

Student Locker Protection Using RFID Tag & Reader

A.M.Balaji Venkatesh, Karthik Kalkura, Shriram A.C

Abstract— Student lockers are something very common and essential in an educational institution. A student keeps all his valuables inside the locker, and the protection of it is an essential aspect in the design of student lockers. A student not only stores his material valuables, but can also keep his intellectual ideas like research prototypes and important project papers. Some the student's wouldn't have obtained patent to his work when lost will be a huge loss in his career. These kind of theft can't be neglected and we have planned a project on the prevention of these thefts. This Project is designed to enable security to student locker in educational institutions using RFID tags and Zigbee protocol to create electronic locks and password protected. The locker can be opened by the authorized individuals. To ensure this, the system uses RFID reader which is placed in the locker and the corresponding tags are given to the authorized individuals. Then using wireless Zigbee protocol the values are compared with the database and the lock is opened using a random password. When someone unauthorised tries to access the locker a message is intimated to the owner

Index Terms- PIC Controller, Random Number Generation algorithm RFID, Zigbee

I. INTRODUCTION

Unique thinking goes into any research process and when it is lost or stolen, it creates a huge impact in one's career. Having worked hard for a long time with innovative thinking one can't afford to lose it easily. Today the competition is very high in the field of research and development, and people have gone to the extent of stealing one's idea to become successful. We have designed a project which increases safety in a student locker. Our project consists of RFID tags and a reader, ZigBee protocol for wireless transmission and a PIC microcontroller. When the correct RFID tag is shown at the reader, the PIC controller senses its equivalence and the GSM module is triggered. The GSM module receives the command from the PIC controller it sends a one-time generated password is sent to the authorized person. The authorised person can then unlock the locker by entering the password which he has received in his mobile. If someone unauthorized tries to unlock the locker with a wrong RFID tag, a message stating "Illegal Activity" will be sent to the person who owns the locker.

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The GSM module is enabled with JAVA technology, with acts as an interface between the pic Controller and the mobile phone. In our project we have used Nokia Xpress Music 5130, which is java powered phone which acts as the server phone and transmits the one time generated password to the concerned user. We have placed a relay controlled DC motor which gets turned ON when the password received is entered into the PIC controller.

II. OVERALL DESIGN OF THE SYSTEM

The design is based on the Radio Frequency Identification and Zigbee protocol and the one-time password is used as the key of the electronic student location, the key is mobile, which receives the password, thus eliminating human factors. So the student locker only can be opened or shut only by the authorized person. This gives privacy to the students and staffs. The theory scheme of the RFID electronic lock of student locker is shown in Figure 1.

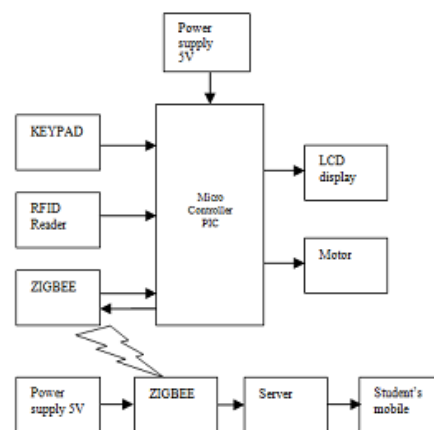


Figure 1. The theory scheme

The system consists of a pic microcontroller, Zigbee module for wireless transmission RFID tags and reader. The electronic lock system is represented by the DC motor. The principle of the system is as follows. The PIC controller acquires the accurate synchronization information from the RFID tag and Reader, and then compares it with the unlocking localization information stored on the PIC controller, when the two kinds information are consistent, the PIC Controller sends out an unlocking request to the electronic lock through message from the server. After receiving the lock request, the PIC Controller confirms the password entered by the user and the lock is opened. The PIC Controller sends out the lock command to the student locker through the authorized software. In addition, the student locker with RFID locker also has an emergency setup, when an unauthorized person tries to access the student locker a message conveying "Illegal Activity" will be sent to the owner of the locker.

III. THE HARDWARE DESIGN OF THE SYSTEM

A. The design of the main control board

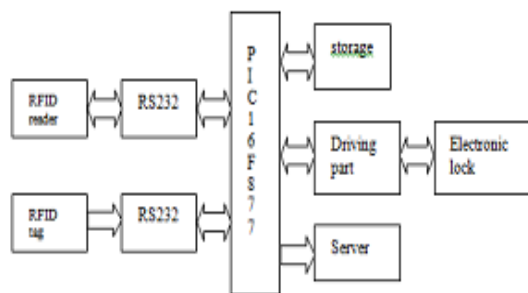


Figure 2. The structure of the master board

The PIC controller PIC16F877 acquires the RFID data through the serial port and generates the one time password when the pattern matches. PIC microcontroller is based on Harvard architecture. The development of flash ROM helped open up the market, and Microchip was among the first to take advantage. The cheap and reprogrammable PIC16F877 became the most widely known, rapidly becoming the number one device for students. Flash ROM is one of the technical developments that made learning about microsystems easier and more interesting. Flash ROM is one of the technical developments that made learning about microsystems easier and more interesting. Interactive circuit design software is another. The whole design process is now much more transparent, so that working systems are more quickly achievable by the beginner. Low-cost in-circuit debugging is another technique that helps get the final hardware up and running quickly, with only a modest expenditure on development tools. The structure of the main control board is shown in figure 2.

