

Automatised Toll Gate System Using Passive RFID and GSM Technology

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Abstract - Automatised toll gate system using passive Radio Frequency Identification emerges as a converging technology where time and efficiency are the matter of priority in toll collection systems of present day. In order to overcome the major issue of collision, in our project the reader is placed in a strip which is laid beneath the lane, and the tag is placed in the front side of the number plate. The object detection sensor which is placed on the side of the road detects the approach of the oncoming vehicle and intimates the stepper motor to raise the strip. Thus the reader raises to ground level and reads the information in the tag and the transaction takes place through a centralized database and the aftermath details of the transaction is intimated to the user's mobile through GSM technology.

Keywords: *Radio Frequency Identification, Global System for Mobile communication.*

I. INTRODUCTION

The need for manual toll based systems is completely reduced in this method and the tolling system works through RFID. A complete RFID system consists of a transponder (tag), reader/writer, antenna, and computer host. The transponder, better known as the tag, is a microchip combined with an antenna system in a compact package. The microchip contains memory and logic circuits to receive and send data back to the reader. These tags are classified as either active or passive tags. Active tags have internal batteries that allow a longer reading range, while passive tags are powered by the signal from its reader and thus have shorter reading range. Passive RFID have no internal power source and use external power to operate. These tags are powered by the electromagnetic signal received from a reader. The received electromagnetic signal charges an internal capacitor on the tags, which in turn, acts as a power source and supplies the power to the chip. Though these passive tags have both UHF and LF, the low frequency tags are best because UHF tags have high read range and hence capable of reading multiple tags simultaneously which in turn may lead to collision. The obvious advantage of the strip in our project is that it reads only one tag at a time and hence it is very advantageous compared to all the other previously existing system.

With reference to Journal of Theoretical and Applied Information Technology the study regarding the previously existing techniques such as using Optical Camera Recognition, Microwave Technology, RFID technology (active), GPS proved to be inefficient in some ways and these are discussed below. When taken into consideration the optical camera

recognition since the whole object will be captured it is a time consuming process and also the error rectification in the laser cameras is very difficult. Seeing through the Microwave technology it requires different transponders and also it tends to produce various problems regarding reflection. The Active RFID technology also did not prove to be useful since the reader used has Long read range which can result in collision reading multiple tags at a time and also it cannot function without battery power, limiting the lifetime of the tag. Thus our project which uses passive RFID technology proves to be very efficient having small read range and also avoids problems like reflection, cost, lifetime and different transponders.

II. SYSTEM MODELLING

2.1 RFID Technology

Radio-Frequency Identification RFID is a technology that uses radio waves to transfer data from an electronic tag, called RFID tag or label, attached to an object, through a reader for the purpose of identifying and tracking the object. The application of bulk reading enables an almost-parallel reading of tags but in turn may lead to collision also. Passive RFID tags do not use batteries and must be used at a close range of 3m or less. The antenna, tuned to a particular radio frequency, sends out radio waves. The reader then sends out a radio signal to the tag/antenna, which is activated to transmit the pertinent information. The radio signal contains enough energy to power the tag long enough to send out its

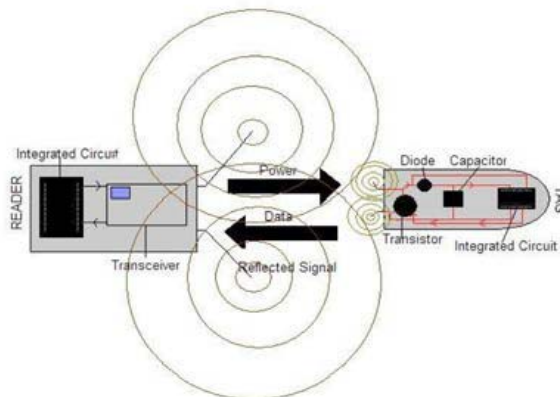


Figure 1:RFID Reader and Tag Operation

information. Most passive RFID tags use Electrically Erasable Programmable Read Only Memory (EEPROM) for small amounts of data.

2.2 PIC Microcontroller

PIC Microcontroller has a very basic advantage of having Parallel Slave Port. The Master Synchronous Serial Port (MSSP) module is a serial interface, useful for communicating with other peripheral or microcontroller devices. PIC16F877A has host of features intended to maximize system reliability, minimize cost through elimination of external components, provide power saving operating modes and offer code protection. It has 33 pins and this makes it easier to decide what external devices to attach without worrying too much if there

enough pins to do the job. One of the main advantages is that each pin is only shared between two or three functions so it's easier to decide what the pin function.

