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AUTOMATED TOLLPLAZA SYSTEM USING RFID

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***Abstract*— An Automated Toll System is used for toll collection without making traffic congestion and waiting in long queue with help of RFID technique. Also, by using this system, it will save time, i.e. by avoiding long queue as no need to stop the vehicle and no need of manual transaction. Most important that, the stolen vehicle will be able to catch easily with help of RFID technique and nail assembly.**

The current system for collecting toll is on the basis of manual transaction. In this each vehicle has to stop at the toll plaza for payment and there can be a problem of exact transaction. It causes traffic congestion, increase in pollution, and wasting time of people. In Automated Toll System no need to stop vehicle at toll plaza, it will detect the RFID tag, which is mounted on vehicle. After detecting RFID tag, the database on the administrators screen will appear and the balance from the customer's account will get deducted. So there will not be any problem as mentioned above.

An RFID tag is installed on each vehicle with read/write memory. A reader device reads this data when near to toll system from the vehicle and compares it with the data in the computer database, if ID is in defaulter i.e. complaint is in police station about lost or something for security purpose nails get up so that it will not able to go outside and it will get automatically caught then allows the access accordingly by opening the gate. But, ID is not in the defaulter list, toll collection is taken and nails goes down and gate get open .The entire system is developed as an embedded system using micro-controller and associated devices. The system is connected to a PC using the RS232C interface in the embedded system. This allows the system to read and write data from/to a database that is from the account.

***Keywords*—Automated toll collection, RFID.**

Manuscript

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I.INTRODUCTION

Toll plaza system increasing traffic volume makes congestion commonly around the tollgates of Highway. So, reform measure of congestion around the tollgates is urgently required. One of the methods is Toll Collection System.

Develop a micro simulation model, which reproduces the operation states of various tollgate systems: waiting time, passing time. With this simulator, proposed the optimal operation strategy of highway tollgate by benefit-cost analysis on the basis of benefit in saving total waiting time and operating cost.

- Reduce time for collecting toll at the toll plaza.
- RFID tags can be read at much greater distances; an RFID reader can pull information from a tag at distances up to 300 feet.
- As the vehicle approaches the identification site, the computerized control unit placed near toll lane receives the identifier signal and calculates the toll to be debited and electronically debits the toll on the account of the particular vehicle.
- This system allows a vehicle to persist past the scan point without stopping, thus offering maximum convenience to motorists, speeding up the flow of traffic, and reducing the number of human resources required at highway toll plazas.
- Smooth traffic flow at toll gates.
- Convenient toll collection without handling cash.
- Reduction of management costs.
- Convenient and quick service to the vehicle owners.
- Stolen vehicles can be detected.

Automated Toll System using the RFID technology, it contains the RFID tag and the RFID reader.

RFID tends the Radio Frequency Identification; they consist of the tags which can be either active or passive. Passive RFID tags do not have their own power supply: the minute electrical current induced in the antenna by the incoming radio-frequency scan provides enough power for the tag to send a response. Due to power and cost concerns, the response of a passive RFID tag is necessarily brief, typically just an ID number.

Active RFID tags, on the other hand, must have a power source, and may have longer ranges and larger memories than passive tags, as well as the ability to store additional information sent by the transceiver. The technological differences between tag types do not affect their abilities to collect travel time data; the necessary data (i.e. unique ID numbers) are transmitted from the transponders to the roadside units regardless of transponder type.

At present, the smallest active tags are about the size of a coin. Many active tags have practical ranges of tens of meters, and a battery life of up to several years. Radio frequency identification (RFID) is a method of remotely storing and retrieving 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 a product. RFID tags contain antennae to enable them to receive and respond to radio-frequency queries from an RFID transceiver.

RFID tags can be either active or passive. Passive RFID tags do not have their own power supply: the minute electrical current induced in the antenna by the incoming radio-frequency scan provides enough power for the tag to send a response. Due to power and cost concerns, the response of a passive RFID tag is necessarily.

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. The technology requires some extent of cooperation of an RFID reader and an RFID tag.

What is RFID Tag?

A basic RFID system consists of three components:

a) An antenna or coil

b) A transceiver (with decoder)

c) A transponder (RF tag) electronically programmed with unique information.

Automatic vehicle identification tags can be further broken down into distinct tag types based on the degree to which they can be programmed and the type of power source.

Type I: The information stored in these tags is fixed (read-only), and the tags do not have any processing capabilities.

Type II: These tags contain an updateable (read/write) area on which the antenna/reader may encode information such as point of entry, date/time of passage, etc.

Type III: (also called Smart Tags) are used in conjunction with an in-lane RF antenna/reader to communicate identifying information about the vehicle, customer, and account balance information to the toll system. Some portions of the tag information are fixed (such as vehicle and customer data) while others are updateable (such as balance information). The Smart Tag contains a microprocessor, which maintains account balance information that is updated each time the smart tag is used.

