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RFID BASED AUTO TOLL MANAGEMENT

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Abstract - *The expressway transportation has become more and more important in today's road network and the manual toll collection system has become outdated due to its number of drawbacks. By employing automated toll collection system, driver of vehicles need not to stop at a window or and waste time for waiting in a long queue to pay their toll. This reduces the consumption of fuel; reduce congestion, increase road safety. An Automated Electronic Toll collection (ETC) system is basically designed for an uninterrupted toll collection, which has become an important part of intelligent transportation system. ATCS is an Automated Toll Collection System used for collecting tax automatically. In this we do the identification with the help of radio frequency. A vehicle will hold an RFID tag. This tag is nothing but unique identification number assigned. This will be assigned by RTO or traffic governing authority. In accordance with this number we will store, all basic information as well as the amount he has paid in advance for the TOLL collection. Reader will be strategically placed at toll collection center. Whenever the vehicle passes the toll naka, the tax amount will be deducted from his prepaid balance. New balance will be updated. Incase 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.*

Key Words: **Automatic toll collection, EM18 RFID Tag reader, RFID tags, Ultrasonic sensor, GSM.**

1. INTRODUCTION

Automatic toll collection is a technology allows the automated electronic collection of toll costs. As it is studied by researchers and also applied in various expressways, bridges, and tunnels require such a process of Automatic Toll Plaza. ATP is capable of determining if the vehicle is registered or not, and then informing the management center about to process violations, debits, and participating accounts .The most excellent advantage of this ATP system is that it is capable of eliminate congestion in toll plaza, especially during those seasons when traffic seems to be higher than normal. Electronic toll collection system allows the vehicle drives to pass the toll tax booths without stopping at the toll booth. The toll amount is deduced from the RFID card. This RFID cards is rechargeable and account is stopped on the records. Automatic Toll Tax systems have really helped a lot in reducing the heavy congestion caused in the metropolitan cities of today. It is one of the easiest methods used to organize the heavy flow of traffic. When the car moves through the toll gate on any road, it is indicated on the RFID reader that it has crossed the clearing. The need for manual toll based systems is completely reduced in this methods and the tolling system works through RFID. The system thus installed is quite expedient reducing the time and cost of travelers since the tag can be deciphered from a distance.

1.2. LITERATURE REVIEW

Before going further we just take the overlook of history of the toll plazas. So before the 90's decade the toll plazas were fully manual controlled. Means there are total four people for operating the Toll gate in this two people will be used for opening & closing of the gate & another two are for reception of the money & data keeping etc.

Satyasrikanth P et al, International Journal of Computer Science and Mobile Computing, Vol.5 Issue.8, August-2016, pg. 247-253©2016, IJCSMC All Rights Reserved 249Semi Automatic Toll plazas were launched after the introduction of Express ways in 1995, in which data is stored in computers and gate operation is automatic, only two personals are required for single booth. But here we are going to see the human less toll plaza. Active wave Inc [2] 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 receive 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. Elementary signals are shown with the help of blinking LEDs and beeping sounds. Smart key Access Control Systems [3] have a client –

server model based system with an SQL server handling multiple vehicle monitoring systems. They have designed a user interface 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 [1] uses active RFID tag which uses car battery power. The implementation is divided into the design of two modules- the Vehicle Module (Active Tag) and the Base Module. The two modules communicate via RF modem connected to each module. These RF modules communicate over the ISM Frequency Range of 902 –928MHz.

2. PROPOSED SYSTEM

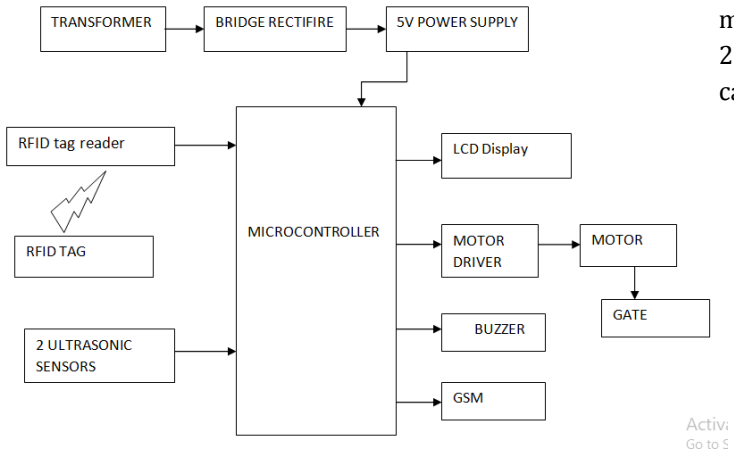

Fig 1: Block Diagram of System

The system has two parts, namely hardware and software. The hardware system consists of microcontroller, LCD, RFID, motor driver, and GSM. The software system consists of a Assembly based language is used. This system consists of a microcontroller interfaced with RFID, Motor driver, Max 232 and LCD 16x2 display, forming the hardware unit and interfaced to the server making up the software unit. Two sensors are attached far from the toll plaza. When any vehicle crosses to first sensor which is RFID reader it check the balance and deduct require amount. If user balance is deducted online and web system sends signal back to the RFID card system, that the user has billed. On receiving this signal the system operates the motor to open the toll gate when vehicle passes to next sensor which is IR sensor. Here we also check speed of vehicle if speed is more than given limit then rule break fine apply to that vehicle. To check speed of vehicle we are using two ultrasonic sensors.

