Automatic Toll Plaza using RFID

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Abstract:

Now a day, there is a huge rush in the toll plazas in order to pay the toll tax. Therefore in order to reduce the traffic jam and to save time & also to reduce the money loss, we have designed project for the automation in toll tax payment using RFID. We have made the automation of toll plaza using combination of microcontroller, RFID and Load cell technology. This report explains the implantation of automation in toll plaza which is a step towards improving the monitoring of vehicles, traveling in predetermined routes. The aim of our project is to design a system, which automatically identifies an approaching vehicles and record vehicles number and time. If the vehicle belongs to the authorized person, it automatically opens the toll gate and a predetermined amount is automatically deducted from its account. This translates to reduced Traffic congestion at toll plazas and helps in lower fuel consumption. This is very important advantage of this system.

Index Terms: AT89S52, GSM, LCD, RFID, TOLL PLAZA

I. INTRODUCTION

RFID is an acronym for Radio Frequency Identification. This project is a standalone Automatic two door interlock control system for toll tax using AT89S52 microcontroller. This project is useful in all applications where two door interlocking is needed. RFID is increasingly used with biometric technologies for security. Primarily, the two main components involved in a Radio Frequency Identification system are the Transponder (tags that are attached to the object) and the Interrogator (RFID reader). Communication between the RFID reader and tags occurs wirelessly and generally doesn’t require a line of sight between the device RFID tags are categorized as either active or passive. This project uses passive tags. Read-only tags are typically passive and are programmed with a unique set of data (usually 32 to 128 bits) that cannot be modified. The reader has three main functions: energizing, demodulating and decoding. The antenna emits radio signals to activate the tag and to read and write data to it. This module is interfaced with the microcontroller and when the card is brought near to the RFID module it reads the data in the card and displays on the LCD. The aim of this project is to atomize the toll tax collection on highways. RFID reader, tags are used in this project to identify the entry of the vehicle with IR sensor. The RFID reader is placed at the toll tax collecting area and each and every vehicle is provided with a RFID card. Each and every time when we place the RFID card on the reader the current value (in Rs) in the card has to be stored in the EEPROM. Once we pay the tax through RFID card the value of the card get decremented which can shown on 16X2 LCD. Initially the gate is closed. Whenever any vehicle comes in front of the entry gate, which is sensed by IR sensor, the reader detects the RFID card owned by the vehicle owner and certain value of amount is detected automatically which will be displayed on 16X2 LCD. By using serial communication the data will be processed by the microcontroller and opens the entry gate by rotating the DC motor. After some delay, the gate will be closed. If certain amount is not there in the card then he/she can renewal the RFID card. Once the amount is successfully deducted from RFID card only the gate opens.

And again the RFID reader will be waiting for the next vehicle to enter. A GSM modem is also interfaced to the controller to send the SMS.

II. LITERATURE SURVEY

The automatic toll e-ticketing system is the approach used for the vehicle when it reaches the toll plaza; this is detected by using Infrared Proximity Sensor. An IR receiver is used to receive these pulses and sends it to a controller (MSP 430 Launch pad), which then transmits the vehicle number through the RF transmitter located in vehicle. We assume that vehicles have 16-bit identification numbers. The RFID tags to readers read the signal and information about vehicles owners. These RF signals are received by an RF receiver at the toll plaza, which send data to a computer’s parallel port. A software program running on the computer retrieves vehicle details from its vehicle database. Depending on this information, appropriate toll tax is deducted from the pre-paid account of the vehicle's owners. The owner receives an SMS message on his/her mobile about the details of the payment. If the balance in the owner's account is low or if the vehicle is not equipped with an RF system, the toll gate remains close.[1] ATCSR (Automated Toll Collection System using RFID) is used for collecting tax automatically. In this we do the identification with the help of radio frequency. A vehicle will hold an RFID (Radio Frequency Identification Device) tag. This tag is nothing but unique identification number assigned to it. The reader will be strategically placed at toll collection centers. Whenever the vehicle passes the toll booth, the tax amount will be deducted from his prepaid balance. New balance will be updated. As vehicles don’t have to stop in a queue, this translates to reduced Traffic congestion at toll plazas and helps in lower fuel consumption. This is a very important advantage of this system. An RFID tag is installed on each vehicle with read/write memory. A reader device reads this data when the vehicle is near the toll system, and compares it with the data in the computer database. This helps us to provide security since vehicles with RFID can be tracked easily. Apart from that we can conserve fuel and also reduce the amount of pollution. [2]

The aim of this research paper is to illustrate the convenience and versatility of an automatic toll plaza system using RFID...
technology and its advantages over toll plazas using other techniques. With the number of vehicles increasing every year, the time and fuel wasted on waiting at the toll plazas is ever increasing. Automatic toll plazas can eliminate this wastage of time, fuel and enhance the vehicle security by providing a host of other features such as sending a text message to the registered mobile number of the owner, displaying the information about the vehicle on the display in addition to automatic opening and closing of the barricade. The toll is deducted from the vehicle owner’s prepaid account. A 125 KHz RFID reader is used for detecting the passive tags by the reader module. The motor for the barricade, on-site LCD display and GSM modules have been interfaced with the microcontroller. This system will cut down time and fuel wastage at the manually controlled toll plazas, provide a layer of security because the SMS sent and will ensure a smoother travel experience for the travelers. [3] 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. [4] This research paper describes the automated toll collection system for toll gate based on RFID technology. Most of the toll collection systems commonly used in Myanmar is manual transaction. Nowadays, streams of traffic are increased and toll gate on highways are congested. It will cause the traffic jam and waste time. The objective of this journal paper is to transform manual transaction to automated toll collection with the help of RFID technology. There are three portions in toll collection system. They are RFID system, balance deduction system in host computer and toll gate control system. For the RFID system, 13.56 MHz passive RFID reader and tag pairs are used. The balance deduction system is implemented by Microsoft Visual Studio and Microsoft SQL Server as IDE. C# language is used to implement this system. The PIC microcontroller is also used to control the stepper motor and display the deposit on the LCD. The authorized person at the toll gate can check the ID numbers, vehicle numbers and the amount of balance with the database on PC. The new user can register and update the amount of balance via Graphical User Interface (GUI) easily. The amount of deposits will also update simultaneously at the two database of the toll gate because of LAN network. 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 at the toll gate. [5]

