Radio Frequency Identification and Detection (RFID) based e-passport verification scheme using Contactless IC Technology

N. Jagan Mohan Reddy[1]
[1]CBIT,Osmania University,Hyderabad.
(E-mail: jaganmohan118@gmail.com)

Abstract— Recent advances in technology have created better situations and greater assertion of authorized travel documents to be owned by people at large. Current scenario focuses on people possessing Electronic passports that are gaining wide popularity over time in many developed and developing countries for several security reasons. This helps in making the potential of identification of individuals to be carried on a much easier and a pragmatic level. This paper describes a novel design based on RFID security system principle to address the loop-holes of present day passport verification techniques and provides an alternative and foolproof method to identify individuals at a much more accurate level. The system combines RFID communication technology with an Embedded Systems approach through the use of a microcontroller. The RFID tag is installed in the passport and is detected by means of ZigBee transceiver. Any malpractice or counterfeit is examined and the criminal is immediately caught. Furthermore, by making use of a contactless IC technology it simplifies the task of passport verification by eliminating the cumbersome process of verifying smart cards.

Keywords—Security, Contactless IC technology, RFID tags, E-passports, embedded systems, smart travel documents, visa-embedded passport.

I. Introduction

In the present day society, security is becoming an increasing concern at an alarming rate in the lives of many travelers and governments of various countries on an international scale. Most of the countries in the globe are involving passport verification as a mandate in order to improve the security levels for travelling abroad.   Radio Frequency Identification (RFID) technique has become very handy now-a-days in order to identify and verify passports, visas and other immigration related papers though still it is not into the market so effectively. Travel abroad permission grants that are to be issued in the coming days can be made with the help of contactless IC technology On top of that it also accounts for a large memory and storage space when compared to its primitive. The processing speed and computational power are also fairly on the higher side. Hence, this paves the path to provide visas in a completely different and secure manner. On top of this, since the contactless design does not depend on any line of sight or particular orientation for inspection, future visas can be used as RFID tags themselves and can be attached to the existing blank pages of the passport.

This paper deals with an Embedded Systems approach and task that includes a microcontroller for performing the desired application. The particulars of the particular individual are stored in the RFID tag and the RFID reader finds out the information and specific radio waves thereby interpreting significant and consequential information from the frequencies associated. The data is then wirelessly transmitted from the RFID card to the ZigBee transceiver which in turn sends the received information to the microcontroller. The microcontroller simply compares the data received with that present in the EEPROM memory. If the data is completely coherent, them the person is allowed else the person is referred as unauthenticated through the help of a buzzer or alarm signal. The details of the decision are displayed in an LCD.

II. Literature survey

At present, technology is imbibed with the ability to accomplish various tasks of multiple complexities in almost all walks of life. The way to justify this boom or advancement in technology is to implement it for fulfilling various requirements of human life. Hence it always takes the frontier position in improving the quality of human life. One method by which it is done is to unite and automat several individual tasks by using complex logic.
The book [1] provides an exhaustive idea about various features of the conventional 8051 microcontroller from which the other logics and concepts were produced for the purpose of implementing them in this work.
Complete credit goes to innovative RFID technology that has paved the way to creative prospects and breakthroughs for the identification as well as verification of passports and visas, although its utility still remains in question due to several practical and legal reasons. With the electronics passports, several advantages can be drawn as mentioned earlier. Therefore, this provides a great impetus to the concerned authorities to look for a while on this matter and utilize the value of information it offers. Although contactless IC based technology is being supported over here still there are many challenges that are involved in replacing the contact based

smart card systems. Amongst all the odds against the issue, the greatest concern for the security and confidentiality watchdog groups and supervisory bodies is regarding the case where someone could speed-read or else covertly track the data that is there on the chip of the RFID tag, provided that he has some hidden motivation. A secondary and significantly bothering situation that can take place during the data transfer from chip to the reader is that the data has the vulnerability of being hacked. In order to avoid such kind of eavesdropping or snooping of information by any unauthorized individual cryptographic techniques can be implemented.