II. NEED

The current system for collecting toll is on the basis of manual transaction. In this each vehicle has to stop at the toll plaza for payment. It causes traffic congestion, increase in pollution, and wasting time of people. In Automated Toll System no need to stop vehicle at toll plaza, it will detect the RFID tag, which is on vehicle. After detecting RFID tag, the database on the screen will appear and the balance from the customer's account will get deducted. So there will not be any problem as mentioned above.

The goal is to implement the reliable system that leads to:

- Saving the time at toll plaza for toll collection.
- Reducing traffic congestion and increases security concerns.

III.SYSTEM DESIGN

System Architecture and Business Logic:

Background:

The most creative & challenging phase of the system like cycle is system design. The term "design" describes a final system & the process by which it is developed. It refers to the technical specifications that will be applied in implementing the candidate system. It also includes the construction of programs & program testing. The key question involved here is "How the problem should be solved?

System design is a solution for the question of how to approach to the creation of a new system. This important phase is composed of several steps. It provides the understanding & procedural details necessary for implementing the system recommended in the feasibility study. Emphasis is on translating the performance requirements into design specifications. Design goes throughout logical & physical stages of development. Logical reviews the present physical system; prepares input & output specifications makes edit security & control specifications; details the implementation plan; prepares a logical design walkthrough. Physical design maps out the details of the physical design, plans the system implementation, devises a test & implementation plan & specifies any new hardware & software.

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Develop a micro simulation model, which reproduces the operation states of various tollgate systems: waiting time, passing time. With this simulator, we proposed the optimal operation strategy of highway tollgate by benefit-cost analysis on the basis of benefit in saving total waiting time and operating cost.

IV.ARCHITECTURE

The deals with the transmitter section where the vehicle Number , smart card number details of the vehicle are taken they are verified with the data base and checked, if the details satisfy, after transferring the data the comes to the receiving section the encoded signal is decoded and the given to the microcontroller the microcontroller does the two things, it displays the data on the PC which is to be verified by the security and the vehicle gets the relevant receipt, if the details are verified after the transaction then goes to actuator unit and then the gate opens automatically.

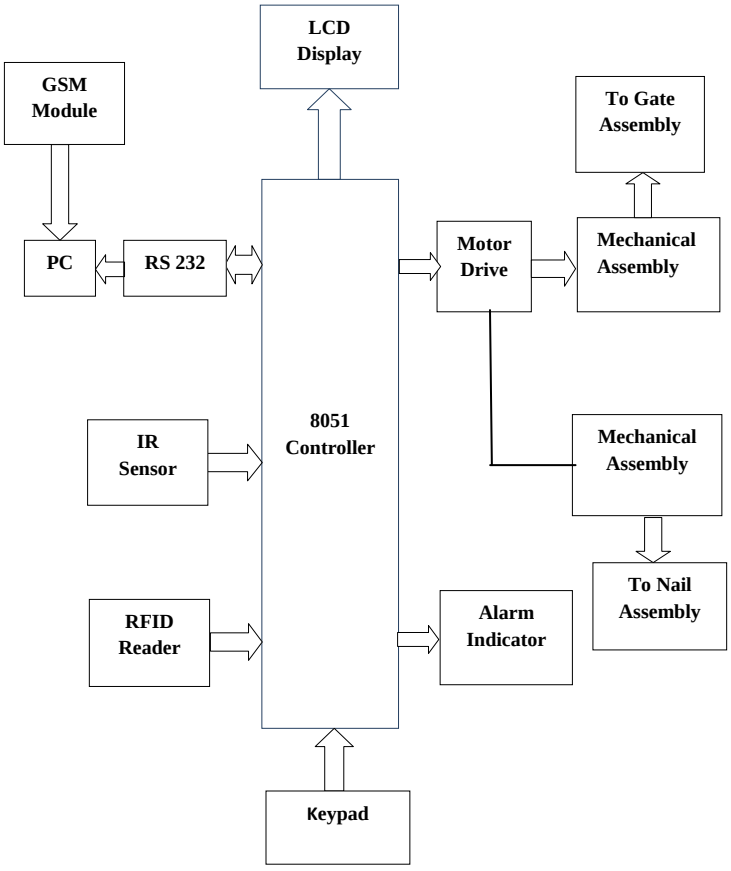

Fig.4.1 Module Block Diagram:

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to receive and respond to radio-frequency queries from an RFID transceiver.

Fig.4.2 General RFID based Toll Tax Image

Microcontroller is used to controlling the process.IR sensor is used to detect whether the vehicle gone or not to close the gate again and to make nails down. The system is connected to a PC using the RS232C interface in the embedded system. This allows the system to read and write data from/to a database that is from the account.