GSM

Global System for Mobile Communications is a 2nd Generation cellular mobile system. Global System for Mobile (GSM) is a second generation cellular standard developed to cater voice services and data delivery using digital modulation. It has got full international capability. The main application of GSM in our project is that it provides Support of Short Message Service (SMS).

Stepper Motor

A stepper motor is a brushless, synchronous electric motor that can divide a full rotation into large number of steps. The motor's position can be controlled precisely without any feedback mechanism as long as the motor is carefully sized to the application. Stepper motors are similar to switched reluctance motor.

MP Lab

MPLAB Integrated Development Environment (IDE) is a free, integrated toolset for the development of embedded applications. MPLAB IDE runs as a 32-bit application on MS Windows, is easy to use and includes a host of free software components for fast application development and super-charged debugging. Moving between tools is a snap, and upgrading from the free software simulator to hardware debug and programming tools is done in a flash because MPLAB IDE has the same user interface for all tools.

Visual Basic

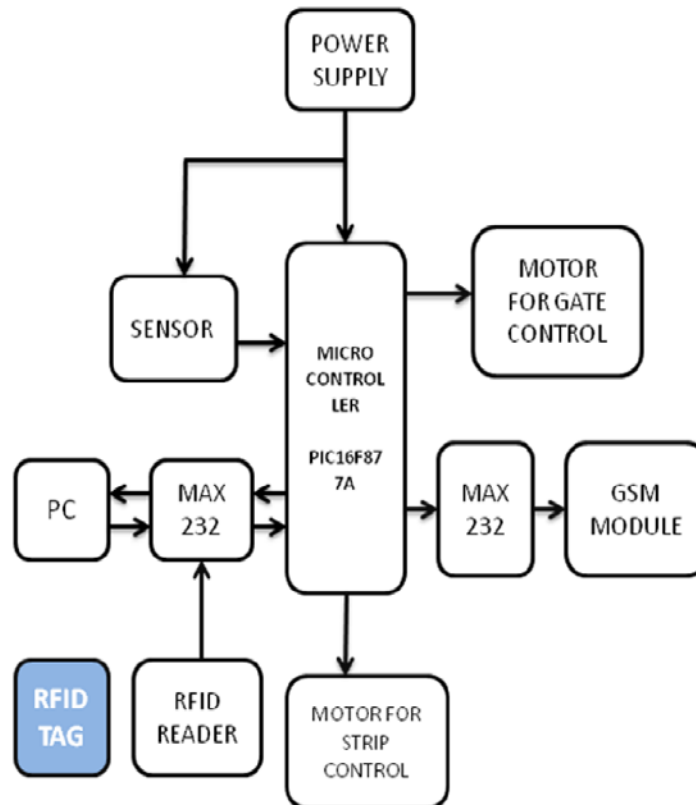
It's simple language. Things that may be difficult to program with other language can be done in Visual Basic very easily. Finding answers for programming problems is much easier than other programming languages. For example, if we want to ping a user over the internet in your program, Instead of writing the ping function yourself, you can download a control that does it, and use it in your program.

MS Access

Microsoft Access, is a relational database management system from Microsoft that combines the relational Microsoft Jet Database Engine with a graphical user interface and software-development tools. It also has the ability to link to data in its existing location and use it for viewing, querying, editing, and reporting. This allows the existing data to change while ensuring that Access uses the latest data.

