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Design & Development of Pic-Micro Controller with RF Based Toll Gate Management System

P. Satyanarayana
PG Scholar, Department of ECE,
Sri Vasavi Engineering College,
Tadepalligudem, Andhra Pradesh, India.

D. Rajesh Setty
Professor, Department of ECE,
Sri Vasavi Engineering College,
Tadepalligudem, Andhra Pradesh, India.

***Abstract*-Time is a matter of priority now RF (Radio Frequency) technology comes forth as one of the meeting technologies. In all developed countries transportation is occupies one of the major contribution in total development of a country. This paper aims to understand the benefits of RF technology in transportation management system at toll gate. We are going to implement this application by one of RF based device is called RFID (Radio Frequency Identification). This will fulfill the major requirements of this application .RFID is used for various applications like textile industry, contact less smart cards, supermarkets etc.**

Keywords---Pic micro controller application; pic micro controller with RF based Applications; Micro controller Applications; RFID Technology; RFID Reader and Tags; RF Based Toll gate management; RFID Applications; RF Based Embedded System; Embedded system application.

INTRODUCTION

Road transportation is one of the major transportation in our country. It is necessity to apply perfect management system at highways for vehicles moving without any disturbance and latency in its journey .We are going to apply new management system at tollgate due to this we can able reduce traffic density at tollgate. This new management system can be applied by using available technology in market with low cost.

The purpose of this project is explained as follows it is mainly used for reduce the rush at tollgate. Also we will make all the vehicle details are computerized for future reference. Every vehicle contains the RFID tag with unique ID and RFID reader at tollgate. When any vehicle enters at the tollgate by using its unique ID, all Payment details can be automatically update in local computer.

I. HISTORY

Traditional tollgate management system is not automated due to this more vehicles struck up at tollgate due to this vehicle transportation time gets increased. In market more technologies are available to implement automation they are all more expensive. Here we make an attempt to design & develop a low Cost, simple technology using micro controller with RFID.

II. SYSTEM IMPLEMENTATION DIAGRAM

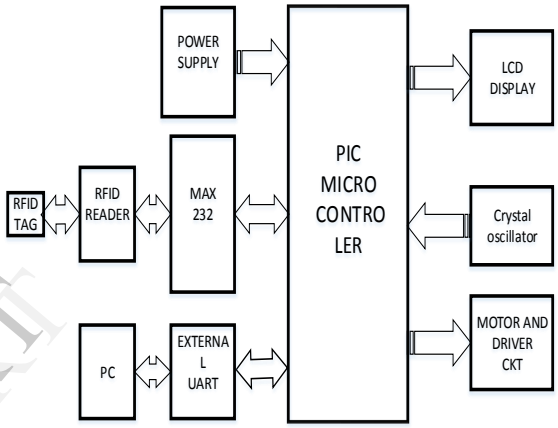

Fig. 1. Block diagram

A. PIC Micro controller

PIC Micro controller is a heart of this system. In this design PIC 16f 877A was used. It is a RISC processor it contains following features Wide operating voltage, (2.0 to 5.5v), Operating frequency of 20MHz max, 35 instructions of 14 bit wide, 8bit data path, 8 level stack, 13 bit program counter, 8K×14 Words of Flash, 368 bytes of data memory,256×8 bytes of EEPROM data memory, Three timers two of them 8 bit (timer 0,2), one 16 bit timer(timer 1), 8 bit wide parallel slave port, two capture comparator PWM modules and brown out detection circuit for brown out reset, synchronous serial port with SPI and I2C interface, 8bit wide parallel slave port with RD, WR, CS controls, five peripheral ports for interfacing to the external devices like External UART , Memory etc.

B. Power supply

This is used for energize system. Here +5v DC supply is sufficient for this system. 230v AC is applied from main supply to the voltage transformer to get +12v AC out voltage. This output voltage is fed to the input of bridge rectifier input. Since bridge rectifier is a full wave rectifier type it will give full cycle output. To reduce the ripples at rectifier output voltage by fed to this to the choke filter. Choke filter consists of capacitor series with inductor and another capacitor at load. This filter completely reduces ripples. To get required load voltage by applying this filter output to the regulator circuit. This regulator gives constant +5v at output.