From this database send the user update about his balance. And from that send the reminder on him mobile and balance update. RS232 is used for serial communication. By using RS232 signal is transferred from RFID to pc. An RFID tag is installed on each vehicle with read/write memory. A reader device reads this data when near to toll system from the vehicle and compares it with the data in the computer database, if ID is in defaulter i.e. complaint is in police station about lost or something for security purpose nails get up so that it will not able to go outside and it will get automatically caught then allows the access accordingly by opening the gate. But, ID is not in the defaulter list, toll collection is taken and nails goes down and gate get open .The entire system is developed as an embedded system using micro-controller and associated devices. The system is connected to a PC using the RS232C interface in the embedded system. This allows the system to read and write data from/to a database that is from the account. Keypad is used to control the gate and nail position. IR sensor is used to detect whether the vehicle gone or not to close the gate again and to make nails down.

What is a GSM Modem?

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves.

A GSM modem can be an external device or a PC Card / PCMCIA Card. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop computer. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate. As mentioned in earlier sections of this SMS tutorial, computers use AT commands to control modems. Both GSM modems and dial-up modems support a common set of standard AT commands. You can use a GSM modem just like a dial-up modem.

In addition to the standard AT commands, GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards.
With the extended AT commands, you can do things like:

- Reading, writing and deleting SMS messages.
- Sending SMS messages.
- Monitoring the signal strength.
- Monitoring the charging status and charge level of the battery.
- Reading, writing and searching phone book entries.

The number of SMS messages that can be processed by a GSM modem per minute is very low -- only about six to ten SMS messages per minute.

V.OPERATION

Once the System has been implemented completely then next task is to observe how system is supposed to operate to carry out different operations involved in System.

When vehicle will cross the sensor which are fixed at some meter distance from processing unit, Tag will read by RFID Reader. Sensor may fixed vertically at both sides or at the center of road depend upon where the TAG is mounted on vehicle. TAG contains unique identification number. Then data read by the RFID reader will be taken by Microcontroller (8051) which will process the data for authentication of authorized user.

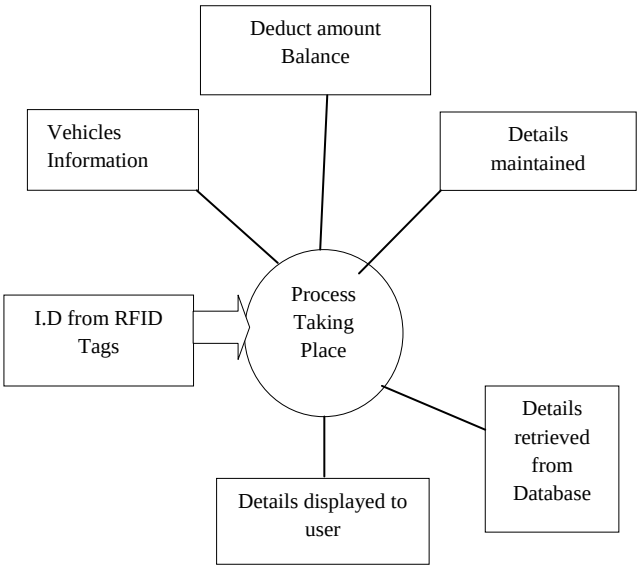

Fig. 5.1 Detailed of processes working simultaneously

If valid user then data will send to processing unit which then check the respective account of that user from database to ensure weather user have sufficient amount for toll payment or not. If amount is not sufficient to pay toll then user must have to recharge its account by paying manually. If sufficient amount then user is allow to pass by iron bar which will rise up with the help mechanical assembly after receiving the permission signal from processing unit. If user is not valid then iron bar will remain down and appropriate action will be taken against invalid user.

VI. ADVANTAGES

1. Reduces the man power.
2. Enables very specific detection of vehicles.
3. Simultaneous multiple detection of vehicles are possible using RFID.
4. Proximity of loop antenna and tag provides potential for increased reliability.
5. Saves time and money.
6. Minimizes work stress

VII. DISADVANTAGES

1. Low frequency results in lower maximum data rate, although it is fast enough to allow multiple transmissions to increase reliability.
2. Tag usually requires power from vehicle (active tag).
3. Tag installation is not as convenient as that of a windshield-mounted tag.
4. Moderate difficulty in duplicating tags.

VIII. CONCLUSION AND FUTURE SCOPE

Designed a system to give complete solution for traffic and transport related problems such as Toll gate control, traffic signal control, traffic rules violation control, parking management and special zone alert using the latest RFID technology. It is proposed as a low cost optimized solution using RFID and GSM mobile technology.

At the toll plaza, there will be a large LCD screen for displaying details of the transaction.

At the same time, it will show:

1. Total cost of that road.
2. The duration of toll plaza.
3. And the remaining balances after each transaction.

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