RFID and GSM Based Automatic Toll Collection System Using LPC 2148 Controller

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ABSTRACT

In the developing countries many crimes are happening at the highways and bridges. In this paper we have introduced a security feature which can resist the occurrence of those crimes. However, this system is based on RFID (Radio Frequency Identification) technology which replaces the traditional manual tolling system. In the existing automated tolling system RFID reader only detects the RFID card to deduct the toll amount according to the vehicle types. In our integrated system if the authority wants to block a certain type of vehicle or a specific vehicle, it can be done at the toll booth area. For this, a simple code text is sent to the system using GSM module and then the vehicle is blocked by not lifting the barrier even after deduction of the toll amount from the vehicle owner's prepaid based account. In addition, this can also be done to block all the vehicles at the toll booth area in the bridges in case of emergency

INTRODUCTION

In the developing countries we have seen a lot of crime happening at the bridges and highways. Specially, during evening and midnight many occurrence like- hijacks, murders etc. are commonly taking place.

However, those criminals easily get escaped from the crime zone and victims lose their valuable assets including cars, jewelries etc. Although the presence of police, sometimes it gets difficult for them to identify the right vehicle and stop it for the checking. Most of the cases those vehicles pass the toll booth area by giving toll amount and no one can identify the criminals. To avoid those problems we have built an advanced security system which is integrated with the automated RFID based tolling system. This system will not let the criminals pass the toll booth area even after paying the toll amount. Thus, the crime rates at highways and bridges can be reduced. The overall system is user friendly, fast responsive and convenient for the developing countries. By implementing this system in the highways and bridges, primary steps can be taken to resist a criminal or any sort of crime. As the data of each vehicle owner should be recorded in the database previously, so when any information of that vehicle owner is needed by the authority or police, it can be easily found from the database to ease the investigation process. We have analyzed many research works regarding automation of toll collection system to replace manual toll collection system. Manual toll collection system is unreliable, time conswning and it creates traffic congestion. Researchers modeled automated tolling system on the basis of RFID technology using different

types of microcontrollers and sensors. Prepaid based toll deduction is introduced which can reduce hwnan labor and also ensure secured transaction process. Moreover, RFID based security and access control system in confidential areas has been introduced previously.

We have seen RFID card punch system in hostels, medical centers and offices to restrict the entry of general people. We aimed to combine those ideas and introduce something new which can be implemented at the highways and bridges to ensure security.

GSM MODEM

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz.

RFID READER

A RFID reader is a network connected device (fixed or mobile) with an antenna that sends power as well as data and commands to the tags. RFID systems allow the unique identification of items [1][5] or any other products which allows tracking of individual items throughout the supply chain. In our system, RFID reader is used to detect the RFID tag attached to the vehicle. The reader used in our prototype can read RFID tag within 3.5 cm. However, for the real time model we will use more powerful reader which can detect the RFID tag from a longer distance.

RFID TAG

Radio-Frequency Identification (RFID) is the use of radio waves to read and capture information stored on a tag attached to an object. In RFID system, every individual item is equipped with an inexpensive and small RFID tag. The tag contains a transponder with digital memory chip. An antenna packaged with a transceiver and decoder emits a signal activating the tag so that it can read and write data into it. When RFID tag passes through the reader zone, it detects the reader activation signal . For our prototype five different active RFID tags are used for identifying five types of vehicle

PROPOSED SYSTEM ARCHITECTURE

The system is a compact hardware system which starts when a vehicle enters in the toll booth area. Then vehicle identification is done by detecting the value of the RFID tag which is attached to the vehicle. However, this identification is done by using RFID reader which is placed at the toll collection booth. If it founds valid tag, the overall process moves further. Moreover, the weight of the vehicle is measured by using FSR (Force Sensitive Resistor). The calculation of the toll charge is done in the database where the toll amount is predetermined according to the vehicle type.For truck or cargo which carries extra weight, the calculation is done by using a formula or method. Then the toll charge is debited and credited from the vehicle owner's prepaid based account. Required information about the account, like-account number has to be recorded in the system database prior. A confirmation SMS will also be sent to the vehicle owner's mobile number via GSM module. After that the servo motor will rotate and lift the barrier to pass the vehicle if access permission is not blocked by the authority.

