IOT BASED TOLL COLLECTION SYSTEM USING RFID

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Keywords:

IOT, RFID Tag, RFID Reader, IR Sensors, LCD Display, Servo Motor, Ultrasonic Sensor, Vehicle, Node MCU, Adafruit IO, Buzzer

Abstract:

The Internet of Things (IoT) is a novel concept and is aimed at enabling the interconnection and integration of the physical world and the IT space. The main concept of project is to design a toll collection model using RFID based on Internet of things (IOT) concept and to implement our project, we are developing a model to show how the TOLL collection system works. Project is mainly based on sensors and RFID which are connected to Arduino. Therefore, the amount deducted from the RFID tag can be found through IOT server using node MCU. The use of RFID modules that mechanically collects the toll from shifting automobiles once they cross the toll plaza. Proposed system of project addresses the problems comes at toll plaza. Therefore we can recognize the speed of the vehicle entering at toll plaza.

Introduction:

The toll collection system using RFID is a fully digitalize system which has no need of any manual operations at the toll stations. To design and develop an Automatic toll collection which is based upon microcontroller, RFID technology and sensors save the time at toll plaza and to have a cash free operation. As the name "Toll collection system using RFID" refers to the main key theme automation. Here we are going to see the human less plaza. In earlier system the highways take 1 minute to complete the toll collection process for one vehicle. With this automatic process, it will take just 40 to 42 sec to complete the whole process. There is reduction in time for completion of the process so indirectly there will be no traffic as such and as there is no traffic so no fuel wastage takes place and the purpose of optimal use of the highways is achieved i.e. reduction in journey time and cost.

Objectives:

The main objective of the project is to develop an efficient module for automatic toll tax collection

The proposed objective is based on three modules

1. **Sensor technology**- it is used to detect vehicle arrived and the speed is also detected using ultrasonic sensor. If the speed of the vehicle and if the speed exceeds then vehicle must pay the fine along with toll tax.

2. **RFID technology**- it mainly aims for identifying the card sensed on the toll plazas. RFID tag is scanned through RFID reader, by Radio frequency in the form of waves within a particular distance. The RFID tag is linked with owner account, each RFID tag has a wallet to which the owner has to top-up with prepaid amount.

3. **IOT technology**-To report the amount deducted, this research work utilizes the Node MCU to send message through Internet of Things (IoT) server, which has worldwide coverage. It is currently the most efficient communication technology. To report the Total amount with or without fine deducted to the authorities, IoT is the best possible solution.
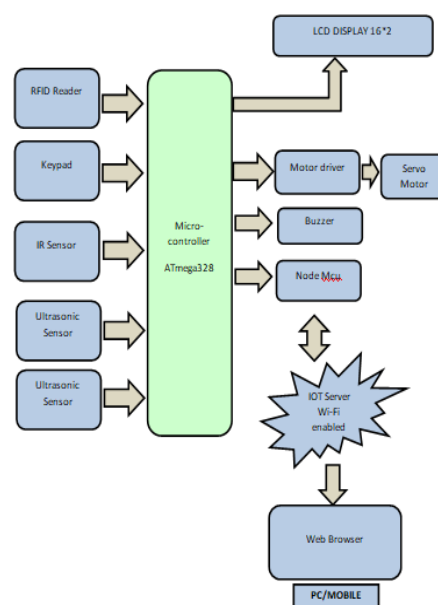
Methodology:

Fig 1: Block diagram for the proposed method

There are mainly two stages in proposed method

    1. Before paying toll tax
- IR sensor senses the vehicle arrival and displays on LCD
- Speed recognition of a particular vehicle is done using ultra sonic sensors.
- Proposed method asks tax payers to tap their card for payment

    2. After payment
      I.With sufficient balance-
- After paying the allotted amount as toll tax, barrier opens and allows the Vehicle to pass.
- IOT server determines tax payers with debited amount including appropriate

      II.With insufficient balance-
- Asks tax payers to recharge their RFID card or to pay tax with given fine.
- After paying the allotted amount as toll tax, barrier opens and allows the Vehicle to pass.
- IOT server determines tax payers with debited amount including appropriate
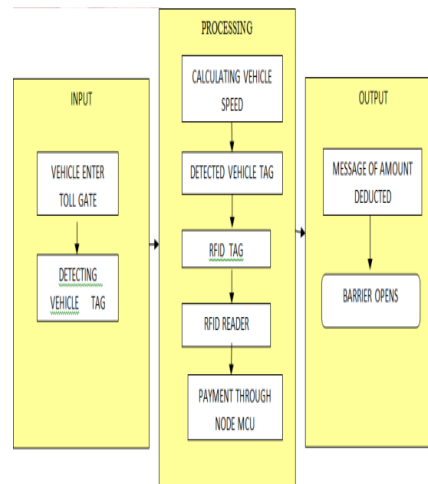
Fig 2: Module Overview

Input Module:

Firstly, when vehicle arrives IR sensors senses the vehicle at toll booth.

