

DESIGN AND DEVELOPMENT OF RFID BASED INTELLIGENT SECURITY SYSTEM

Sukhraj Singh, Neeraj Kumar, Navjot Kaur

Abstract- Radio frequency identification is one of the most exciting technologies that revolutionize the working practices by increasing efficiency. It is often presented as replacement for barcode, but the technology has much greater potential such as individual serial numbers for each item and possibility to read these numbers at some distance. RFID is a technology being adopted in security field, business fields and in the medical field. This work has the objective to present a system for security based on RFID technology. The proposed system used contactless smart card to limit the entries of unwanted persons. Contactless smart card has information stored in it which when come in the field of RFID reader it immediately read the information stored in card. Reader recognize the information and match it with the information stored in it. If this reader has the information about that card it will allow the card user to enter. If reader does not find information in tag in its memory it will not.

Index Terms: RFID, Contactless smart card, Microcontroller 8051, AIDC

I. INTRODUCTION

Security is one of main concern in today's life, till date numerous state of art type of technologies have been implemented for security purposes. Some technologies are not widely used due to cost factor and difficult implementation. For achieving the objective of security purposes, the object and person is to be labeled and codified whenever there is other redundant object/person present in the working cell for which security is provided. For such technologies automatic identification and data capture is used.

Automatic Identification and Data Capture (AIDC) refers to the methods of automatically identifying objects, collecting data about them, and entering that data directly into computer systems (i.e. without human involvement). Technologies typically considered as part of AIDC include bar codes, Radio Frequency Identification (RFID)(1), biometrics, magnetic stripes, smart cards, and recognition. When we think of card technologies mainly there are three technologies-Smart cards, Magnetic stripe and Barcode. A smart card, chip card, or integrated circuit card, is any pocket-sized card with embedded integrated circuits. Generally integrated circuit chip consists of microprocessor, read only memory, RAM and electrically erasable programmable read only memory.



Fig. 1 Magnetic stripe card

Magnetic Stripe technology is one of the most universal methods in Automatic Identification and Data Capture(AIDC) industry The technology is embedded in credit cards, ID cards, ATM cards, security control of selected rooms or buildings, time and attendance cards, factory floor data collection cards, driver's licenses, mass transits tickets, airline tickets and many more.

Magnetic stripe is basically a row of tiny magnets. The data entered is encoded to the media by setting the polarities of these magnets. In order to do this, a reader must detect the changes in the polarity in the magnets.

A barcode is an optical machine-readable representation of data, which shows certain data on certain products.

Barcodes can be read by optical scanners called barcode readers, or scanned from an image by special software.



Fig 2. Barcode

The contact less smart card or RFID technology overcome the demerits of bar codes ,dirty or damaged bar code is difficult to read also barcodes can store a limited amount of information. Barcode must be changed as every time when information are modified. Barcode and barcode reader require line of sight communication. Another advantage of RFID system is that they don't require line of sight communication RFID tags can be read very quickly. Also the tags can be read in all types of environment such as dirt, ice, snow, fog and other harsh conditions.

III. PROPOSED TECHNIQUE AND IMPLEMENTATION

The proposed scheme is to develop an intelligent security system using RFID reader and tags to stop entries of unwanted persons in a critical area where only few persons are given permission to come inside. For this we are going to use RFID reader and passive tags, microcontroller 8051, dc motors, IR sensors. In this system the RFID reader is to be fixed to the door through which we want to stop unauthorized persons. RFID reader is connected to microcontroller which is connected to motors. When a person with valid tag comes in the range of RFID reader the reader detects the tag, sends signal to microcontroller, then the microcontroller turns on the motor to open the door. After the person passes through door another motor closes the door.

IV. METHODOLOGY

RFID systems operates from very low frequency(VLF) to extremely high frequency(EHF).RFID system operating in low frequency range make use of electromagnetic wave propagation to communicate their data and commands, these use passive tags. RFID systems operating in low frequency range operates on principle of near field coupling between tag and reader. Faraday's principle of electromagnetic induction is the basis of near field coupling (2). In near field RFID system, electromagnetic waves are transmitted by reader or interrogator which propagates outwards with spherical wave front. Tags placed within field collect some energy. Then exchange of data between tag and reader takes place. The amount of energy available at any particular point is related to

distance from the transmitter as expressed as $1/d^2$ (2) where d is distance from the transmitter.