To control the barrier for security purpose, we have used a text message with the help of GSM module. The code text format to block the system is given below:
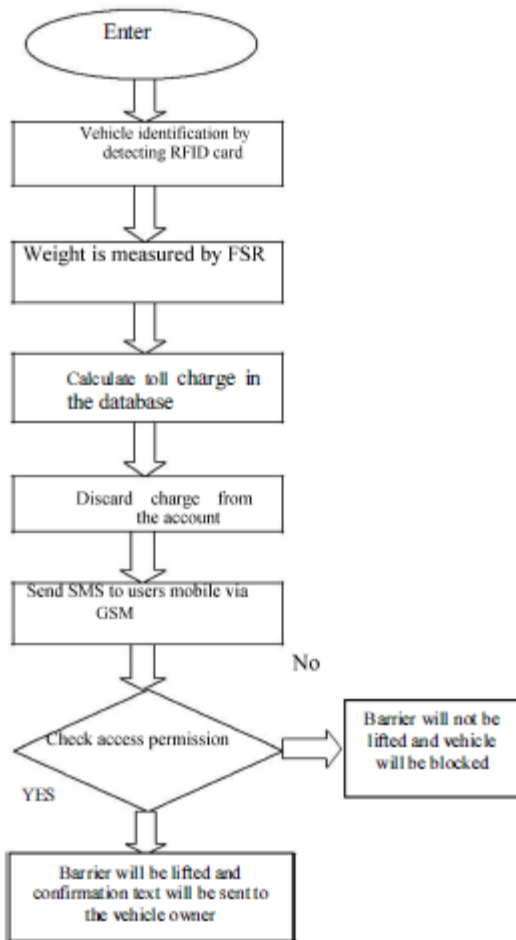

Fig 1. Entire system flow chart

Entire System Flow Chart

RESULTS SUMMERY

Embedded Systems

An embedded system can be defined as a computing device that does a specific focused job. Appliances such as the air-conditioner, VCD player, DVD player, printer, fax machine, mobile phone etc. are examples of embedded systems. Each of these appliances will have a processor and special hardware to meet the specific requirement of the application along with the embedded software that is executed by the processor for meeting that specific requirement. The embedded software is also called "firm ware". The desktop/laptop computer is a general purpose computer. You can use it for a variety of applications such as playing games, word processing, accounting, software development and so on. In contrast, the software in the embedded systems is always fixed listed below, Embedded systems do a very specific task, they cannot be programmed to do different things.

Embedded systems have very limited resources, particularly the memory. Generally, they do not have secondary storage devices such as the CDROM or the floppy disk. Embedded systems have to work against some deadlines. Embedded systems are constrained for power. As many embedded systems operate through a battery, the power consumption has to be very low. Some embedded systems have to operate in extreme environmental conditions such as very high temperatures and humidity.
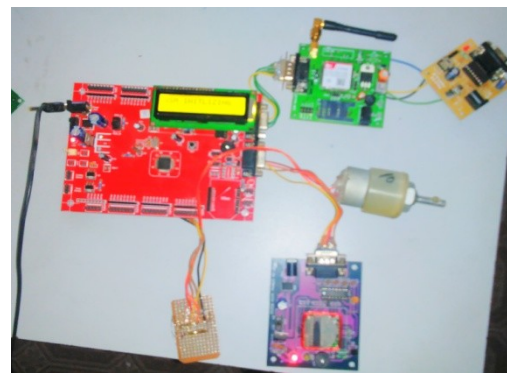
LPC 2148 BOARD
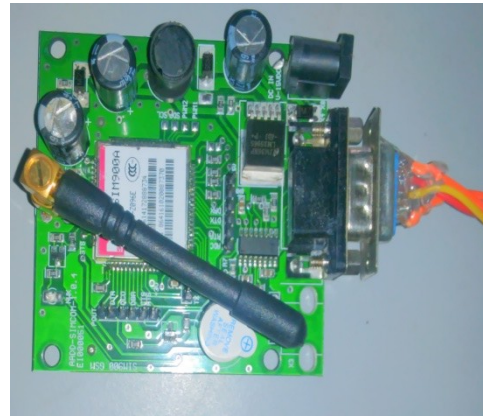
GSM MODULE
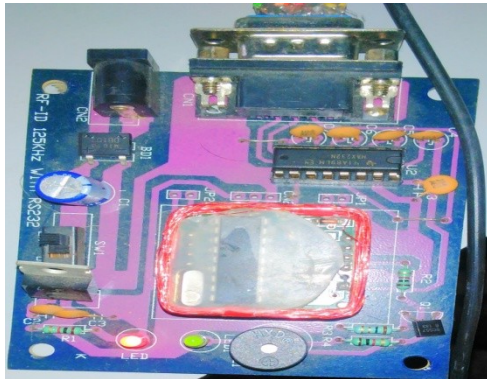
RFID MODULE

TOTAL CIRCUIT

In our demonstration we wanted to block the RFID card which was registered in our database system as 'car'. So we sent a text message writing 'Block Car' to the system and then the LCD showed 'Car Blocked' and barrier was not lifted.

Then again we wanted to block the total system so that no vehicle can pass the toll booth area. For this we used the format of the SMS "AII<space>Block" and sent a message to the system. After receiving the

SMS, the system blocked all types of vehicle and showed in the display "All Blocked"

CONCLUSION

In this paper we tried to design an embedded system to ensure a faster toll collection system along with security feature that will contribute a lot to stop crimes at the highways and bridges. It will also ease the work of the police authority to catch a criminal. The system performs the whole task by processing the data received through GSM shield from the police authority. However, the same concept can be

implemented at the car parking system or any other security

concern places. The real life model construction cost of the system is very less and sustainable too. We can improve the response time of the whole system by using more powerful RFID system. As a whole, the integrated toll collection with security system is very beneficial and effective system.

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