III. MICROCONTROLLER DESCRIPTION

The microcontroller AT89S52 is invented by the ATMEL Corporation for usage in several applications related to the electronics industry. Some of the salient technical details of the AT89S52 microcontroller are that it has an operating voltage that is between 4 to 5.5 volts, 3 level program memory systems and there are 32 input/output programmable lines. It comprises an in built flash memory of size 8 kilobytes. It has inbuilt timers that can be used for counting applications. The RAM it contains is 256 bytes and is a monolithic device with full duplex port that is serial in its type and hence very effective in operation.
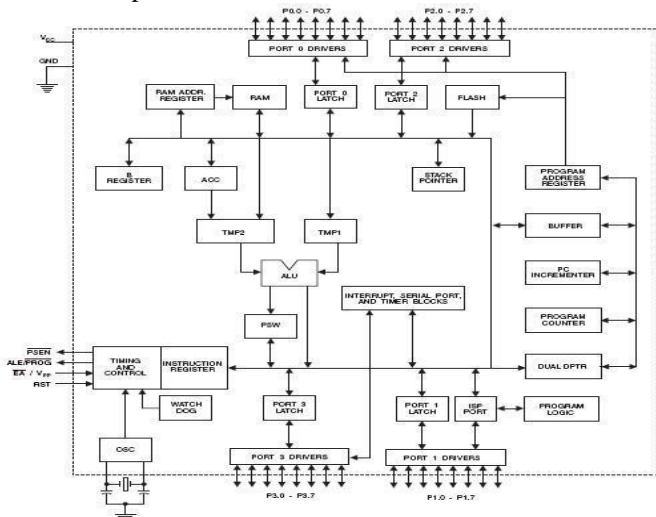

Figure 1: Microcontroller 89S52 Block diagram.

In addition to these features, there include special function registers, interrupts , 4 ports and oscillators that support the micro chip system in its various logical and programming operations.

IV. RFID TECHNIQUE DESCRIPTION

A. RFID Tag
The RFID tags are soon going to replace almost in all products the Universal Product Code (UPC) bar codes. These are also called as smart labels. These are referred to as intelligent and clever electronically associated codes which communicate to a complexly linked system to keep an account of every product.
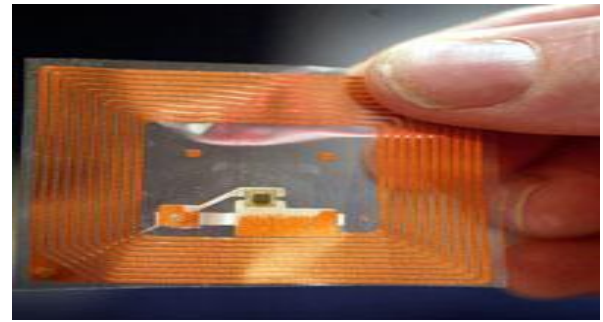

Figure 2: RFID tag

B. Advantages of RFID Tags
Several advantages of RFID is that unlike the bar codes which are just used for reading and identifying purpose, these can be used to store detailed information about a person, object or a vehicle, etc. Moreover, these are very useful in tracking objects and thus make the process of sales and marketing an easy job. Of course, they have many applications in the security and privacy related concerns.

C. Operation of RFID tags.
RFID technology was found out in the 1970's. The technology was primarily based on developing labels that were coupled inductively. These RFID labels are run by the electric field created. Entire operation of these labels depends on creating an attraction between the wires carrying current through induction by electrical field.
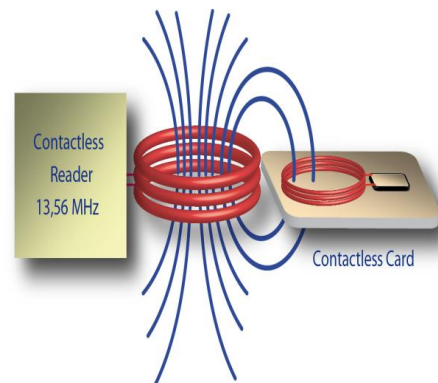

Figure 3: Contactless RFID reader using Inductively-coupled type card.