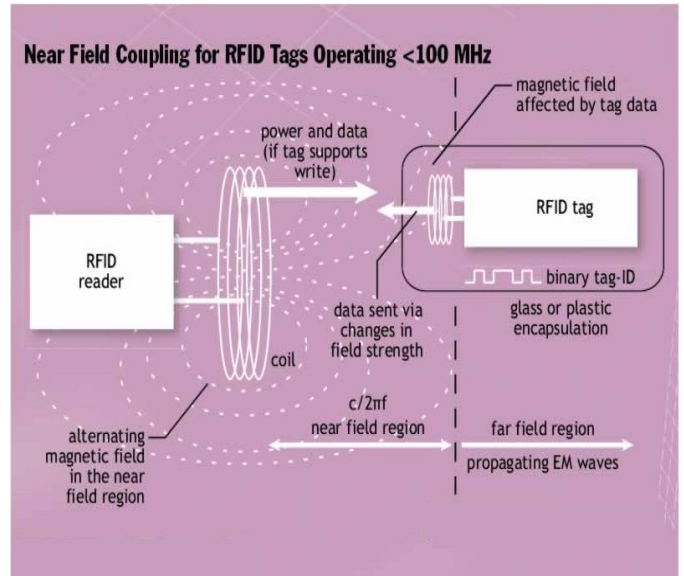


Fig 3. Operating principle

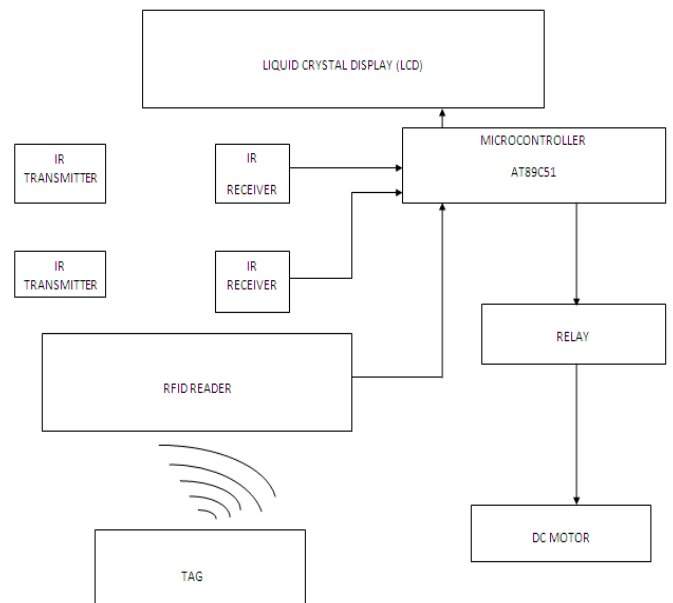


Fig 4. Block diagram of complete hardware

a) RFID tag

Tag is the basic building block of RFID. It consists of small silicon chip and an antenna. Silicon chip is used to store the data and antenna is used to energize the chip and communicate with reader.

b) RFID reader or interrogator

The RFID reader sends a pulse of radio energy to the tag and listens for tag's response. The tag detects this energy and sends back a response that contains the tag's serial number and other information as well. Implemented RFID reader having frequency of 125 KHz for this design. It reads the tags and output their information to the microcontroller.

c) Power conversion circuits

Power conversion circuits allow individual modules to make use of existing power supplies.

d) Microcontroller

Microcontroller to be used is AT89C51.

e) Relay

Relay used is of 5V.

f) DC motor

5V DC motor is used.

