

A REVIEW: SMART TOLL BOOTH SYSTEM BY USING IOT

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ABSTRACT

Extensive vehicles crowd is observed on tollbooth even after the modifications in a tollbooth system. The lengthy process of tax collection not only waste time but fuel as well. Several technologies adopted in the process of toll collection from manual to RFID, barcodes, e-pay. However, stoppage of vehicle is mandatory in every method. In this paper, a communicative system is proposed which eliminates all the official procedures at tollbooth. It also equipped with facility of vehicle positioning and remedy over vehicle theft.

Keyword : - RFID, GSM, GPS, IoT.

1. INTRODUCTION

In India, most of highway projects developed on Public Private Partnership basis. These private organizations then collect the toll from vehicle owners/ drivers passing through tollbooth. There are different toll collection systems practiced by various organizations at toll plazas. However, due to stoppage of every vehicle and in toll collection processing ample time gets wasted. It hampered traffic and burn fuel unnecessarily. It is observed that *Manual toll collection system* widely used in India. Based on the type of four wheeler vehicle the specific amount is charged at tollbooth. The operator on duty enters the number of vehicle in a computer, give receipt of payment and return the change. This process is less efficient, excessively slow and takes the plethora of time. On *Barcode base toll booth*, a barcode mounted on the number plate of vehicles scanned using Scanners and information gets exchanged between toll booth server and owner of vehicle. Toll gets collected through cash or card payments. Barcodes Based toll collection system proved poor for reading capability, when it faces inclement weather. *RFID Based Toll Collection System* having two components a reader and the tag. Reader automatically identity and track the tags attached to the vehicles. RFID tag includes an integrated chip attached to an antenna, containing vehicle's related information along with the unique serial number. RFID reader is a device which wirelessly communicates with RFID tags. It detects the presence of RFID tags and also sends and receives the data from tags. For communication, reader and tag must have to drive with the same standards. In this system, whenever vehicle arrives at the toll booth, Reader identifies the tag attached to the vehicle and fetches the information and automatically debits the toll amount from prepaid account of vehicle owner. However, it is necessary to attach tags to each and every vehicle for further operations, so difficult to implement in the countries like India.

Many researchers proposed a concept of smart toll collection systems by embedding microcontrollers, smart sensors, GSM and GPS modules. One of them is Smart Accident Alert and Toll Pay System uses arduino interfaced along with GSM (SIM 300) and GPS (PMB-648), which passes messages to a helpline and reduce the burden of waiting in line at the toll plaza by developing auto toll pay system[1]. This system also uses a speed sensor which sends a notification, if a vehicle is caught over speeding. Linux development board based Smart Toll Collection System using Embedded Environment processed through Optical Character Recognition (OCR) [2]. An image of license plate will be converted into equivalent ASCII characters. This extracted information will further send to the RTO server to identify the type of vehicle and owner of the vehicle. The retrieval information will once again send to the system through GSM module. The nominal toll will be deducted from owner's account. After receiving the notification message on registered mobile number of the owner about the deducted amount from owner's registered account, the barrier will open and the vehicle is allowed to leave toll booth. In one of the proposed IoT Based Unmanned Toll Booth Monitoring System, RFID reader reads the card number and

microcontroller processes the information of the card [3]. Fixed amount is deducted from the user account whenever the card scans at the toll booth. The online server monitors the data sent by the microcontroller. MySQL database creates the folder of the user details which contains the information about the amount remaining in the account of vehicle owner and time of entry at the toll. A HTML page is used for interaction between user and web.

2. PROPOSED SYSTEM

The System is divided into two types. The first one is Inside the Car and another is at the Toll Booth location.