C. LCD Display

In Liquid crystal displays (LCD) materials having a high melting point and high temperature range. In LCD liquid crystal material is sandwiched between two glass panels. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed in polymeric layers which are present in between the electrodes and the liquid crystal.

These layers which makes the liquid crystal molecules to maintain a defined orientation angle. When the light passes through polarizer these polarizer's would rotate to a definite angle, in a particular direction.

During the LCD is in the off state light rays come out of the LCD without any orientation because of this LCD appears as transparent.

These liquid crystal molecules will be aligned in a specific direction by applying supply voltage to electrodes.

In LCD there is a special provision called backlit for character visualization even in dark conditions. LCD can be classified according to their displaying data 1) Text LCD 2) Graphical LCD. Graphical and Text LCD available in different sizes and easily available in market.

Text LCD can be displayed only numbers, alphabets and some of special characters only. But Graphical display apart from above it can able to work in graphical mode also. In this graphical mode it can be able to display small pictures and vector diagrams also.

LCD consists of two registers code register and data register when writing any commands select the code register. When writing any data which we want to be displayed in the LCD is selected in data register. These registers are useful at the time of program.

D. MAX- 232

Max-232 is ASIC. It has multichannel line drivers and receivers used for converting the signals from RS-232 level (±9V) to TTL level (5V) and vice versa. It is operated at +5V power supply and it has two receivers and two drivers. Typically a pair of a driver/receiver of the MAX232 is used for TX and RX and the second one for CTS and RTS.

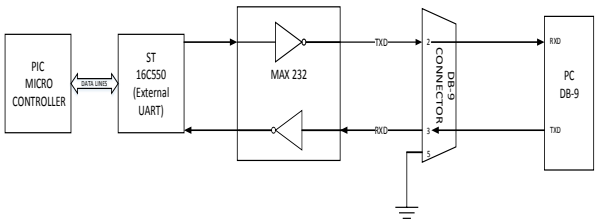

Fig. 2. Micro **C**ontroller communicate with pc

E. ST16C550 (UART) chip

The ST16C550 is a universal asynchronous receiver and transmitters with 16 byte transmits and receive FIFO. It operates at 2.97 to 5.5 volts. A programmable baud rate generator can select transmit and receive clock rates from 50 bps to 1.5 Mbps.

The ST16C550 on board status registers provides the error conditions, type and status of the transfer operation being performed.

The ST16C550 provides internal loopback capability for on board diagnostic testing. The ST16C550 is available in 40 pin PDIP, 44 pin PLCC, and 48 pin TQFP packages. It is fabricated in an advanced CMOS process to achieve low drain power and high speed requirements. It has following features

Operating voltage is 5.5V max,16 byte transmit FIFO, Full duplex operation, Transmit and receive control , Standard modem interface ,Low operating current (1.2 mA typ.),Four selectable receive FIFO interrupt trigger levels, Available on different packages Ex: PLCC,DIP,TQFP.

F. Crystal oscillator

Crystal oscillator contains a crystal with in-built capacitors for generating oscillations. It mainly used generating fixed frequency oscillations for micro controller. Crystal oscillator is used in this application generating frequency of 1.8432MHz.

G. DC motor

DC geared motor is used for lifting and closing the gates quickly at tollbooth. This is high efficiency, high quality low cost DC motor with gearbox. These are very easy to use and available in standard size. Internal threaded shaft for easily connecting it to wheel. This wheel is used for gate lifting.

H. RFID

1) Origins

Radio frequency identification (RFID) is a rapidly growing wireless technology. RFID systems consist of small transponders or tags attached to objects. When these objects are nearer to the RFID readers these readers will read the information contained in the transponders. RFID tags and readers are available in the different frequencies which are license free.

These are:

High frequency 13.56MHZ
Ultra high frequency 868-930MHZ
Low frequecncy-125 to 135KHZ
Micro Wave 5.8 GHZ

2) Working Principle

In this RFID technique object can be detected with out Any requirement of line of sight amid tag and reader. In this technology objects can be identified by an inductive coupling.

RFID Structure consists of transponder and reader. The tag is on the product to be scanned and the reader which can be either just a reader or a read & write device, depending upon the system design.