After the innovation of inductively coupled labels, capacitively coupled labels have been invented. The motivation for making these was to reduce the expense in making RFID tags and for using them in delivery and tracking of stock whose tags can be disposed of after some time. These labels transmitted information through the use of conductive ink made from carbon instead of using wire loops made of metals like copper. The ink was used for putting the information on to the label and then filtered after passing through the readers.

V. DESIGN AND HARDWARE IMPLEMENTATION

The selected components can be listed as follows i.e. the ATMEL 89S52 microcontroller, 2 ZigBee transceivers, a step down transformer, a RFID module, capacitive type filter, a voltage regulator, LCD(16*2 size), a diode type full wave rectifier, buzzers, DC motors, and finally an L293D motor driver. All these components are soldered on the predesigned PCD according to the requirements. Connections are made among the different modules in order to enable communication among them.

The ZigBee transceiver acts a medium to connect the output of the RFID module directly to the microcontroller. The output of the microcontroller is in turn connected to the LCD, DC motor and the buzzer through wires and then is further connected to the ZigBee transceiver of the PC module. Then a serial communication port that is present is used to connect the kit's PC module to PC in order to view the data.
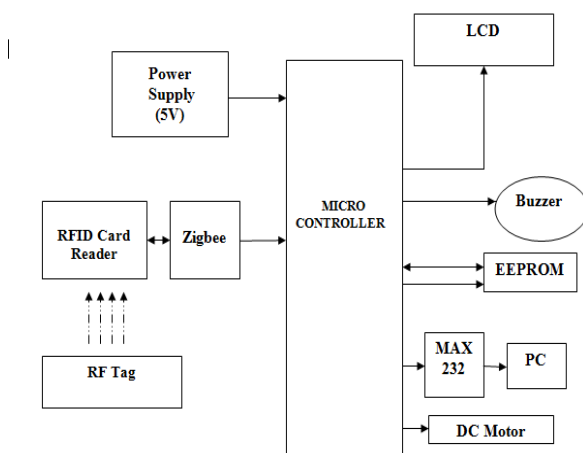

Figure 4: Block Diagram of e-passport system

VI. IMPLEMENATATION.

Generally, the HEX code is obtained from the C code using Keil µVision3 software. The power coming from the power supply circuit is +5V DC to all the passive components like resistors, microcontrollers, ICs and capacitors. The 230V input Ac supplied to the step down transformer is converted to 12V AC that is passed to a full wave rectifier, filtering capacitor and a regulator in order to ensure excellent load and line voltage regulation through a low voltage ripple.

In this system, a RFID tag is assigned for every passport and when a person passes to a checking counter (generally a gate) along with the passport, the RFID reader goes through the RFID tag through a pictorial scan and picks up the radio waves and interprets them into some expressive meaningful data. This provides the complete details of the passport holder and simultaneously an automatic door opens for only that person. The intended reading range of these tags is kept around 10 cm and it can be varied according to the application. The person's name and card number are displayed on the LCD as well as the official computer online. This is then followed by a mechanical action where the doors open for that person or else buzzer sounds are indicated and doors do not open in case of an invalid passport.

But for displaying the information on the PC, we need to have some connection between the PC module present on the kit and the PC. This done using a serial communication port and along with a Hyper Terminal program.

The following sequence of operations would enable one to establish a new connection. The method is to first click on Start, go to Programs, then to Accessories -> Communication and finally to the Hyper Terminal.

- On the File menu, click New Connection.
- A name has to be given in the sapce provided in the Name box and an icon should be slected afterwards. After finishing Click on OK.
- The dialog box that appears with Connect |To is seen and port selection must be made from the drop down list.
- Select the appropriate Port Settings and click OK.

