ijecs open access www.ijecs.in
International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume 3 Issue 11 November, 2014 Page No. 9040-9042

Automatic Toll Gate Management and Vehicle Access Intelligent Control System Using Arm7 Microcontroller

M. Jyothirmai[1], D. Prashanth[2], J. Vamsikrishna[3]

[1]STUDENT (M.TECH) Department of ECE (Embedded systems)
Megha Institute of Engineering & Technology for women, Jawaharlal Nehru Technological University,
Hyderabad- 500098, India.
jyothirmai.merugu@gmail.com

[2]Assoc. Professor (M.TECH), Department of ECE
Megha Institute of Engineering & Technology for women, Jawaharlal Nehru Technological University,
Hyderabad- 500098, India.
Prashanth.megha27@gmail.com

[3] Asst. Professor (M.TECH), Department of ECE
Megha Institute of Engineering & Technology for women, Jawaharlal Nehru Technological University,
Hyderabad- 500098, India.
Jupudi.vamsikrishna8@gmail.com

Abstract: *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 in 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 way of collecting the toll and traffic management. It is called Electronic Toll Gate Stations using RFID Technology.*

In this paper we use ARM based LPC2148, PIC18F452, RF434, ZigBee and GSM. In this system three sub systems are present. Those are central database system, toll gate unit and vehicle unit. The vehicle unit consists of an active RF434, GSM modem, keypad and ignition control unit. The RF434 sends the necessary vehicle identification information to toll gate unit based on user request. GSM send the vehicle starting intimation to user and also receive the necessary command from user to stop the vehicle. Keypad is used for authentication password to access to start the vehicle. The toll gate unit contains the RF434 which reads the necessary vehicle identification information. When a vehicle comes in the vicinity of the toll gate the tag attached to the vehicle communicates with the toll gate station and the information of tag is sent to central data base station using ZigBee wireless communication protocol. At the other side the central data base system receives this information and compares from database for sufficient details and amount information. 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 success then the toll gate will be opened for the vehicle to pass and the gate will be closed automatically based on IR sensor interfaced at toll gate

Keywords: ***GSM, LPC2148, PIC18F452, RF434***

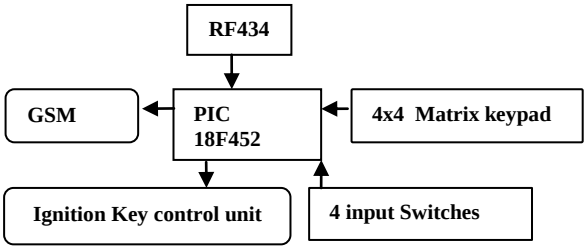
1. INTRODUCTION

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 IS becoming low cost. Both these aspects are the primary reasons for rapidly growing RF434 based authentication system.

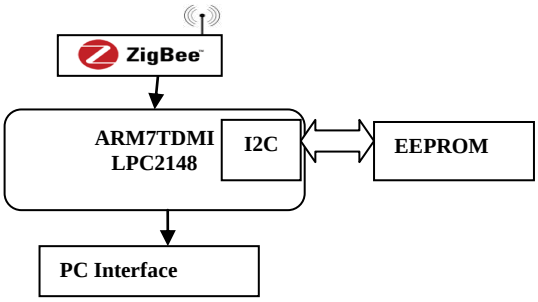
Today several wireless technologies are used for building wireless networks. Among them the 2.4GHz wireless network is most widely deployed and used. The wide usage of 2.4 GHz wireless communication indicates that this infrastructure can give near real time responses and makes suitable for crucial industrial systems. An automated Vehicle monitoring system is developed by using an Active Tag RFID system. The requirement for an active tag arose from the fact that vehicle applications requires a long range as well as sufficient power for the tag to ensure reliable data transfer between the modules. Radio Frequency Identification (RFID) has attracted considerable attentions in recent years for its broad applications in ubiquitous computing. The main aim of the project is to detect the vehicle, find out the present and next locations of the vehicle and easily we can control the speed of the vehicle.

