International Journal of Research Studies in Science, Engineering and Technology
Volume 2, Issue 7, July 2015, PP 115-119
ISSN 2349-4751 (Print) & ISSN 2349-476X (Online)

# Reliability and Availability Analysis of an Automatic Highway Toll Collection System

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**Abstract:** *There are millions of drivers passing through Toll Gate Stations every day. The conventional or the traditional way of collecting the toll from the vehicle owners or the drivers is to stop the car by the Toll Gate Stations and then pay the amount to the toll collector standing (or perhaps sitting!) by the side of the toll booth, after which the gate is opened either mechanically or electronically for the driver to get through the toll station. So in order to stop all these problems and inconvenience, we introduce an automated or a more convenient way of collecting the toll and traffic management. It's called Electronic Toll Gate Stations using RF434 Technology.*

**Keywords:** *GSM, Toll.*

## 1. INTRODUCTION

The advances in the technologies related to wireless communication has led to the emergence of several engineering designs to aid the human requirements. Today on one side the importance for secured access is growing in several fields and on other side with technology advancements the RF434 cards and readers are becoming low cost. Both these aspects are the primary reasons for rapidly growing RF434 based authentication system.

Today several wireless technologies are used for building wireless networks. Among them the 2.4GHz wireless network is most widely deployed and used. The wide usage of 2.4 GHz wireless communication indicates that this infrastructure can give near real time responses and makes suitable for crucial industrial systems. Global system for mobile communication is that it is an international standard and GSM is only type of cellular service available.

Implementing mobile communication based health monitoring via short message service (sms) simple wireless control device to achieve the targets, or use the GSM network technology to achieve. Nevertheless, the functions of these devices are too simple to prevent the vehicle theft crimes from happening.

## 2. PROPOSED SYSTEM

In this project we are implementing automatic toll gate management and vehicle access control system using ARM based LPC2148, PIC18F452 and wireless technologies such as RF434, ZigBee and GSM. In this system three sub-systems are present those are central database system, tollgate unit and vehicle unit.

The vehicle unit consists of a active RF434 tag, GSM modem, keypad and ignition control unit. The Active RF434 tag sends the necessary vehicle identification information to tollgate unit based on user request. GSM send the vehicle starting intimation to user and also receive the necessary command from user for stop the vehicle. Keypad is used for authentication password to access to start the vehicle. The tollgate unit contains the Active RF434 reader reads the necessary vehicle identification information When a vehicle comes in the vicinity of the toll gate the tag attached to the vehicle is communicates with the reader attached to Toll gate station and the information of tag is sent through Central data base station using ZigBee wireless communication protocol. At the other side the central data base system receives this information compares the database for the sufficient details and amount.

If the details are matched and sufficient amount is found then the successful information is sent to the corresponding toll gate station via ZigBee. At the toll gate if the received information is about success then the toll gate will be opened after vehicle passed away it will be closed automatically based on IR sensor interfaced at toll gate.

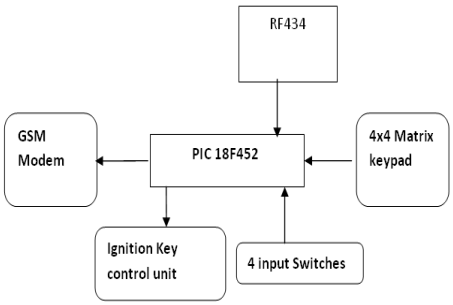


**Fig1.** *Vehicle Unit*

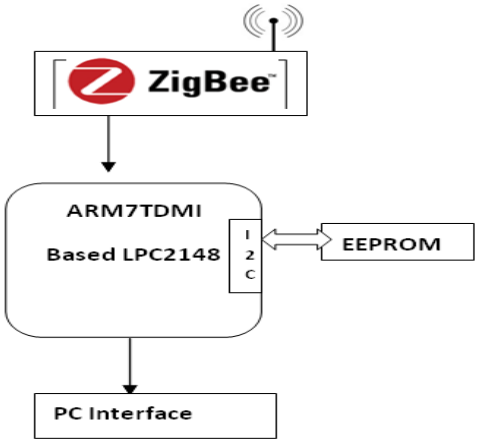


**Fig2.** *Central Unit*

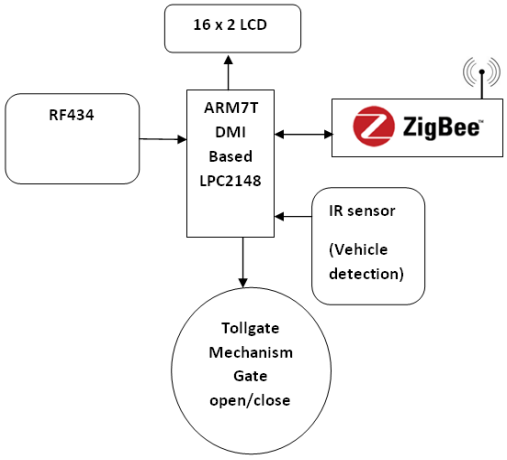


**Fig3.** *Toll Gate Unit*

## 3. HARDWARE IMPLEMENTATION

### 3.1. PIC Microcontroller

PIC microcontrollers come in a variety of "flavors", each with different components and capabilities. The PIC is a very general purpose microcontroller that can come with many different options. General Instruments produced a chip called the PIC1650, described as a Programmable Intelligent Computer. This chip is the mother of all PIC chips. Maybe that is why most people think PIC stands for Peripheral Interface Controller. Microchip has never used PIC as an abbreviation, just as PIC and recently. PIC microcontrollers are finding their way into new applications like smart phones, audio accessories, video gaming peripherals and advanced medical devices. Microchip Provides

