RFID Based Security System

K.Srinivasa Ravi, G.H.Varun, T.Vamsi, P.Pratyusha

Abstract*— Radio Frequency Identification (RFID) is one member in the family of Automatic Identification and Data Capture (AIDC) technologies and is a fast and reliable means of identifying any material object. The significant advantage of all types of RFID systems is the non-contact, non-line-of-sight nature of the technology. Tags can be read through a variety of substances such as snow, fog, ice, paint, crusted grime, and other visually and environmentally challenging conditions, where barcodes or other optically read technologies would be useless. This project can provide security for the industries, companies, etc. This security system gives information about the authorized and unauthorized persons. Primarily, the two main components involved in a Radio Frequency Identification system are the Transponder (tags that are attached to the object) and the Interrogator (RFID reader). In this project, when the card is brought near to the RFID module it reads the data in the card and displays on the LCD. The data in the card is compared with the data in the program memory and displays authorized or unauthorized message. The door opens for an authorized person, closes for an unauthorized person; it alerts the persons through a buzzer. The RFID module indicates a buzzer whenever it reads the data from the RFID card.

Index Terms*— Authentication, RFID Reader, RFID Tag, Security.

I. INTRODUCTION

Identification of persons is always important in places like Airports, railway stations, theatres, etc. Identification can be made automatic using Auto-identification. There are various methods for auto-identification; some of them are bar-code systems, optical character recognition, biometrics, smart cards and RFIDs, of which RFID technology is a revolution. Various applications of RFID include: Transportation and logistics, manufacturing and processing, security, animal tagging, waste management, time and attendance, postal tracking, airline baggage reconciliation, road toll management, etc. To keep unauthorized personnel out of their building, companies have implemented access control systems. Employees are given an access badge with radio frequency identification (RFID) chip in it. This technique uses electromagnetic fields to exchange data from a tag (like a smartcard) to an object (a reader) for the purpose of authentication, identification or tracking [5].

A. RFID

The application and standardization of RFID are widely increasing but its adoption is still relatively new and hence many features of the technology are not well understood. Developments in RFID technology continue to yield larger memory capacities, wider reading ranges, and faster processing. Though the RFID technology is advantageous compared to bar code, it's highly unlikely that the technology will ultimately replace bar code, even with the inevitable reduction in raw materials coupled with economies of scale, since the integrated circuit in an RF tag will never be as cost effective as a bar code label. If some standards commonality is achieved, whereby RFID equipment from different manufacturers can be used interchangeably, the market will very likely grow exponentially [1].

Extending the benefits of wireless communications to communication of data, to and from portable low cost data carriers, we can appreciate the nature and potential of radio frequency identification (RFID). RFID is an area of automatic identification that is now being seen as a radical means of enhancing data handling processes, complimentary in many ways to other data capture technologies such bar coding.

The range that can be achieved in an RFID system is essentially determined by [1]:

1. The power available at the reader/interrogator to communicate with the tag(s)
2. The power available within the tag to respond
3. The environmental conditions and structures, the former being more significant at higher frequencies including signal to noise ratio.

B. RFID Tag

RFID tag is contactless card, referred to as a Proximity Integrated Circuit Card (PICC) [5]. Tags may either be actively or passively powered. Active tags contain an on-board power source, such as a battery, while passive tags must be inductively powered via an RF signal from the reader. The distance a reader may interrogate tags from is limited by the tag's power. Consequently, active tags may be read from a greater distance than passive tags. Active tags may also record sensor readings or perform calculations in the absence of a reader. Passive tags can only operate in the presence of a reader and are inactive otherwise [6]. An active tag's memory size varies according to application requirements and some systems operate with up to 1MB of memory. Passive RFID tags operate without a separate external power source and obtain operating power generated from the reader. Tags contain microchips that store the unique identification (ID) of each object. The ID is a serial number stored in the RFID memory. The chip is made up of integrated circuit and embedded in a silicon chip. RFID memory chip can be permanent or changeable depending on the read/write characteristics. RFID tags can be different sizes and shapes depending on the application and the environment at which it will be used. A variety of materials are integrated on these tags. For example, in the case of the credit cards, small plastic pieces are stuck on various objects, and the labels. Labels are also embedded in a variety of objects such as documents, cloths, manufacturing materials etc. The range of the RFID tags depends on their frequency.

Manuscript received April, 2013.

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This frequency determines the resistance to interference and other performance attributes [3].