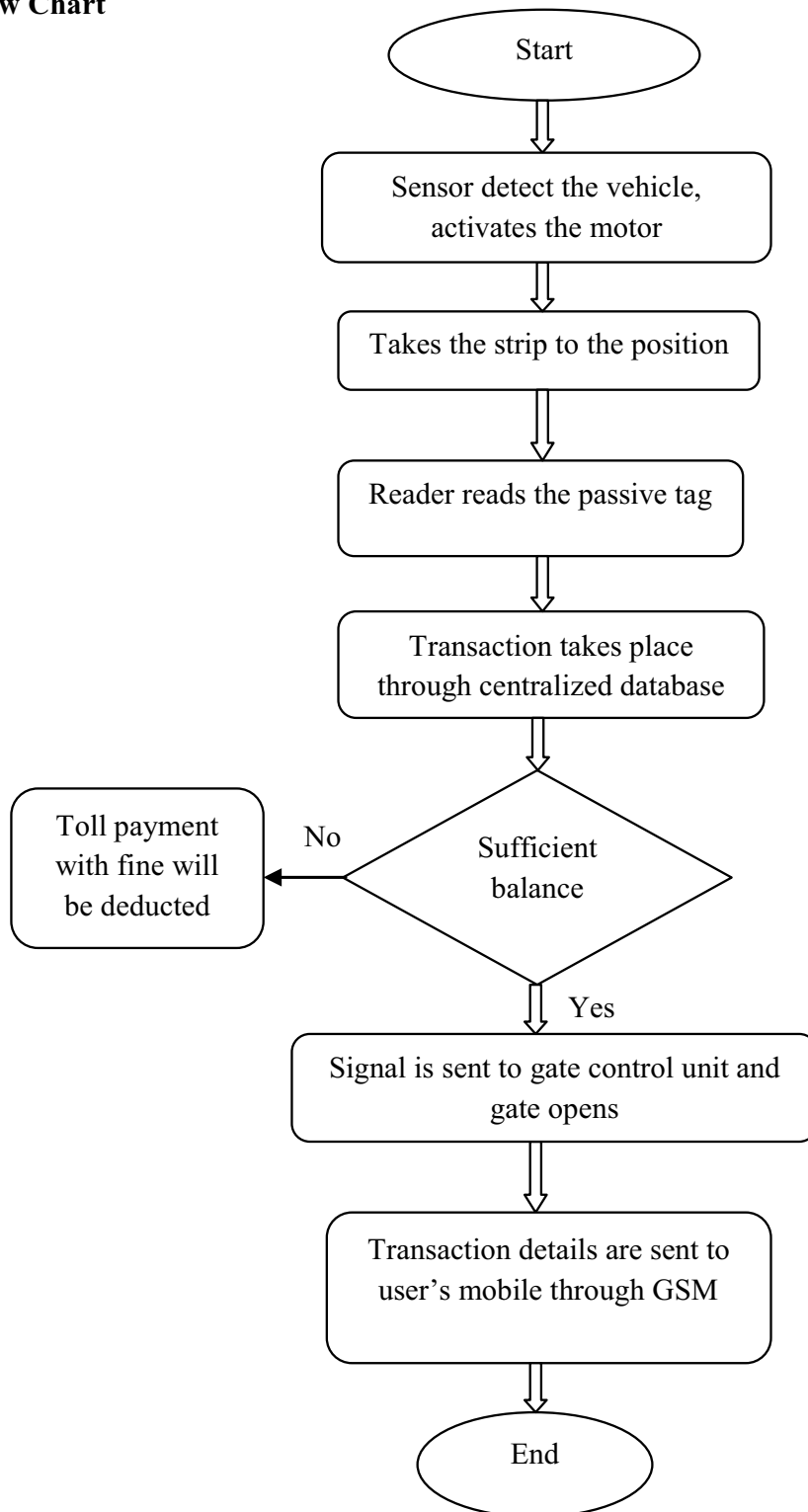
III. PROPOSED SYSTEM

Block Diagram



Automatised toll collection system is an efficient method of collecting tolls as the vehicles passing through the toll plaza do not stop to pay toll and the payment is automatically deducted from the driver's account. The main difference in idea in our project is the placement of the reader and the tag which avoids collision majorly, where the tag is placed in the front side number plate and the reader is placed in a strip which is laid beneath the road in an opening on the track of the vehicle. As the vehicle approaches, the sensor which is placed on the side of the road activates the stepper motor and raises the strip and the information on the tag is read by the reader and the transaction takes place. Simultaneously the transaction details or details regarding if the user is valid or not is sent to the microcontroller and this will intimate the gate control which is supported by a stepper motor to open if the user is valid. The aftermath details regarding the deducted amount and the main account balance are intimated to the user through GSM technology.

Flow Chart



IV. CONCLUSION

In this we have discussed various types of ETC systems applied in some countries. The proposed automatic method of collecting toll applies passive RFID technology but with a difference in idea of implementation which will avoid collision and various other existing problems too. By doing so, increased efficiency will be guaranteed since RFID is known as a highly stable technology. With the elimination of human interaction in the entire toll collection process, it is possible to create an efficient toll collection process. It can also significantly improve the efficiency of toll stations and avoid the traffic congestions on roadways.

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