2.1 Inside Car

(A) Construction:

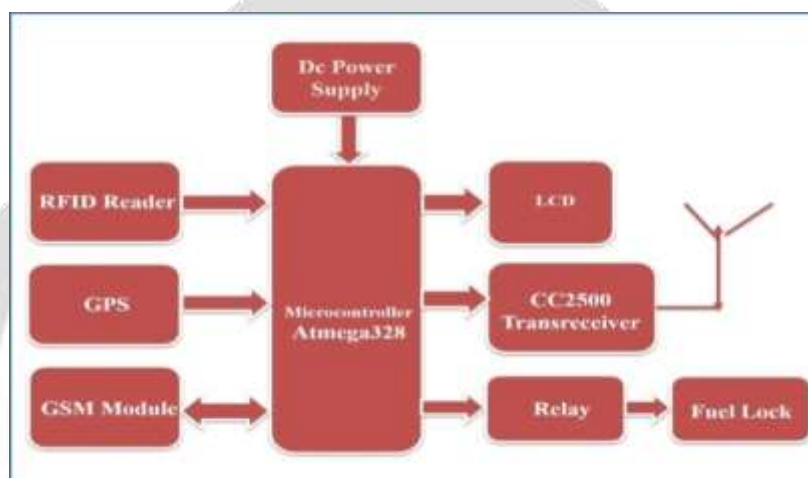


Fig -1 : Block Diagram of Embedded system inside the car

In the car, the system can be placed at the Bonet of car. The user places the RFID tag within relatively short range so that the radio freq. signals can be detected. Once this tag enters the required range, it can be detected by the reader module and it receives the signal of activation. Once the RFID tag has been identified by the reader then the tag can read and write information to the reader. Then the tag can transmit the information to the RFID reader and then it can be sent to the microcontroller. This corresponding data can be save inside the car and account link with the car. When vehicle travel and when it come near to the toll booth then cc2500 trans receiver module wirelessly send the signal to the toll booth.

ATMEGA 328 Microcontroller: ATmega-328 is basically an Advanced Virtual RISC (AVR) micro-controller. The proposed system uses this microcontroller at both ends i.e, Car system and Toll booth system. These microcontrollers controls the whole operation of system. Microcontroller will carry out its functions according to the in Embedded C coding.

GPS Modem: GPS chips and modules provide users with instantaneous location and time data anywhere on Earth. The proposed system uses GPS Modem to detect the location of vehicles whenever required.

GSM Module: GSM is a cellular technology used for transmitting mobile voice and data Services. The proposed system uses GSM for transmitting the message of money deduction on user's Mobile Number.

RFID Reader: A radio frequency identification reader (RFID reader) is a device used to gather information from an RFID tag to track individual objects. The Proposed system uses RFID reader to read the information stored in the RFID tag to start the Vehicle.

Relay: Relay is a Switch which controls (open & Close) circuits electromagnetically. The Proposed system uses relay to control the function of fuel lock. The fuel lock system is used as a remedy for vehicle theft.

LCD: LCD (Liquid Crystal Display) screen is an display module. The proposed system uses LCD to show the information of system.

CC2500 Transceiver: CC2500 transceiver is used to transmit and receive data at different baud rates. The proposed system uses this transceiver inside the car for transmitting and receiving the data the data from toll booth System.

2.2 At Tollbooth

(A) Location:

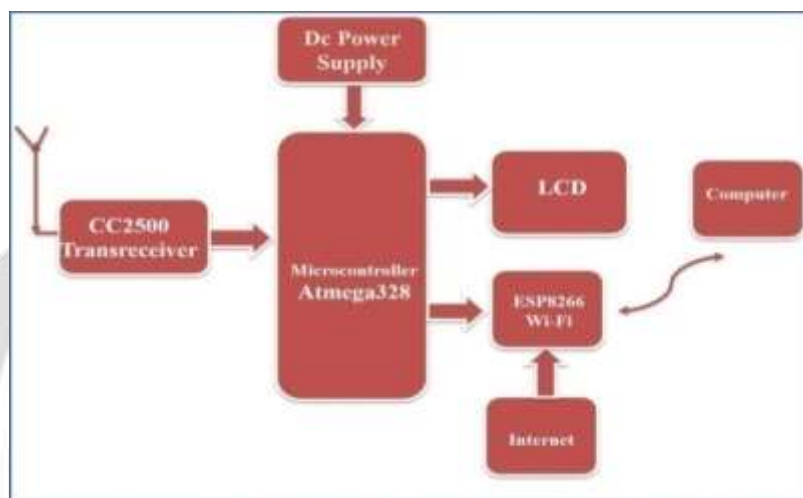


Fig -2 : Block Diagram of Embedded system at Toll Booth

At the toll booth for receiving signal another cc2500 transceiver is present and then signal is transmitted via the Wi-Fi module to the online cloud database. For the prototype system, a dummy Government registration database is utilized for the verification purpose. If user is identified, process goes to next level. Corresponding amount is deducted (A reference amount is taken for demonstration purpose) and the operation of the toll booth is complete. Display Unit is used to display the transaction amount message. For implementation purpose, switches are made available at the toll booth for performing top-up operation for topping up money in the account. Entire operation is performed using the microcontroller. IoT has been implemented for online application of the system. It has been connected to the cloud server and entire data of the transaction and remaining balance amount in the account is available online for users. As a result entire operation is recorded on the server and information can be accessed remotely. Hence entire operation can be made devoid of human intervention. Also, we can track the location of the vehicle by using the GPS Modem used in our system.

ATMEGA 328 Microcontroller: ATmega-328 is basically an Advanced Virtual RISC (AVR) micro-controller. The proposed system uses this microcontroller at both ends i.e, at Car System and Toll booth System. These microcontrollers controls the whole operation of system. Microcontroller will carry out its functions according to the Embedded C Coding.

Wi-Fi Module: ESP8266 is Wi-Fi enabled system on chip (SoC) module developed by Espressif system. Is is mostly used for development of IOT embedded applications. The proposed system uses wi-fi module to

WeMos Board: The WeMos D1 is a ESP8266 WiFi based board which is controlled by ESP8266 chip. ESP8266 is a Wi-Fi chip which is present in WeMos Board. The Proposed system uses WeMos Board to connect ATMEGA 328 microcontrollers to a Wi-Fi network.

CC2500 Transceiver: CC2500 transceiver is used to transmit and receive data at different baud rates. The proposed system uses this transceiver inside the car for transmitting and receiving the data from System inside the car .

Internet connection: The proposed system uses internet connection to store the information of vehicles into Server. Broadband Connection of minimum 512 Kbps will be needed to work the system.

LCD: LCD (Liquid Crystal Display) screen is an display module. The proposed system uses LCD to show the information of system.

2.3 Coding and Softwares

ATMEL Studio 6.0 : ATMEL studio 6.0 is a software used for developing & debugging ATMEL Microcontrollers. The proposed system uses this software for programming ATMEGA 328 Microcontroller. ATMEGA 328 Microcontroller is the main component of whole system which controls all the process of system.

Arduino IDE : Arduino IDE is a lightweight, cross-platform application used for programming WeMos and Arduino Boards. The Proposed system uses this application to program WeMos board.

Embedded 'C': Embedded C is adapted from 'C' language. Embedded C is the language used for Programming Microcontrollers. The proposed system uses Embedded C for programming ATMEGA 328 Microcontroller.

HTML : HTML is a scripting Language used for Designing Web page. The Proposed system uses HTML for designing web pages which stores the information of vehicles received from cc2500 Transceiver Module.

3. PROBABLE OUTCOME

The probable outcome for the proposed system are listed below:

- Proposed system will allow customer to pay toll tax without stoping the vehicles.
- The problem of long queue will be solved .
- Proposed system will save the fuel as well as time.
- Proposed system will also help to avoid illegal toll gate entry.
- Proposed system will track the location of the system.

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