

# An Internet of Things Approach for RFID Smart Tollgate Automation

S. Nedunchezhian

Lecturer (Sl. Grade), Department of ECE, Sankar Polytechnic College, Tirunelveli, Tamil Nadu, India

## ABSTRACT

With the significant development in Roadways, there is an increase in the number of toll plazas. These toll plazas have long queues and the time consumed in paying cash and returning change causes all the more delay. In this project, an IOT based Toll booth Manager System is designed in which a person can use an RFID to pay the Toll charge. The system would check if it has sufficient balance and then deduct the toll charge and update the balance through IOT. Internet of Things (IoT) is basically the network of 'things' by which physical things can exchange data with the help of sensors, electronics, software and connectivity. These systems do not require any human interaction. IoT Technology is found in many industries like healthcare, Energy, Transportation etc. In this project, the data of the RFID card is sent to the website, through IOT.

**KEYWORDS:** Micro Controller, Relay, Liquid Crystal Display, Motor, Uart, IR Sensor, RFID Reader

## I. INTRODUCTION

This system is a thruway solution designed for collection in automatic toll. The composing of frame, system functioning is explained and information of data is also effortlessly exchanged between the automobilist and authorities of toll, thus by this system we can reduce a possible errors by human & with a less traffic we get a well-organized collection of toll system. Since Raspberry Pi is enabled with IOT, vehicles data base can be created and it can be linked to the server using an application installed in any laptop. It gives a flexible front end for toll gate authorities to have a complete update of the vehicle and toll collected. Vehicle user can also recharge his vehicle card using this web based application. Application also shows the owner's balance in the card. In indirect old method, the operating cost is compensated also allocating a budget to the national income or by the fuel tax payment. The notwithstanding of this mechanism is that a small number of civilians, who do not use any of the carriageways, should pay for allowance. In direct new method, tolls fees are directly collected from the driver who passes that street or road. Every day many drivers pass through station of toll gate. Usually the toll fees were collected from the owner of the vehicle or driver of the vehicle by stopping his car near the station of the toll. He should pay the fees of the toll and after payment is completed, the gate of the toll will be opened either by electrically or mechanically. In ordered to overcome this problem the proposed system is introduced so that convenient or automated way of collecting toll fess & management of traffic is introduced. And this proposed system is called as stations of electronic toll gate using a technology of RFID. The advantage of the proposed system is to avoid loss of fuel, time saving in collecting toll fees, avoids monetary loss, to check the traffic, detection of bombs and weapons and checking the overload of goods. In the proposed system the IR sensors are used for the detection of vehicle & to open or close the gate, when the vehicle is leaving or entering the toll station. The tags of the vehicles are read by the RFID reader card.

## II. EXISTING SYSTEM

In Existing System, Every time the person passes a tollgate he/she has to wait in the queue and should swipe his smart card for making payment. This is time-consuming and tollgates must have staffs to assist in this process, so it need man power to monitoring these activities. The Gate which is available in the toll gate takes a minimum amount of time to open/close by the motor action every time though the motorist made the payment in that particular time.

## III. MANUAL METHOD

Until somewhat recently, the most common approach for collecting tolls was to have the driver stop and pay a toll collector sitting in a tollbooth. The toll collector determines the amount to be paid by each vehicle based upon its characteristics or classification. The system have the following disadvantages and need to improve the system, Long Time Needed, Complexity is high, Heavy Traffic

## IV. PROPOSED SYSTEM

In the proposed system, The Internet server maintains all the data of user accounts and also their balance. All vehicle owners would possess an rfid based card that stores their account number. Our system at toll booths will monitor the cards scanned when a car arrives at the toll booth. The system now connects to the online server to check if the card is valid and if valid what is the balance. If user balance is sufficient, the user balance is deducted online and web system sends signal back to the card scanner system that the user has been billed. On receiving this signal the system operates a motor to open the toll gate for that car. The system is controlled by a microcontroller to achieve this purpose. The microcontroller uses wifi connection to connect to the internet through which system interacts with web server to perform the online verification process. Also system allows to store data of all the vehicles passed at particular time intervals for later reference and surveillance. This system thus automates the entire toll booth collection and monitoring process with ease using RFID plus IOT based system, More Number Of Vehicles Can Pass Freely, Avoid traffic, Less cost, Easy to maintain.