Project Methodology

![Block Diagram of the System](image-url)
Figure 2. Hardware Implementation

Figure 3. Circuit Diagram
Figure 4. Working Procedure

Start

Detect the RFID Tag

Tag?

Yes

Stolen Vehicle

No

Read the RFID

Record to owner

Yes

Had enough balance

No

A

Toll amount deduction

END
Major component of the system are as follow:

- AT89S52 microcontroller
- Em-18 (RFID reader module)
- SIM800(GSM module)
- DC Motor with drive(L293D)
- LCD display
- Power supply unit

1. **AT89S52 microcontroller:**
   Micro controller senses the signal given from switches and decides the mode of operation i.e. recharge mode or toll collection mode. It fetches data from memory location and send it to output devices like display, motor driver and buzzer. At the same time it can accept data from Keypad for recharging options and from IR receiver to sense that vehicle has passed from toll collection booth.

   **Features:**
   - 8K Bytes of In-System Programmable (ISP) Flash Memory – Endurance: 10,000 Write/Erase Cycles
   - 4.0V to 5.5V Operating Range
   - Fully Static Operation: 0 Hz to 33
   - Three-level Program Memory Lock
   - 256 x 8-bit Internal RAM
   - 32 Programmable I/O Lines
   - Three 16-bit Timer/Counters
   - Eight Interrupt Sources
   - Dual Data Pointer
   - Fast Programming Time
   - Dual Data Pointer
   - High speed (25 MHz)

2. **EM-18 RFID reader:**
   An RFID reader is a device that is used to interrogate an RFID tag. The reader has an inbuilt antenna that emits radio waves; the tag responds by sends back its data

   **Features:**
   - 5V supply
   - 125KHz read frequency
   - EM4001 64-Bit RFID tag compatible
   - 9600bps TTL and RS232 output
   - Magnetic stripe emulation output
   - 100mm read range

3. **SIM 800(GSM module)**
   Global System for Mobile (GSM) is a second generation cellular standard developed to cater voice services and data delivery using digital modulation.

   **Features:**
   - Quad-band 850/900/1800/1900MHz
   - GPRS multi-slot class 12/10
   - GPRS mobile station class B
   - Complaint to GSM phase 2/2+
   - Bluetooth: Complaint with 3.0+EDR
   - Dimensions: 24*24*3mm
   - Weight: 3.14g
   - Supply voltage range 3.4 - 4.4v
   - Low power consumption
   - Operation temperature: -40 degree – 85 degree C.

4. **DC Motor with drive (L293D)**
   DC motor is an electric motor that runs on direct current (DC) electricity.

   **Features:**
   - 600ma output current capability
   - Per channel
   - 1.2 a peak output current (non repetitive)
   - Per channel
   - Enable facility
   - Over temperature protection
   - Logical “0” input voltage up to 1.5v
   - (high noise immunity)
   - Internal clamp diodes

5. **LCD display:**
   LCD screen is a electronics device display module and find a wide range of application. A 16*2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5*7 pixel matrix. This LCD has two register, namely, Command and Data register.

   - 20*4 line display
   - 5*7 dot matrix display
   - 4 bit data interface

6. **Power supply unit:**
   The input to the circuit is applied from the regulated power supply. The ac input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating dc voltage. So in order to get a pure dc voltage, the output voltage from the rectifier is fed to a filter to remove any ac components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage.

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III. RESULT

![Figure 1](image1.png)

Figure 1. First we will enroll figure. 2. Then recharge the card for balance the user information
Figure 3. Card Recharged

Figure 4. Vehicle reaches the toll plaza if the user wants to change or add a new number then by using calling option user can change their number.

Figure 5. System will save the number in memory for sending the message to the user after that balance is deducted from the account of the user and gate of toll plaza is open and it will close automatically.
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Figure 6. Message has been sent on the mobile of the user through GSM.

Advantages
• Reduced Time.
• Identification and Calculation.
• Reduced The Number Human Resource.
• Smooth Flow.
• Convenient.
• Reduced Management Cost.
• Stolen Vehicles Can Be Detected.
• Quick Service.

IV. CONCLUSION
In this project work, we have studied and implemented a complete working model using a Microcontroller. The programming and interfacing of microcontroller has been mastered during the implementation. This work includes the study of RFID module. RFID is increasingly used with biometric technologies for security. The significant advantage of all types of RFID systems is the non-contact, non-line-of-sight nature of the technology. Tags can be read through a variety of substances such as snow, fog, ice, paint. Hence, this project can be very much useful and can be implemented in real time applications for recording the attendance.

V. FUTURE SCOPE
• Implementation of automatic money debit system.
• Implementation of image processing for centralized data recording.

VI. REFERENCE


