

Automated Toll Gate System Using RFID And GSM Technology

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Abstract: ATCS is an Automated Toll Collection System used for collecting tax automatically. RFID cards simulate a credit card in a capacity and pattern, the tag usually contains an embedded microprocessor. Normally the Intelligent control system does not allow the unauthorized entry of any person into the control areas. If suppose the illegal entry through gate is observed, then it will be registered and providing the warning sound. Each vehicle will hold an RFID tag and its contains unique identification number assigned. The assigning process will be done by RTO or traffic governing authority And the Reader will be strategically placed at toll collection center. Whenever the vehicle passes the toll booth, the tax amount will be deducted from his prepaid balance. New balance will be updated. In case if one has insufficient balance, his updated balance will be negative one. To tackle this problem, we are alarming a sound, which will alert the authority that this vehicle doesn't have sufficient balance and that particular vehicle can be trapped. As vehicles don't have to stop in a queue, it assures time saving, fuel conservation and also contributing in saving of money.

Keywords: RFID Reader, RFID Tag, Global System for Mobile communication

1. Introduction

The main idea behind implementing Automated Toll Gate System Using RFID and GSM Technology is to automate the toll collection process their by reducing the long queues at toll booths using the RFID tags installed on the vehicle. In addition to this, it can not only help in vehicle theft detection but also can track vehicles crossing the signal and over speeding vehicles. This system is used by vehicle owners, system administrator. Other general advantages for the motorists include fuel savings and reduced mobile emissions by reducing or eliminating deceleration, waiting time and acceleration.

2. Existing System

Active wave Inc has currently deployed a system of active tag vehicle monitoring solution. Active wave vehicle products have a range of 30 meters and operate in the 916 – 927 MHz for the transmit operations and 433 MHz for the gain link. Active wave products are currently equipped with 256 Kbits of fixed memory. The tag is powered with a replaceable 3V battery and the total weight is 14 grams. Rudimentary signals are shown with the help of blinking LEDs and beeping sounds. Smart key Access Control Systems have a client – server model based system with an SQL server handling multiple vehicle monitoring systems. They have designed a user combine using the Microsoft .NET Framework. Smart key also operate in the 900MHz band but have a small range of 30 meters. RFID based toll collection system uses active RFID tag which uses car battery power. The operation is divided into the design of two modules the Vehicle Module and the Base Module. The two modules communicate via Radio Frequency modem connected to each module. These Radio Frequency modules communicate over the ISM Frequency Range of 902 – 928 MHz.

3. General System

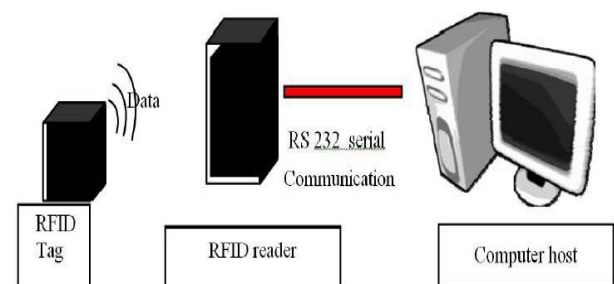


Figure 3.1: Complete RFID Systems

RFID is an automated data-capture technology that can be used to electronically identify, track, and store instruction involve on a tag. A radio frequency reader scans the tag for data and sends the information to a database, which stores the data contained on the tag. The main technology components of an Radio Frequency Identification system are the tag, reader, and database.

3.1 RFID Tag

An RFID tag, or transponder, consists of a chip and an antenna. A chip can store a unique serial number or other information based on the tag's type of memory, which can be read-only, read-write, or write once read-many (WORM). The antenna, which is attached to the microchip, transmits information from the chip to the reader. Typically, a larger antenna indicates a longer read range. The tag is attached to or embedded in an object to be identified, such as a product, case, or pallet, and can be scanned by mobile or stationary readers using radio waves.