A. PIC 16f690 microcontroller:

The PIC16F range of microcontrollers from Microchip are 8-bit MCUs that incorporate Microchip's PIC® architecture into a variety of pin and package options, from space efficient 14-pin devices to feature-rich 64-pin devices. Devices with Baseline, Mid-Range or Enhanced Mid-Range architecture are available with numerous different peripheral combinations, giving designers flexibility and choice for their applications. The PIC16F631/677/685/687/689/690 family of microcontrollers is based upon Microchip's Mid-range core with an 8 level deep hardware stack and 35 instructions. These MCUs provide up to 5 MIPS, up to 7 Kbytes program memory, up to 256 bytes RAM and Data EEPROM of up to 256 bytes. On board is a configurable oscillator factory calibrated to ±1% accuracy.

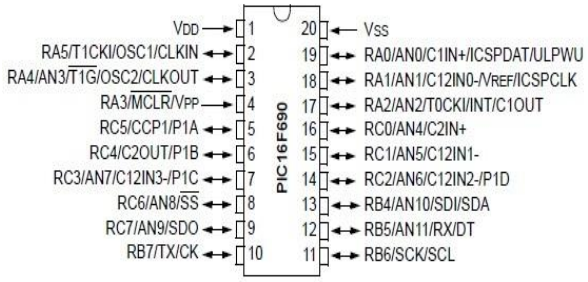

Fig -2: PIC16f690

B. Ultrasonic sensor (HC05):

Ultrasonic ranging module HC -SR04 provides 2cm -400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:(1) Using IO trigger for at least 10us high level signal.(2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.(3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning. Test distance = (high level time) * (velocity of sound (340M/S) / 2.

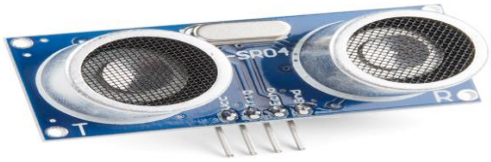

Fig -3: Ultrasonic Sensor

C. RFID Tag Reader (EM18):

It is used to read unique ID from RFID tags. Whenever RFID tags comes in range, RFID reader reads its unique ID and transmits it serially to the microcontroller or PC. RFID reader has transceiver and an antenna mounted on it. It is mostly fixed in stationary position. **EM18** is a RFID reader which is used to read RFID tags of frequency 125 kHz. After reading tags, it transmits unique ID serially to the PC or microcontroller using UART communication or Wigand format on respective pins.

EM18 RFID reader reads the data from RFID tags which contains stored ID which is of 12 bytes. EM18 RFID reader doesn't require line-of-sight. Also, it has identification range which is short i.e. in few centimeters.

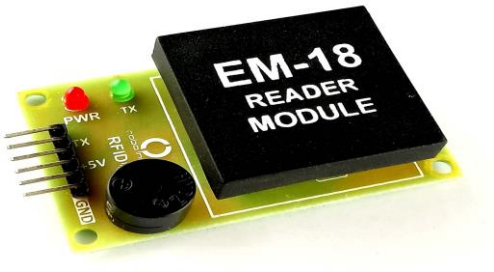

Fig -4: **EM18 RFID Tag Reader**

D. DC Motor:

A DC motor is an electrical machine which converts electrical energy into mechanical energy. The basic working principle of the DC motor is that whenever a current carrying conductor places in the magnetic field, it experiences a mechanical force these motors are simple DC Motors featuring gears for the shaft for obtaining the optimal performance characteristics. They are known as Center Shaft DC Geared Motors because their shaft extends through the center of their gear box assembly.

Fig -5: **LM35 TEMP Sensor**

This DC Motor – 100RPM – 12Volts can be used in all-terrain robots and a variety of robotic applications. These motors have a 3 mm threaded drill hole in the middle of the shaft thus making it simple to connect it to the wheels or any other mechanical assembly

E. LCD display:

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.

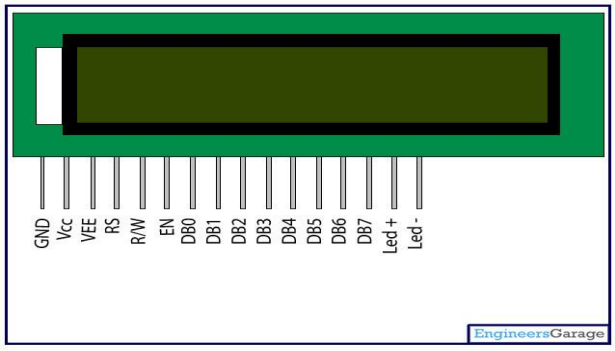

Fig -6 LCD display

F. GSM module:

This GSM modem has a SIM800A chip and RS232 interface while enables easy connection with the computer or laptop using the USB to Serial connector or to the microcontroller using the RS232 to TTL converter. Once you connect the SIM800 modem using the USB to RS232 connector, you need to find the correct COM port from the Device Manger of the USB to Serial Adapter. Then you can open Putty or any other terminal software and open a connection to that COM port at 9600 baud rate, which is the default baud rate of this modem.

Fig -7 GSM Module

3. CONCLUSIONS:

The Electronic Toll Collection system in expressway based on RFID, a design scheme was put forward. It is low cost, high security, far communication and efficiency, etc. It not improves the passage ability of expressway but also improve the technology level of charge. Electronic toll collection system using RFID 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.

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