solutions for the entire performance range of 8-bit microcontrollers, with easy-to-use development tools, complete technical documentation and post design-in support through a global sales and distribution network. There are hundreds of 8-bit PIC microcontrollers to choose from ranging from 6 to 100 pins and up to 128 KB Flash that are pin and code compatible.

### 3.2. LPC2148 Microcontroller

LPC2148 microcontrollers are based on a 32 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support that combines the microcontroller with embedded high speed flash memory of 512kb. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces the code by more than 30% with minimal performance penalty.

### 3.3. Liquid Crystal Display

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.

### 3.4. GSM

The GSM standard provides a common set of compatible services and capabilities to all mobile users across Europe and several million customers worldwide. Designed for global market, SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz. SIM300 features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.With a tiny configuration of 40mm x 33mm x 2.85mm , SIM300 can fit almost all the space requirements in our applications, such as smart phone, PDA phone and other mobile devices. In this hardware SIM300 is only interfaced with RS232, Regulated power Supply 4.0V SIM Tray Antenna with LED indications

## 4. HARDWARE & RESULTS

In the vehicle unit we are PIC microcontroller for sending the ID to toll gate and for vehicle security. The central database and toll unit is designed on the LPC2148. The output results of the project are as follows.

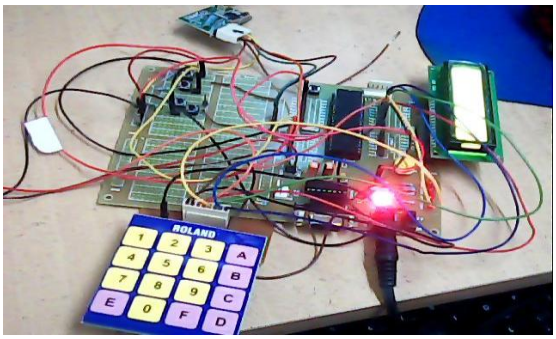


**Fig4.** *Hardware connections of Vehicle Unit*

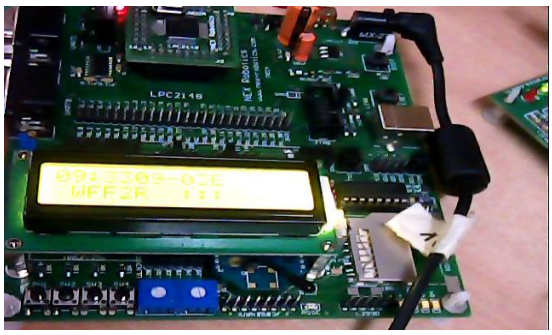


**Fig5.** *Central Unit on LPC2148*

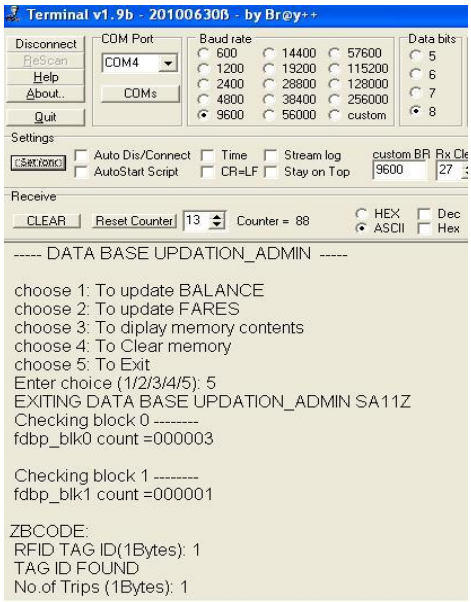


**Fig6.** *Terminal Screen Shots of Data Base*

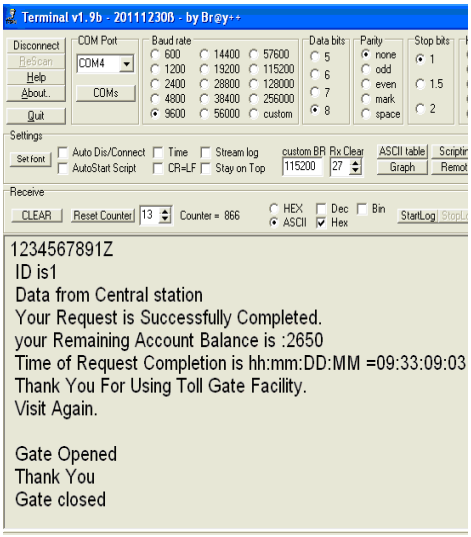


**Fig7.** *Toll Gate Unit Data Processing*

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