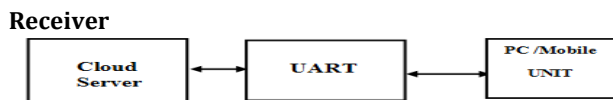
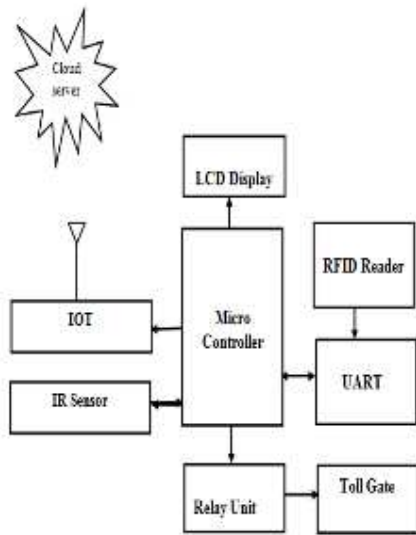


Fig: 1. BLOCK DIAGRAM

## V. HARDWARE REQUIREMENTS

- Micro Controller
- Relay
- Liquid Crystal Display
- Motor
- UART
- IR Sensor
- RFID Reader

### MICRO CONTROLLER

A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system. A typical microcontroller includes a processor, memory and input/output (I/O) peripherals on a single chip. Sometimes referred to as an embedded controller or microcontroller unit (MCU), microcontrollers are found in vehicles, robots, office machines, medical devices, mobile radio transceivers, vending machines and home appliances among other devices.

### CLOUD SERVER

A cloud server is a virtual server (rather than a physical server) running in a cloud computing environment. It is built, hosted and delivered via a cloud computing platform via the internet, and can be accessed remotely. They are also known as virtual servers. Cloud servers have all the software they require to run and can function as independent units.

### LCD DISPLAY

LCD (liquid crystal display) is the technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies, LCDs allow displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it.

### RFID READER

A radio frequency identification reader (RFID reader) is a device used to gather information from an RFID tag, which is used to track individual objects. Radio waves are used to

transfer data from the tag to a reader. RFID is a technology similar in theory to bar codes. However, the RFID tag does not have to be scanned directly, nor does it require line-of-sight to a reader.

### IOT

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

### IR SENSOR

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations.

### UART

UART stands for Universal Asynchronous Receiver/Transmitter. It's not a communication protocol like SPI and I2C, but a physical circuit in a microcontroller, or a stand-alone IC. A UART's main purpose is to transmit and receive serial data.

### RELAY UNIT

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal.

### TOLL GATE

Electronic Toll Collection is a system enabling collection of toll payments electronically allowing for near-nonstop toll collection and traffic monitoring. Under the system, a RFID chip-embedded sticker is put on the vehicles allowing deduction of money at toll plazas automatically.

## SOFTWARE REQUIREMENTS

- EMBEDDED C
- MPLAB IDE COMPILER
- VB

### EMBEDDED C

Embedded C is an extension to C programming language that provides support for developing efficient programs for embedded devices. It is not a part of the C language.

### MPLAB IDE COMPILER VB

Visual Basic is a third-generation event-driven programming language from Microsoft for its Component Object Model (COM) programming model first released in 1991 and declared legacy during 2008. Microsoft intended Visual Basic to be relatively easy to learn and use. Visual Basic was derived from BASIC and enables the rapid application development (RAD) of graphical user interface (GUI) applications, access to databases using Data Access Objects, Remote Data Objects, or ActiveX Data Objects, and creation of ActiveX controls and objects.

## CONCLUSION

In this paper, we have presented the implementation of IoT technology in the application of toll tax system. Wi-Fi toll collection stations allow the traffic to flow continuously and vehicle having been avoided stopping and starting again. Man power and cash risks are also reduced to minimum. The system also increases safety, as bottle necks and long queues are avoided. Society and business community also gain from the system as it results in faster transportation. The system is cost-effective, time saving and easy to install which benefits the operator as well as user. IoT based toll booth monitoring system is a Microcontroller based toll collection system. The results obtained from working have shown that the system performance is quite reliable. The system has successfully overcome the shortcomings of the existing system by reducing the man power at the toll booth. It provides easy way of toll collection and maintenance of the information.

## FUTURE SCOPE

- Change in travel patterns
- Public transport improvements
- Traffic flow improvements
- Congestion Reduction
- Better environment
- Revenue Generation
- Increased Safety

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