V. RESULTS

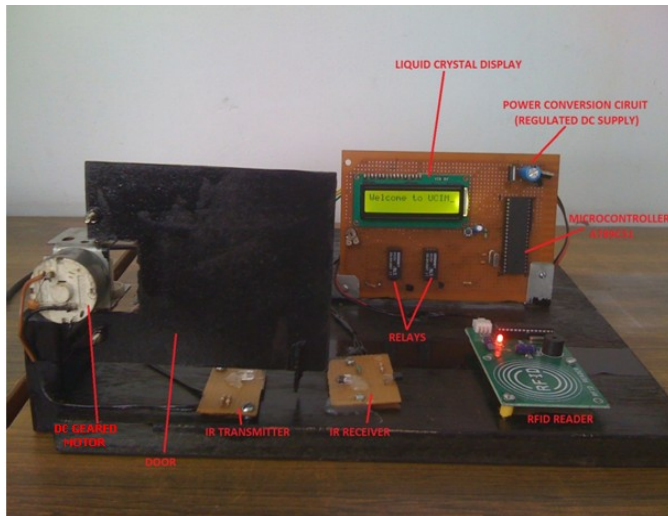


Fig 5. Front View of hardware of RFID based home security system

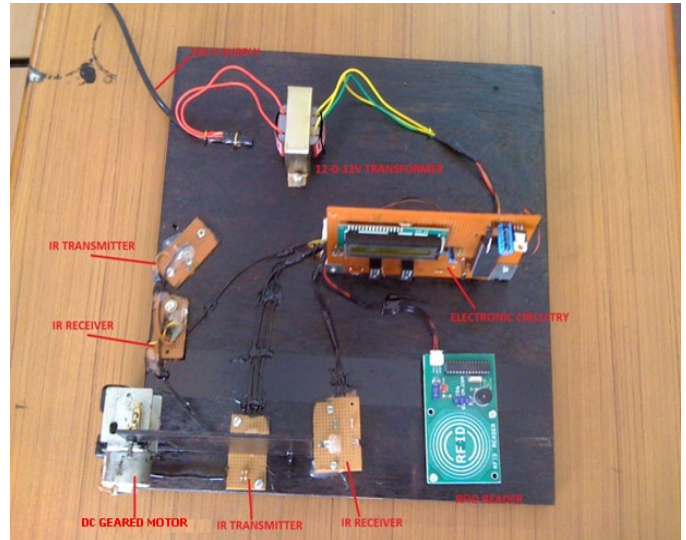


Fig 6. Top view of hardware of RFID based home security system

Here RFID reader and passive tag are the main components used. Each passive tag has different serial number stored in chip inside the tag (3). The serial number is given by manufacturer. We have stored serial number information in programming; I have used here four passive tags. Corresponding to each serial number, I have stored names of person allowed to enter the room, when they will place their card in field of reader, then door opens and name is displayed in LCD display. One card is access denied. When this card will be shown the door does not open and 'entry restricted' message is displayed in LCD display(4).



Fig 7. Message shown on LCD, when no card is shown and power is on



Fig 8. LCD displays the verified user name i.e. "Sukhraj"



Fig 9. LCD displays "Entry Restricted"

VI. CONCLUSION

Access security to unique identification was achieved using the RFID technique. Proper identification was possible with the help of specific 12 character (8 bit each) code embedded in RFID tags. The capture range of RFID reader was seen to be 7 cm maximum which is very convenient in application environment. Unauthorized cards were rejected with hundred percent accuracy and zero error. The door opening and closing arrangement has been successfully synchronized with RFID reading process. Such that door opens and closes with high degree of precision. Door opening and closing sequence was successfully mated with optical IR sensors to give precise results. The RFID based entry system could play a vital role in providing sensitive environments at low cost.

VII. REFERENCES

- (1) Wen Yao, Chao-Hsien Chu and Zang Li, "The Use of RFID in Healthcare: Benefits and Barriers", International Conference on RFID-Technology and Applications, June 2010, pp. 128-134
- (2) Thomas McCoy, R J Bullock, PV Brennan "RFID for Airport Security and Efficiency", IEEE paper. pp.8/1-8/7.
- (3) Hazura H., Mardiana B., Fauziyah S., Zahariah M., Hanim A.R., Siti Normi.Z, "RFID Based Laboratory Management System", ICCTD.2009, pp.289-291.
- (4) T.S. Lim, S.C. Sim and M.M. Mansor, "RFID based attendance system", ISIEA 2009, pp. 778-782



Mr. Sukhraj Singh is presently working as Assistant Professor in Electronics Communication Engineering Department at Chitkara University, Himachal Pradesh, India. He has more than 3 years of teaching experience. His areas of interest are Instrumentation Engineering and electromagnetics.



Mr. Neeraj Kumar is presently working as Assistant Professor in Electronics and Communication Engineering Department at Chitkara University, Himachal Pradesh, India. He has more than 3 years of teaching experience. His areas of interest are Wireless Communication, Signals and Systems and electromagnetics.



Ms. Navjot Kaur is a pass out in M.Tech(Information Technology) from CEC, Landran (Mohali). Her areas of interest are Data structures, operating systems and Embedded systems.