VII. RESULTS AND DISCUSSION

The image given below shows the final implementation of our task, ''ELECTRONIC PASSPORT' obtained by integration of different modules.
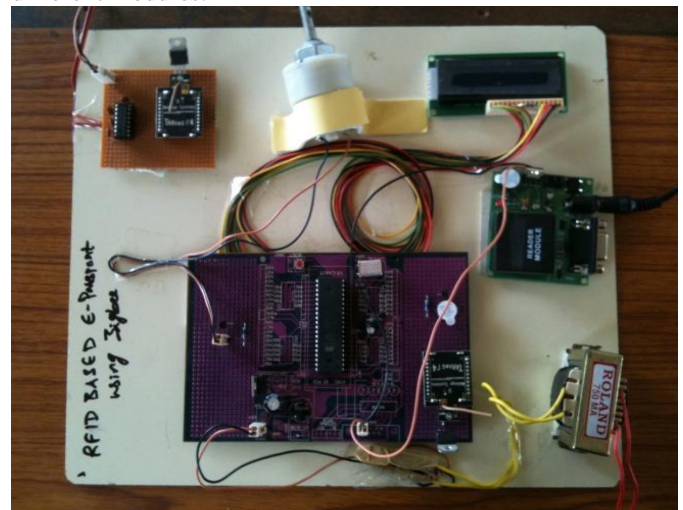

Figure 5: Image showing kit diagram of e-passport.

The data capacity of the labels or tags that have been used for setting up the model and testing equipment is 2 kilobytes. These tags contain in them an inbuilt antenna and a microchip.
- The Valid RFID tag (0010648940 162,32108) contains:
  CUSTOMER NAME: JOHNY
  CUSTOMER ID: CI0143
- RFID tag 0010668031 162, 51199 is an invalid one.

After powering on, the LCD displays a welcome note followed by an instruction to 'scan the RFID tag'

Figure 6: Image showing an instruction to scan the RFID tag.

- When the valid RFID tag is placed above the RFID card reader, then

(a) LCD shows that the card has been accepted
(b) LCD displays the details stored in the tag

Figure 7: Image showing LCD display for valid RFID tag

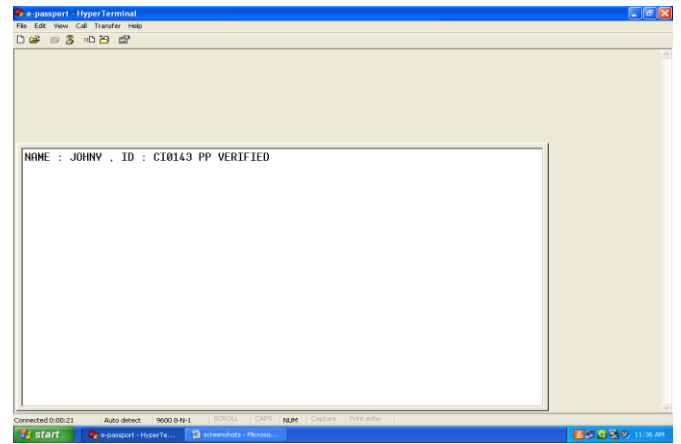(c) The details are then sent to the server

The details shown in PC are:

Figure 8: Screenshot of PC for valid RFID tag

- When the invalid RFID tag is placed above the RFID reader, then
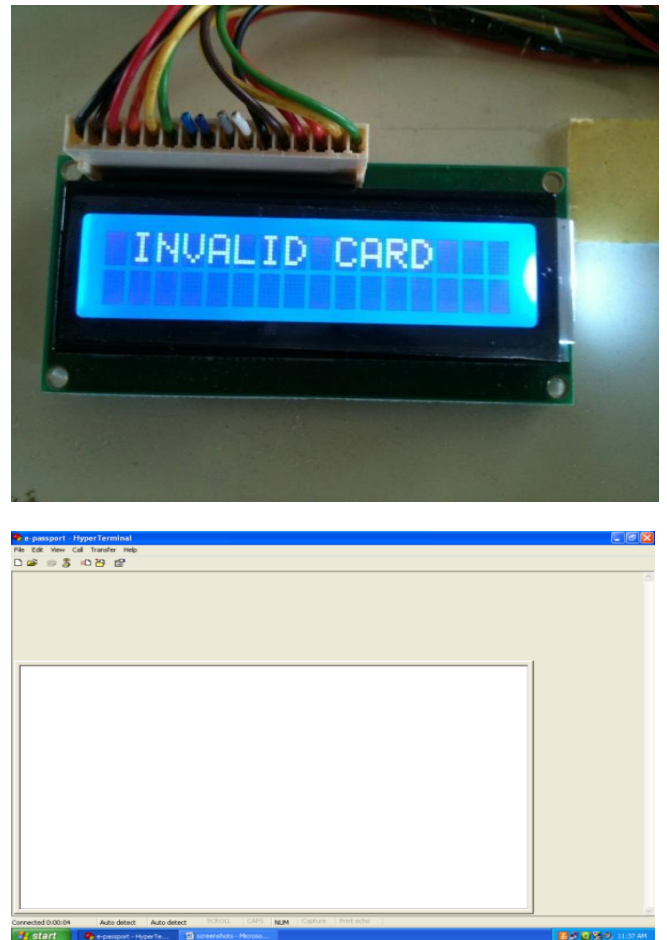
(a) The details shown in LCD and PC are:

Figure 9: Image showing LCD display and PC display for invalid RFID tag.

VIII.   CONCLUSION

Conventional passport makers and issuing authorities are required to incorporate several highly effective security features along with many innovative processes into the passport document.. Instead of that it makes use of contactless IC technologies that are operated based on radio frequencies where the system is comprised of chip and an attached antenna. This kind of technology will provide enough amount of data handling capacity and can be easily embedded in into inside pages or the cover of a passport.

Hence, the RFID technology stands for reducing fraudulent passport documents, and enhances easy checking of identities and improves personal and social security. In addition because of the contactless design that is being offered. It makes it very easy to attach many security related data to the tags through provision of some memory space. If one is willing to simultaneously read the passport and the visa documents, then one has to develop separate algorithm and protocol for performing such a kind of operation. It would then mean that the system would prove more effective.

One most important point to be noted is that the implementation of e-passports is not an easy task, it has to face some challenges. Many privacy groups made substantial arguments regarding the way the data is being stored in the memory space of the tags.   Several countries are now investing their time and resources in finding out better and reliable solutions for personal security purposes and thereby several new opinions have been formed over the usage of RFID technology.

IX.   FUTURE ENHANCEMENT

As the usage of e-passports becomes proliferated and accepted by various passport providing agencies across the world, there will definitely be a drastic improvement and development of smart travel documents and other such similar kind of endorsements and commendations. When the possibility of RFID tags interfering with one another if they come from the same travel document exists, certainly it is not advisable or practically considerable to combine a new RFID tag with each stamp of visa. On contrary to that, we propose that the visa information be stored together in the same place. Just like in case of a standard passport, the particulars of visa are also included.

In the attempt to put the details of the e-passport and the visa together, care must be taken that each smart travel card is properly checked by the issuing authority. Any mismatch of the passport and visa information related to a [particular individual will lead to a havoc on part of the migratory. Therefore, future solutions include development of a database containing passport information of individuals and their corresponding visa data that has to be stored in confidence.

It must be definitely taken into consideration the fact that the particular individual carrying the passport may not want his travel information to be revealed and the border security check forces must take into account the passenger's personal consideration. So, this will make the whole process a challenging one and therefore invited the need and assistance of further developed technologies to resolve and tackle the issue under concern.

X.   REFERENCES

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N. Jagan Mohan Reddy is an Assistant Professor in Department of Electronics and Communication Engineering, Chaitanya Bharathi Institute of Technology (CBIT), Hyderabad, India. He received Masters degree from Osmania University (OU), Hyderabad, in 2006 and received Bachelor's degree from Jawaharlal Nehru Technological University (JNTU), Hyderabad in 2002.His area of Interest includes VLSI for Signal Processing, Digital system implementations on FPGAs, Embedded system for IoT applications.

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