The RFID reader consists of a radio frequency module, controlling unit for configurations, a monitor and an antenna to detect the RFID tags.

RFID Tag – This consists of data, in general it comprises with an antenna and an electronic micro-chip. RFID tags comprise of a RFID transceiver for transferring data from tag to reader. There are two kinds of RFID tags- Passive RFID tags &Active RFID tags.

a) Passive RFID Tags

The name Passive RFID tags indicate these tags will not having built in power supply. These are miniature in size as well as cheap and fit into the pockets. These type tags comprise of 3 key components, namely, an in-built chip, a substrate and an antenna. The inbuilt chip is a circuit and is used to perform specialized tasks along with accumulating data.

Passive RFID tags can consists of various kinds of micro-chips depending up on the structural design of a particular tag. These chips can be MO (read only) or WORM (write once chip other than read many) or RW (read write) chip.

In general RFID chip component consists of accumulating 96 bits of data but some other chips have a capacity of storing 1000-2000 bits of data.

The Passive tag has an in built antenna which is attached to the micro-chip. This antenna is employed for transferring data with the help of RF waves. This type of tag's performance is dependent on the size of the antenna as well as the shape of the antenna.

The third part of the tag is substrate. This substrate is a plastic coating or Mylar which is employed to unite the antenna & the chip.

b) Active RFID Tags

Active tags consists of same components those are exists in passive tags. The only comparison between the two is that the size of the micro-chip in active tags is larger than passive tags' chip.

An active tag is incorporated with a built-in power supply. Maximum of the active tags make use of batteries whereas some of them work on solar cells. The inbuilt power system facilitates the tag to be used as an independent reader which is competent of transferring information devoid of outer assistance.

Active RFID tags are available with some extra features such as microprocessors, serial ports & sensors. The highly developed technology is existing in active RFID tag. It is more capable in comparison to passive tags as the active tags can be easily employed for a large array of tasks.

3) Tag - Reader communication

The RFID Tag can be communicating with reader by using Back Scatter modulation technique. The Power is emitted from the reader's antenna; a small proportion of this power will reach the tag antenna.

This power supplied to the tag antenna connections as HF voltage. This voltage will be rectified by using diodes. This diodes output voltage can be used as turn on voltage for deactivation or Activation of the power in power saving mode.

A proportion of the incoming power E1 is reflected by the antenna and returned as power E2. The reflection characteristics of the antenna can be influenced by altering the load connected to the antenna.

In order to transmit data from the tag to the reader, a load resistor is connected in parallel with the antenna is switched on and off in time with the data stream to be transmitted.

The amplitude of the power E2 reflected from the tag can be modulated. The signal of the transmitter, which is stronger by powers of ten, is a large degree suppressed by the directional coupler.

I. HARD WARE INTERFACING DETAILS

Fig 3, 4 & 6 gives the hard ware implementation details of the system.