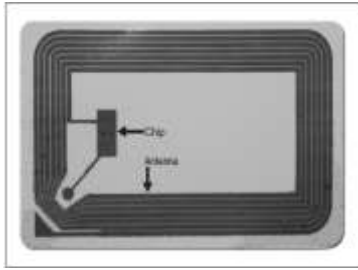


Figure 2: RFID Tag

3.2 RFID Reader

In order for an RFID system to function, it needs a reader, or scanning device, that is capable of reliably reading the tags and communicating the results to a database. A reader uses its own antenna to communicate with the tag. When a reader broadcasts radio waves, all tags designated to respond to that frequency and within range will respond. A reader also has the capability to communicate with the tag without a direct line of sight, depending on the radio frequency and the type of tag (active, passive, or semi passive) used. Readers can process multiple items at once, allowing for increased read processing times. They can be mobile, such as handheld devices that scan objects like pallets and cases, or stationary, such as point-of-sale devices used in supermarkets.



Figure 3: RFID Reader

4. Solution Provided

ATCS is a toll tax collection implementation system that will save time, space and money. Taking the case study of manual toll tax collection system, we came to the conclusion that if the system is made completely automatic, the time require for collection of tax will be reduced, there will not be need for any vehicle to stop, thereby enlarging the space and the system can be efficiently implemented on a large scale with low capital. Automated Toll Gate System Using RFID and GSM Technology is an automatic collection system based on RFID i.e. RADIO FREQUENCY IDENTIFICATION where every vehicle will have a tag (RFID) with a unique tag identification number. This identification number will be associated with the complete information such as vehicle number, owner, etc. and also most importantly with a cost value. This value will be deducted automatically every time the vehicle passes the collection unit. No one will have to wait for any time. This cost value can be recharged at the recharge center.

This system can be effectively implemented on a highway or freeway, where vehicle with a RFID tag will be allowed to pass by deducting an amount from the tag balance. For the vehicles that do not have the tag, their identification will be sent along with the description of the vehicle to the control center identifying an illegal entry, thereby action can be taken. Then it can be done that, the particular vehicle not

having the tag will be billed at their residence or via mail. Reducing these losses is the ample reason for which the need for ATCS is there.

The loss of time puts in a lot of frustration in everyone having to wait for their turn to pay the tax. Most of us want a speedy transport without any obstruction. When it is a known fact that oil is depleting day by day, just standing, waiting and wasting oil does not make any sense. Loss of fuel is most at reduced speed. So there is a need for continuous motion. When a number of vehicles have to wait nobody bothers to witch off the engines while waiting and so fuel emission is most at this level. This is a major contributor to the already increasing pollution. So there is need for ATCS which will cut down on every loss and make it possible to achieve a speedy and non obstructed transport.

4.1 Scope of the Project

Whenever the matter of Integration of systems comes to mind, we think of a system having the following important features viz.

- **Accuracy:** All the functionally bonded logical dependencies must be integrated.
- **Efficiency:** The whole system should work under all circumstances and on a long run it should work efficiently irrespective of their proprietary format.
- **Cost Effectiveness:** As our software do not require any special software for implementation hence is less costly as compared to other existing system.
- **Any Prerequisite for the use:** As the existing systems are not altered, and integration is done at the background
- hence there is no need for any training.

4.2 Feasibility Study

Suppose, If there are 100 manual toll-taxes system and everyday 100 vehicles cross through each system, then
 No of vehicle that pass through one system yearly= $100 \times 30 \times 12 = 36,000$.
 No of vehicle that pass through 100 system yearly= $100 \times 36,000 = 36,00,000$.

Table 1: Vehicles Passed away from Toll Booth in 1 year

Vehicle	Days	Toll Booth
100	1	1
36000	30 x 12	1
3600000	30 x 12	100

4.3 Technology Used in ATCS

RFID (Radio Frequency Identification) is an automatic identification method, leaning on storing and remotely retrieving data using devices called RFID tags or transponders. An Radio Frequency Identification tag is a small object that can be attached to or incorporated into a product, animal, or person. Radio Frequency Identification tags contain silicon chips and antennas to enable them to receive and respond to radio-frequency queries from an Radio Frequency Identification transceiver. Passive tags lack no internal power source, whereas active tags lack a power source.

The purpose of an Radio Frequency Identification system is to enable data to be transmitted by a mobile device, called a tag. The data transmitted by the tag may provide identification or location information, or specifics about the product tagged, such as price, color, date of purchase, etc.