2. BLOCK DIAGRAM & HARDWARE MODULES

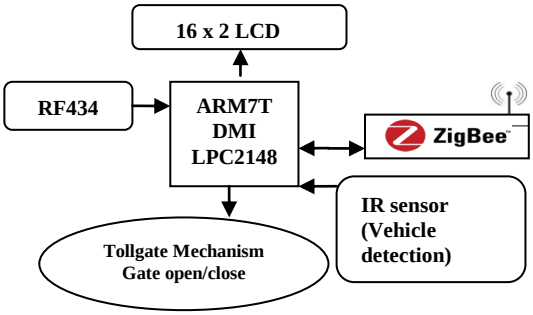
Vehicle unit



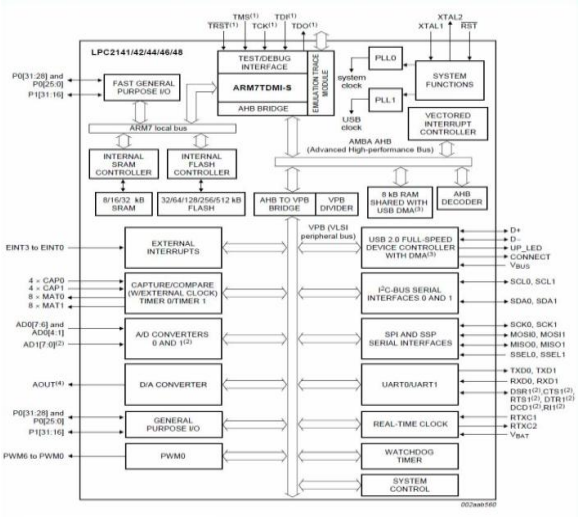
Central station



Toll gate unit



2.1 LPC2148 MICROCONTROLLER



Block diagram of LPC2148

The 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 512 kB. 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.

2.2 PIC18F452

It is a 'C' compiler optimized instruction set architecture. It can operate up to10 MIPS. Power consumed is 40 MHz osc/clock input and 4 MHz - 10 MHz osc/clock input with PLL active. It is of 16 bit instructions, 8 bit wide data path. Three external interrupt pins.

2.3 GSM

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 of 4.0V SIM Tray Antenna with LED indications.

2.4 RF434

The ZigBee standard provides network, security, and application support services operating on top of the IEEE 802.15.4 Medium Access Control (MAC) and Physical Layer (PHY) wireless standard. ZigBee has a wide application area such as home networking, industrial networking, smart dust, many more, having different profiles specified for each field. The purpose of an RF434 system is to enable data to be transmitted by a portable device, called a tag, which is read by an RF434 reader and processed according to the needs of a particular application. The data transmitted by the tag may provide identification or location information, or specifics about the product tagged, such as price, color, date of purchase, etc. RF434 technology has been used by thousands of companies for a decade or more. RF434 quickly gained attention because of its ability to track moving objects.

Active RF434 uses an internal power source(battery) within the tag to continuously power the tag and its RF communication circuitry, whereas passive RF434 relies on RF energy transferred from the reader to the tag to power the tag.

3. IMPLEMENTATION

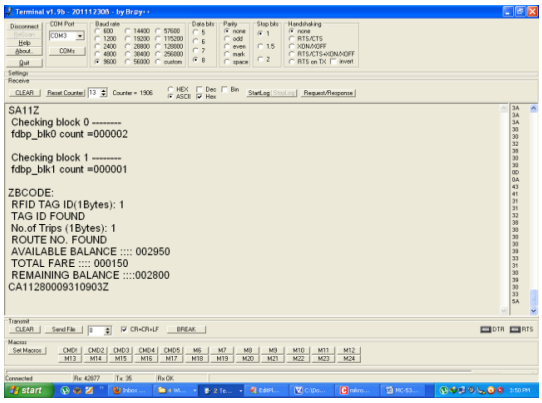
The owner of the vehicle or the authorized person of the vehicle should press the valid password on the keypad. The ignition system of the vehicle will be on only if the password is valid else wrong password will be displayed on the LCD. Next the vehicle unit contains four switches. Switch 2, switch 3, switch 4 are used to provide security to the vehicle i.e., to avoid any unauthorized person to use the vehicle. The working of these switches 2, 3,4 are as follows.

The owner should press switch 2 to access the vehicle. When it is pressed a command is displayed on the LCD placed inside the vehicle whether to on or off the vehicle. The same message is sent to the owner of the vehicle through a SMS. The owner can send "STOP" command as a reply message so as to stop the ignition system. To on the ignition system the owner need not send any reply message. Switch 3 is pressed to on the vehicle and switch 4 is used to off the vehicle. Switch 3 and switch 4 works only if it receives a correct password.

