 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.

Khali.P and Michael.C.W (2009) had proposed technique implemented here is Electronic Toll collection which is introduced and an obvious advantage of this technology is the opportunity to eliminate congestion in tollbooths especially during festive seasons. To enabling a toll gate system by using Ratio Frequency Identification method for easy way of model toll.

Lauren.K and Mariko.B (2002) had proposed the technique used is of E-Pass and Transcode System by the process available the system has been developed to produce an easy access for the vehicle at the toll booth and the more human effort is needed which is an demerit of this system .Strain transducers could serve as the primary asset for health indication through schedule-based experimental load ratings to assess structural deterioration and determine up-to-date structural capacity.

Manish Buhptani and Shahram Moradpour (2010) had proposed technique used Passive RFID Technology.The introduction of the RFID technology has been done in this process. By the RFID technique the processing of the vehicle is easy and human effort is reduced to a far extent.

Manishanma and Firedwales (2005) had proposed the developing Radio Frequency Identification Systems. This having field guide of details. so the passengers detail will maintained easily.

Rahman (2008) had proposed technique implemented here is Fuzzy Logic Technology by this logic the coding system has introduced so the security for the system has been developed and so the processing speed been reduced.

Raj Bridgeall (2013) had proposed the technique implemented here is Cloud Based Security System by this system the processing time has been reduced to very low and the sharing of the data is been implemented here and the loss of data is an demerit of this system.

Stephan (1999) had proposed the technique first method for generating toll collection then despite the simplicity of the sensor node hardware, WSN applications are diverse and demanding. Infrastructural support for WSN applications in the form of operating systems (OS) is becoming increasingly important.

Teauax (2003) had proposed the implemented technique is the advanced toll plazas for toll plaza advanced Many active tags have the practical ranges of tens of meters and a battery life of up to several years. RFID is a method of remotely storing and retreiving data using devices called RFID tags. An RFID tag is a small object, such as an adhesive sticker, that can be attached to or incorporated into the product. RFID tags contain antennae to enable them to receive and respond to radio frequency question from an RFID transceiver.

Venus.M, Dindoo (2000) had proposed system the toll collection method and fees for tax to collected in every vehicles. And some toll gate system advanced fees so only to

common fees for all tolls tax path that required more toll plazas.

William's (1996) had proposed system that technique the RFID Automatic toll gate system can automatically detect the identities of the vehicles, reading items in motion and tracking of the vehicles can be done accurately using RFID. At first the system may seem like very costly but after a year of the system implantation high benefits will be obtained as it will lead to lower operational costs and increased revenue generation.

Xeans, Beam.B (2002) had proposed system Reader collision occurs when the signal from two or more readers overlap. The tag is not able to respond to simultaneous queries. Systems must be carefully setup to avoid the problems. Tag collision occurs when many tags are present in the small area; but since the read time is very fast, it is easier for vendors to develop system that ensure that tags respond one at a time.

Proposed Method

The purpose of the paper 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 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. 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. When the vehicle is going to enter into the toll plaza, the first aim is to detect the type & no. of the vehicle.

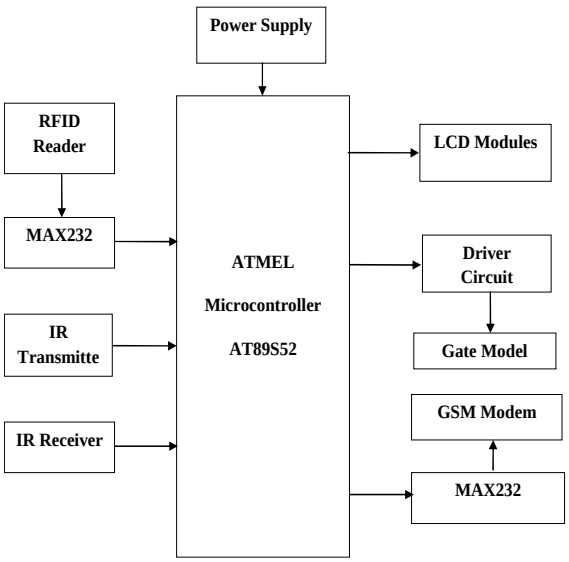

Fig no. 1 Block Diagram of Project

For that purpose it has to first pass through the IR transmitter - receiver gate is shown in fig 1. Then we have here the RFID system. In this system the tag is detected by the RFID reader & the data is matched with the data base 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 asserts and even personnel. The use of RFID technology reduces operational costs by reducing the need for human operators in systems that collect information and in 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 done 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 and the corresponding flow chart is shown in fig 2.