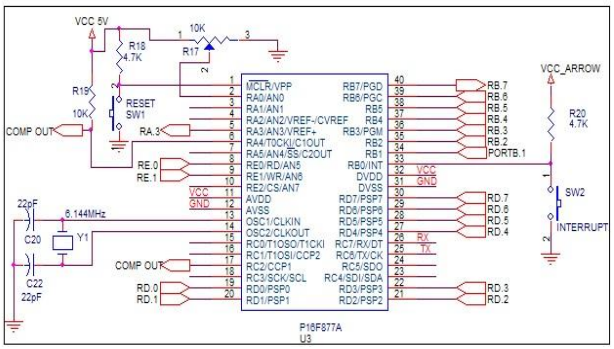

Fig. 3. Connection diagram for PIC Micro controller

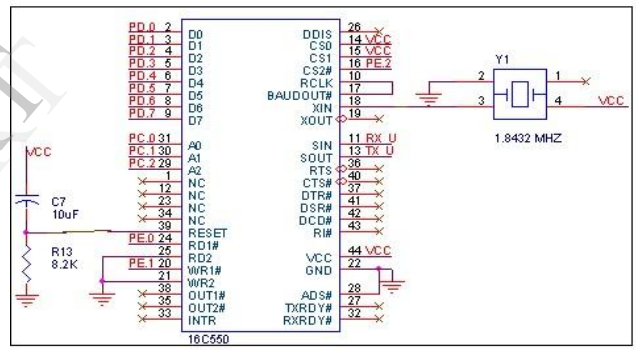

Fig. 4. Connection diagram for UART chip

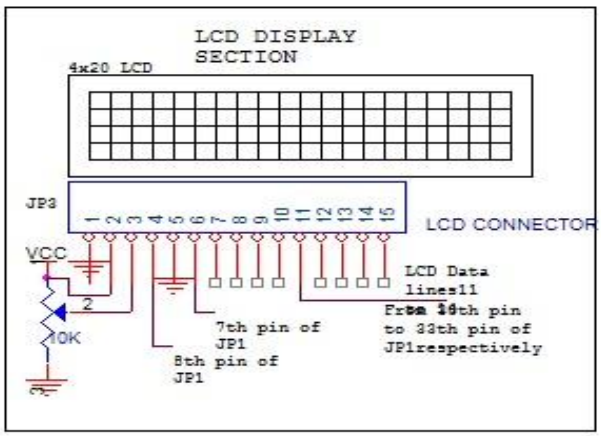

Fig. 5. Connection diagram for LCD

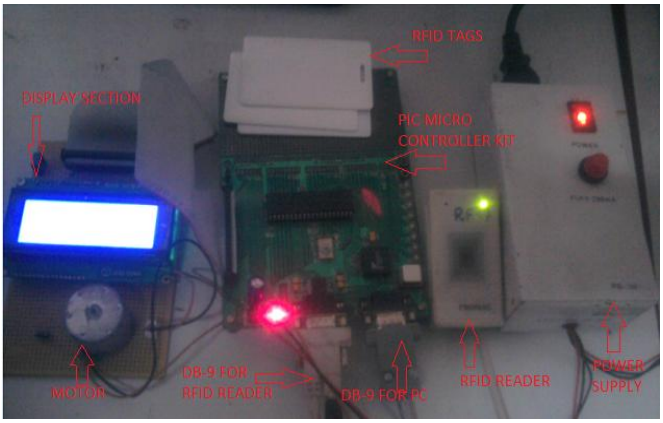

Fig. 6. Design Proto Type

Fig. 7. Result Display

CONCLUSION

In this paper we explained design of Toll gate management system with current technology, low development cost. This type of systems we can easily implemented practically. Major advantage of this technology is lower cost among of all other technologies present & RFID readers, tags are easily available in the market.

In future every toll gate is equipped with this design for effectively reducing traffic at their premises.Fig-8 shows flow diagram of developed code.

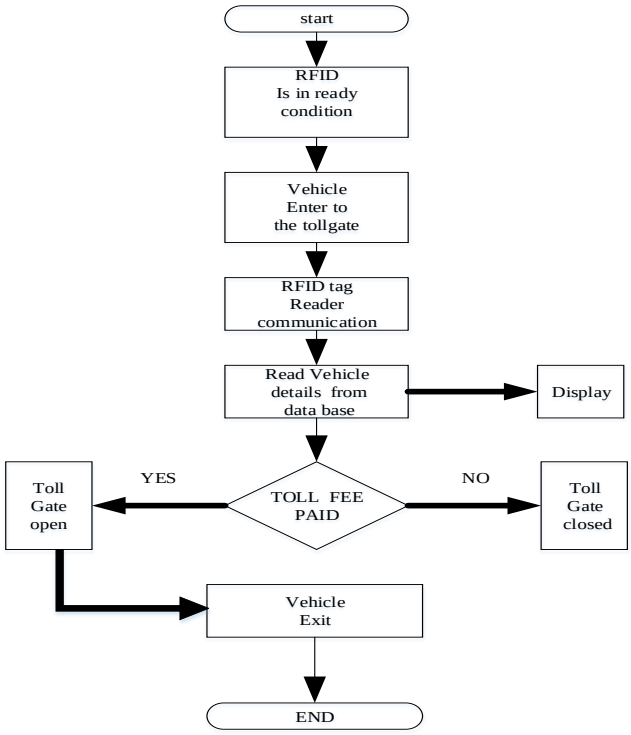

Fig. 8. Flow diagram of developed code

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