C. RFID Reader

RFID reader, also referred as Proximity Coupling Device (PCD) [5], reads tag's data through the RFID antennas at a certain frequency. Basically, the reader is an electronic apparatus which produce and accept a radio signals. The antennas contains an attached reader, the reader translates the tag's radio signals through antenna, depending on the tag's capacity. The readers consist of a build-in anti-collision schemes and a single reader can operate on multiple frequencies. As a result, these readers are expected to collect data from tag. For this purpose readers can be connected using RS-232, RS-485 and USB cable as a wired options (called serial readers) and connect to the computer system. Readers are electronic devices which can be used as standalone or be integrated with other devices and the components/hardware like (1)Power for running reader, (2) Communication interface, (3) Microprocessor, (4) Channels, (5) Controller, (6) Receiver, (7) Transmitter, (8) Memory into it.

D. Microcontroller

89c51 microcontroller is of the series of 8051, one of oldest yet commonly used microcontroller. 89c51 has the less complex features than other microcontrollers and it is also easily available and cheap in comparison of other microcontrollers.

E. Power Supply

As shown in the fig.1, the input to the circuit is applied from the regulated power supply. The a.c. input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating dc voltage. So in order to get a pure dc voltage, the output voltage from the rectifier is fed to a filter to remove any a.c components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage.

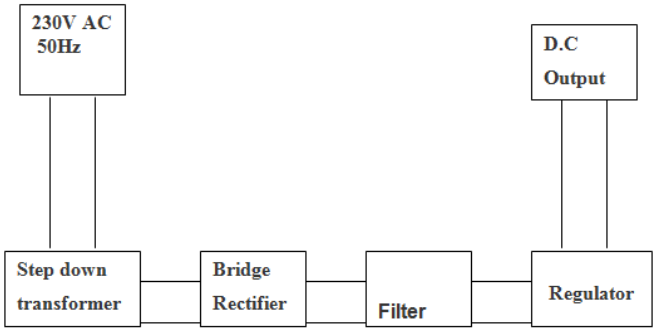

Fig.1 Block diagram of power supply

II. PROBLEM STATEMENT

The aim is to identify the authorized and unauthorized persons, by using RFID technology with RFID tag and RFID reader, by comparing the details of the tag with the data available in the program memory.

A. Proposed Structure and Design of the System

As shown in the fig.2, the process begins when RFID tag comes in the range of the RFID reader then the reader transmits the signals to the tag. Then tag will modulate that carrier signal with the data present in it. Then this modulated signal will be received by the RFID reader.

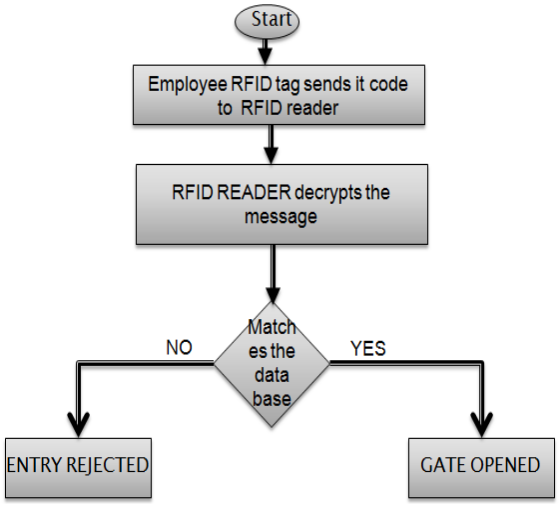

Fig.2 Flow chart of design of the system

The reader is having the RS232 interface so the data will be transferred from the transmitter (Tx) pin of reader to the 3rd pin i.e transmitted data (TxD) pin of the RS232 port. Then the data is taken from TxD pin and is given to the 13th pin of the MAX 232 and output is taken from the 12th pin of MAX232 and is given as the input for the microcontroller. Here MAX232 will change standards from RS232 level to the TTL level standards. The input is given to the Rxd (P3^0) pin of 8051 microcontroller. In the microcontroller there will be code for the identification of the person and output which is either low (0) or high (1).

The output is taken from the other port pins. The micro controller will check the input data of tag with stored data of the authorized person and sets the output pin either to low or high. The data from the receiver module is sent to the relay which acts as the switch to the load. Relay is an electromechanical device. When the 5v signal is given to the circuit then magnetic intensity will be produced and this magnetic intensity will drive the switch from the NC point to the NO and a current passes through the motor and letting it to work to open a door.