In a typical Radio Frequency Identification system, individual objects are equipped with a small, popular tag. The tag contains a transponder with a digital memory chip that is given a unique electronic product code. When an Radio Frequency Identification tag passes through the electromagnetic zone, it detects the reader's activation signal. The reader decodes the data encoded in the tag's integrated circuit and the data is passed to the host computer.

4.4 Requirement Specification

Framework: .NET 3.5

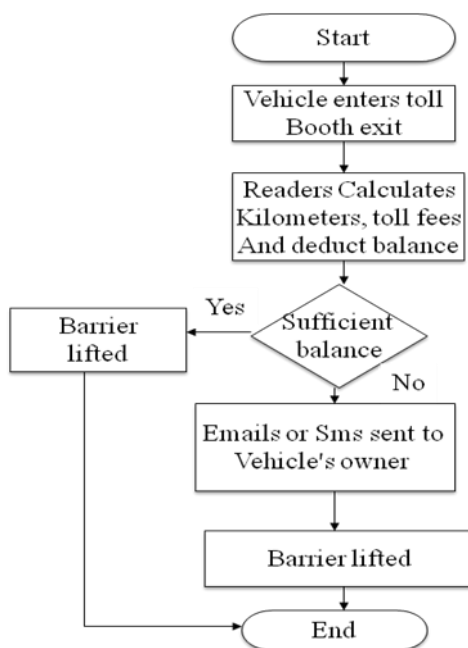
Software Package: VISUAL STUDIO .NET. 08

Language for Development: C# .NET

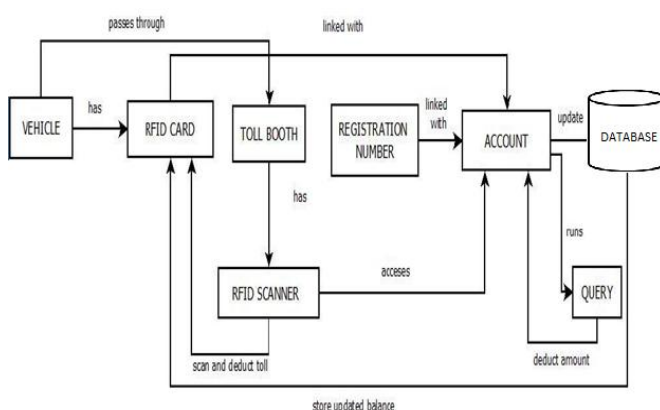
Database: SQL Server 2008

5. System Design

5.1 Data Flow Diagram



5.2 Architecture Diagram



6. Features

ATCS is an automatic collection system used for collecting tax automatically. In this we do the identification with the help of radio frequency. Flexibility is the main feature and with the slightest change this can be converted to a completely new implementation. With the help of the latest technology (RFID), the implementation of this project is very simplified. RFID technology together with a very secure database yields into a highly efficient and secure system.

Following are the features and advancement of ATCS over presently existing system:

- [1] RFID tag cannot be cloned, so cannot be cheated.
- [2] Very efficient saving of time.
- [3] Wastage of money reduced.
- [4] Consumption of oil is reduced.
- [5] Pollution is reduced to a large extent.
- [6] Speedy transport.
- [7] Less congestion on the roadways.
- [8] Comparatively less maintenance cost

6.1 Flexibility of Implementation

The main power of ATCS is the technology which is used, that is the RADIO FREQUENCY IDENTIFICATION. The basic power of this technology is that it's very flexible. Even with the slightest of change in ATCS, the product can be shaped into a completely different implementation and all that can be because RFID is independent of every other hardware that can be used to boost up the system's performance. RADIO FREQUENCY has vast implementation areas in medical, defense and many latest products that are being developed is based on RFID solution. The main areas is animal tracking, human implants, vehicle tracking, speed tracking, physical implementation.

7. Conclusion

RFID is not replacement of Bar code but it is a technology offering various features. RFID offers highly reliable data collection in harsh environments. RFID technology can provide new capabilities as well as an efficient method to collect, manage, disseminate, store, and analyze information. It not only eliminates manual data entry but also inspires new automation solutions. RFID's attributes provide greater automated tracking capability than existing technologies, and thus create the opportunity to reduce labor, improve inventory management and generate better market intelligence, leading to lower operational costs and increased revenue generation.

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