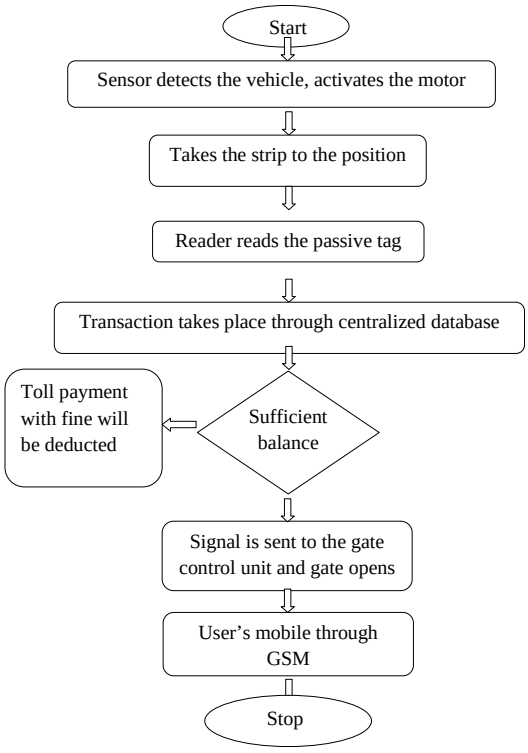

Fig no.2 Flowchart for proposed method

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. It provides a means of communicating with the transponder (the RFID tag) and It provides the RFID tag with the energy to communicate (in the case of passive RFID tags).This is an absolutely key part of the technology; RFID tags do not need to contain batteries, and can therefore remain usable for very long periods of time (maybe decades). The scanning antennas can be permanently affixed to a surface; handheld antennas are also available. They can take whatever shape you need; for example, you could build them into a door frame to accept data from persons or objects passing through. When an RFID tag passes through the field of the scanning antenna, it detects the activation signal from the antenna. That "wakes up" the RFID chip, and it transmits the information on its microchip to be picked up by the scanning antenna. 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.

GSM Technology

GSM provides recommendations, not requirements. The GSM specifications define the functions and interface requirements in detail but do not address the hardware. The reason for this is to limit the designers as little as possible but still to make it possible for the operators to buy equipment from different suppliers. The GSM network is divided into three major systems: the switching system (SS), the base station system (BSS), and the operation and support system (OSS).

Switching System

The switching system (SS) is responsible for performing call processing and subscriber-related functions. The HLR is a database used for storage and management of subscriptions. The HLR is considered the most important database, as it stores permanent data about subscribers, including a subscriber's service profile, location information, and activity status. When an individual buys a subscription from one of the PCS operators, he or she is registered in the HLR of that operator. The MSC performs the telephony switching functions of the system. It controls calls to and from other telephone and data systems. It also performs such functions as toll ticketing, network interfacing, common channel signaling, and others. The VLR is a database that contains temporary information about subscribers that is needed by the MSC in order to service visiting subscribers. The VLR is always integrated with the MSC. When a mobile station roams into a new MSC area, the VLR connected to that MSC will request data about the mobile station from the HLR. Later, if the mobile station makes a call, the VLR will have the information needed for call setup having to interrogate the HLR each time. A unit called the AUC provides authentication and encryption parameters that verify the user's identity and ensure the confidentiality of each call. The AUC protects network operators from different types of fraud found in today's cellular world. The EIR is a database that contains information about the identity of mobile equipment that prevents calls from stolen, unauthorized, or defective mobile stations. The AUC and EIR are implemented as stand-alone nodes or as a combined AUC/EIR node. All radio-related functions are performed in the BSS, which consists of base station controllers (BSCs) and the base transceiver stations (BTSs).

***Atmel Microcontroller* (AT89S52)**

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

RESULT

Fig 3 Circuit Module

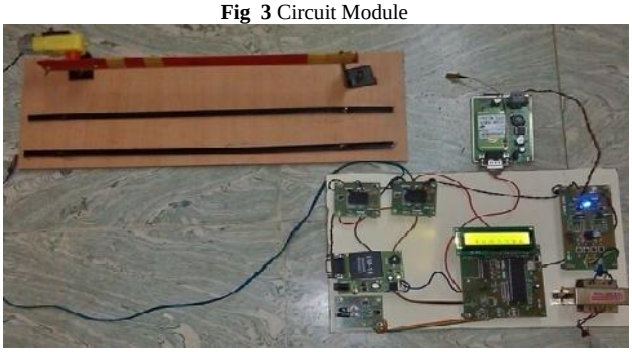

Fig 4 Gate Module

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 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 proper demonstration of some of the objectives did not yield to the wanted extent due to lack of resources for example remote database connection needed a pre-set Virtual Private Network and automatic synchronizing software which was not readily available. Reading items and

objects in motion can be done accurately using RFID.A system developed with a log in windows enables security and the overall cost of implementing the system may seem high but after a year of running the system, very high benefits will be realized. The whole system is very convenient and saves much on time. However when there is no reliable source of power the system just becomes a white elephant and is of no use unless if a solar power supply is installed on site. This decreases reliability of the system and incurs extra costs on unplanned workforce coming to manually collect the revenue, in which case they will most likely start looting money is shown in fig 4 & 5.

CONCLUSION

The automation of toll plaza can have the best solution over money loss at toll plaza by reducing the man power required for collection of money and also to reduce the traffic indirectly resulting in reduction of time at 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 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. In future, the power can be generated by using piezo electric method. Pressure sensors and IR sensors can be installed in addition to this model to collect more tolls from heavy vehicles and multiple lanes for cash and prepaid tolls for vehicles coming from other state. For security and location of the Vehicle GPS can be implemented. Then solar plants can be implemented for reduction of power consumption.

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