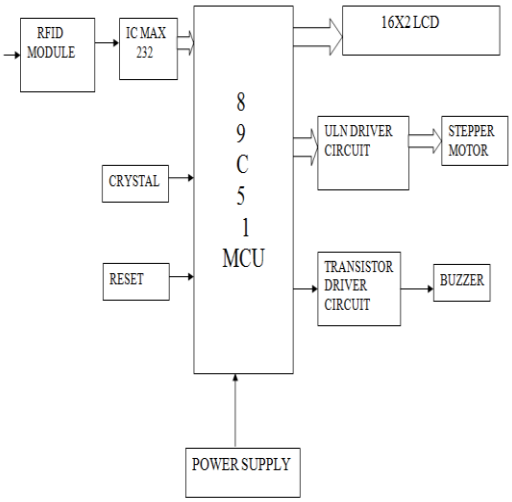

Fig.3 Architecture of RFID Security System

B. Key Specifications

- Power requirements : 7-9VDC
- Current Requirement : <110mA
- Communication : RS232 Serial at 9600 baud (8N1)
- Dimensions : 63mm x 98mm x 5 mm

Operating temp range : -40 to +185 °F (-40 to +85 °C)

III. WORKING OF THE SYSTEM

The RFID reader is operated with +5v power supply. As soon as the supply is given, the reader indicates the user that it is ready. After giving supply to the reader, connect the serial cable of the reader to the DB-9 Connector of the MAX 232 IC. After the above connections are over, a message is displayed on the LCD as "Welcome to RFID reader". After some delay, a message is displayed as "Starting system" with a led blinking for some time till the message is appeared on the LCD. Then again a message is displayed as "System Ready" with a second led blinking till the message is appeared. Now, a message will be continuously appearing as "Place the Card" till we place the card into the reader with a simultaneous led blinking. After placing the card near the reader, the reader indicates with a buzzer that a card has been accepted. Next if the data is matched with the data existing in the card and stored in the code memory then it displays a message as "Authorized" in the first line of the LCD and "KLU welcomes" in the second line of the LCD. When it is matched then a message is again displayed as "Door is Opening" along with the stepper motor rotating in clockwise direction then a message is displayed as "Please Get In…" Then after some time, a message is displayed as "Closing the door" along with a stepper motor rotating in an anti-clockwise direction. Hence in this way we are providing security.

IV. DISCUSSION AND RESULT

RFID Based Gate Access Security System which is able to identify authorized persons and allow only them was successfully developed. The major contribution of this work is managing to write a functional code for Microcontroller to communicate with the RFID devices and store authorized person's data. This system should be able to minimize the technical human error during secured gate access. Besides, the system also helps user to use paperless environment and save the time.

Methodology in the project can be defined as a collection of many components which include procedures, techniques, tools and documentation aids that are intended to help the developer in the development. The use of methodology helps to produce a better quality product in terms of documentation standards, acceptability to user, maintainability and consistency of system.

V. CONCLUSION AND FUTURE SCOPE

RFID is increasingly used with biometric technologies for security. The significant advantage of all types of RFID systems is the non-contact, non-line-of-sight nature of the technology. Tags can be read through a variety of substances such as snow, fog, ice, paint. Hence, this project can be very much useful and can be implemented in real time applications for recording the attendance.

By integrating both RFID and microcontroller generates a project with wider boundaries and effective solutions. The system can be improved by increasing the range of reader in which the tag can be read. Further improvement can be done by using a method in which the tag encrypts its ID and then sends to the reader, which will eliminate the capturing of the tag IDs and hence cloning the tags.

REFERENCES

1. Parvathy A, Venkat Rohit Raj "rfid based examination hall system", a paper on IEEE paper.
2. Kamran Ahasan, Paul Kingston IEEE paper on "rfid applications: an introductory and exploratory study".
3. Mingyan Li, Radha Poovendran, Rainer Falk paper on "multi-domain access control using asymmetric key based tag reader mutual authentication.
4. Wouter van Dullink, Pieter Westein university of Amsterdam, paper on remote relay attack on rfid access control system using NFC enabled devices.
5. Stephen a. Weis, Sanjay E.Sarma, Ronald.L.Rivest a paper on "Security and privacy aspects of low cost radio frequency identification systems".
6. Gynanendra K Verma, Pawan Tripathi, IIIT Allahabad a paper on "A digital security system with door lock system using rfid technology".
7. Bruno Crispo, Melanie R.Rieback, Andrew S Tanenbaum a paper on "The evolution of Rfid security.