When the vehicle comes to the vicinity of the toll gate switch 1 should be pressed by the owner to send the tag id to the toll gate unit through RF434. The tag is inbuilt in the vehicle. The tag contains vehicle number, balance details. The toll gate receives tag id through RF434 and sends this id to central station. The communication between toll gate station and central station is through ZigBee. The central station first checks the vehicle number and then checks whether there is

sufficient balance in the account or not. Maximum balance in the account can be up to 9999 rupees. If there is sufficient balance in the account the toll charge is deducted automatically. The vehicle is detected by the toll gate through IR sensor and the gate is closed. The above mentioned account operations are performed and if the account has the sufficient balance the toll charge will be deducted and the gate will be opened and the vehicle moves on. It takes approximately 2 seconds to perform this operation. If there is insufficient balance the account needs to be recharged at the counter present in the toll area manually. These account details will be displayed to the vehicle owner on pc monitor placed near the toll gate.

1. Results of central station

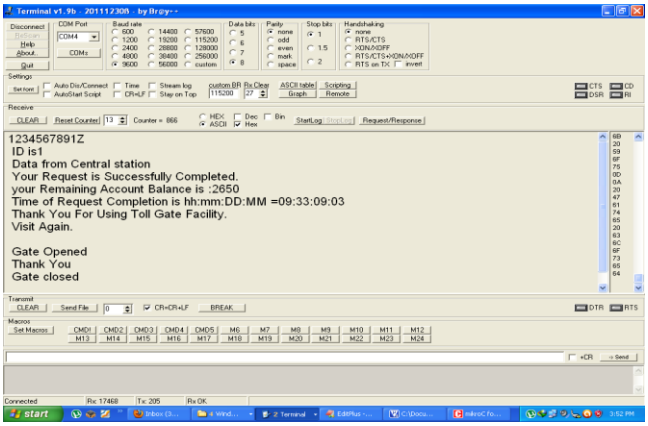


In vehicle unit the vehicles are interfaced with RF transceivers module and Hex keypad. Driver of the vehicle should enter the password then only vehicle should start. The central station is equipped with one ARM7TDMI based LPC2148 microcontroller, and is interfaced with ZigBee wireless module. The complete information of all the vehicles account details, fare amount is stored in the External memory (EEPROM) is interfaced to the station using I2C protocol. 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. If there are any errors like tag detection, not enough balance then the central station will send the appropriate command data to corresponding station.

If the data from central station is successful then the toll gate is opened and remaining account balance is displayed on the PC after which the gate is closed automatically.

2.Results of toll gate station



4. CONCLUSION

The automatic toll gate system reduces man power and cost. It is more automated and convenient way of collecting the toll and traffic management and it is also providing vehicle access security. This paper mainly reviewed the research and development work on the highway parking system. Using RF434 wireless communication we now knew that the vehicle is sensed at the toll gate by the vehicle tag id and the amount is realized to be automatically debited from the user account. By using this traffic at the tollgates can be avoided and the users can pass the toll gates without stopping for a long time.

6. FUTURE SCOPE

The banking module can be implemented with advanced software's like Oracle, Visual Basic so that it can be more perfect in future implementations. The banking module can be implemented dynamically so that the toll bill can be varied at each and every toll gate. The data base can be implemented using SQL server which is faster accessing.

7. REFERENCES

[1]. Wayne Wolf. Computers as Components Principles of Embedded Computing System Design [M), Beijing: Publishing House of Machinery Industry. 2002

[2]. WARWICK A. SMITH, .ARM Microcontroller Interfacing: HARDWARE AND SOFTWARE., elektor International Media BV 2010

[3]. JOHN B. PEATMAN, Embedded Design with the PIC18F452 Microcontroller, Prentice Hall; 1 edition (5 August 2002)

[4]. C.M. Roberts, Radio frequency identification (RF434) Computers & Security, Vol. 25, Issue 1, February 2006, Pages 18-26.

[5] Moratuwa, RF434-based anti-theft auto security system with an immobilizer, Industrial and Information Systems, 2007. ICIIS 2007 International Conference. Pages 441-446