Processing Module:

In processing module actuators or components which we are using for Implementation can be classified into 4 phases:

1. Sensors technology: The speed is detected using ultrasonic sensor. If the speed of the vehicle exceeds then vehicle must pay the fine along with toll tax.

2. RFID technology: RFID tags are made out of three pieces: a microchip, an antenna, a substrate. RFID tag is scanned by RFID sensors in which the transaction is done. An RFID reader is the brain of the RFID system and is necessary for any system to function. RFID tag is scanned through RFID reader, by Radio frequency in the form of waves within a particular distance.

3. Processing of data using IOT: the data which has been processed during whole process is carried out by automated toll tax collection is stored in cloud by using Adafruit IO platform which helps in continues monitoring the process, transaction and the data can be stored unlimitedly.

4. Message sending technology: To report the amount deducted, the work utilizes the Node MCU to send message through Internet of Things (IoT) server. To report the Total amount with or without fine deducted to the authorities, IoT is the best possible solution. The normal criteria is to make a payment using RFID reader. If there is no balance in RFID tag then we should make a recharge to it by using the keypad.

Output Module:

1. Message of Transaction- The transaction details is shown through adafruit io.

2. Opens Gate- When we successfully complete with processing module with all the requirements then toll barriers opens using servo motor.

Conclusion:
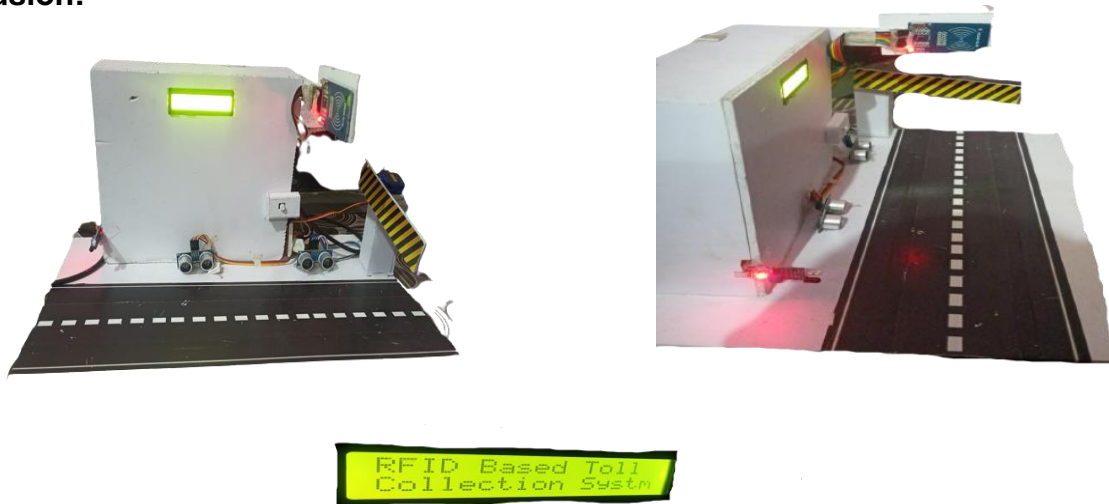
The electronic toll collection system in expressway based on RFID, a design scheme was put forward. It has characteristics of low cost, high security, far communication distance and high efficiency, etc. It not only can improve technology level of charge, but also improve passage ability of expressway. Electronic toll collection system is an effective measure to reduce management costs and fees, at the same time, greatly reduce noise and pollutant emission of toll station. In the design of the proposed Electronic toll collection (ETC) system, real time toll collection and anti-theft solution system have been designed. This reduces the manual labor and delays that often occur on roads. This system of collecting tolls is eco-friendly and also results in increased toll lane capacity. Also an anti-theft solution system module which prevents passing of any defaulter vehicle is implemented, thus assuring security on the roadways.

Scope for future work:

1. Wide Range RFID Readers: Using wide range RFID readers the Toll plazas will be more advanced as the RFID tag can be scanned far away. By this technology, the vehicle owners does not need to stop at toll plaza for scanning his RFID.
2. Automatic Vehicle Identification: The automatic vehicle identification (AVI) component of this system refers to the technologies that determine the identification or ownership of the vehicle so that the toll will be charged to the corresponding customer.
3. Automatic Vehicle Classification: Vehicle type and class may have differentiated toll amount. The vehicle type may include light vehicles like the passenger car or heavy vehicles like recreational vehicles. A vehicle's class can be determined by the physical attributes of the vehicle, the number of occupants in the vehicle, the number of axles in the vehicles and the purpose for which the vehicle is being used at the time of classification
4. Video Enforcement System: When used for electronic toll collection, the video enforcement system (VES) captures images of the license plates of vehicles that pass through an electronic tollbooth without a valid electronic tag. Although the deployment of these technologies makes the initial cost of installation very high, but there exits huge benefits accompanied with such high investment.