B. The design of the electronic lock

This part is formed by driving part, relays and radio frequency inductive zone. The electronic combination lock, and it will detect opening or closing state, when abnormality occurs (for example unlocking the locker using an unauthorized person by using an illegal RFID tag), the PIC microcontroller will send a message to the concerned person through the server which contains the java powered phone (Nokia Xpress Music 5130).

C. The ZigBee protocol

ZigBee is an established set of specifications for wireless personal area networking (WPAN), i.e., digital radio connections between computers and related devices. This kind of network eliminates use of physical data buses like USB and Ethernet cables. The devices could include telephones, hand-held digital assistants, sensors and controls located within a few meters of each other. ZigBee is one of the global standards of communication protocol formulated by the relevant task force under the IEEE 802.15 working group.

D. RFID tag and RFID reader

RFID stands for 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 objects. There are two main components: The Interrogator (RFID Reader) which transmits and receives the signal and the Transponder (tag)

that is attached to the object. An RFID tag is composed of a minuscule microchip and antenna. RFID tags can be passive or active and come in a wide variety of sizes, shapes, and forms. Communication between the RFID Reader and tags occurs wirelessly and generally does not require a line of sight between the devices. An RFID Reader can read through most anything with the exception of conductive materials like water and metal, but with modifications and positioning, even these can be overcome. The RFID Reader emits a low-power radio wave field which is used to power up the tag so as to pass on any information that is contained on the chip. In addition, readers can be fitted with an additional interface that converts the radio waves returned from the tag into a form that can then be passed on to another system, like a computer or any programmable logic controller. Communication between the RFID Reader and tags occurs wirelessly and generally does not require a line of sight between the devices. An RFID Reader can read through most anything with the exception of conductive materials like water.

III. THE SOFTWARE DESIGN OF THE SYSTEM

A. The Random Number Generation Algorithm

Random number generation algorithm is used to perform a computational task to generate a sequence of number or symbols in a random manner. The many applications of randomness have led to the development of several different methods for generating random data. Many of these have existed since ancient times, including dice, coin flipping, the shuffling of playing cards and many other techniques. Because of the mechanical nature of these techniques, generating large amounts of sufficiently random numbers (important in statistics) required a lot of work and/or time. Thus, results would sometimes be collected and distributed as random number tables. Nowadays, after the advent of computational random number generators, a growing number of government-run lotteries, and lottery games, are using RNGs instead of more traditional drawing methods. RNGs are also used today to determine the odds of modern slot machines. The figure for random key generation is shown in figure 3.

```

import java.util.Random;

/** Generate 10 random integers in the range 0..99. */
public final class RandomInteger {

    public static final void main(String... args){
        log("Generating 10 random integers in range 0..99.");

        //note a single Random object is reused here
        Random randomGenerator = new Random();
        for (int idx = 1; idx <= 10; ++idx){
            int randomInt = randomGenerator.nextInt(100);
            log("Generated : " + randomInt);
        }

        log("Done.");
    }

    private static void log(String aMessage){
        System.out.println(aMessage);
    }
}
    
```

Fig 3. Random key generation

B. Java program for OTP code

The random password generated will be sent to the concerned student using the java coding as shown in figure 4.

```

try
{
    if((inputString.trim().intern() == ""))
        System.out.println("no data found");
    }else{
        System.out.println("received data is...."+inputString);
        if((inputString.trim().intern() == "1"){
            String pass = passwordGeneration();
            outputStream.write(pass.getBytes());
            System.out.println("password..."+pass);
            SendSMS.sendMessageToMobile(pass.trim(), "9840400328");
        }else if((inputString.trim().intern() == "2"){
            String pass = passwordGeneration();
            outputStream.write(pass.getBytes());
            SendSMS.sendMessageToMobile(pass.trim(), "9840400328");
        }else if((inputString.trim().intern() == "3"){
            String pass = passwordGeneration();
            outputStream.write(pass.getBytes());
            System.out.println("password..."+pass);
            SendSMS.sendMessageToMobile(pass.trim(), "9840400328");
        }else{
            System.out.println("illegal activity..");
            SendSMS.sendMessageToMobile("illegal activity", "9840400328");
        }
    }
    Thread.sleep(1000);
}

```

Figure4.Java coding for OTP code

The mobile number to which the one time password to be sent is entered at the ISendSMS.SendMessageToMobile. The time delay is set at the thread line of the coding.

IV. RFID TASK FLOW DIAGRAM

The process begins with the synchronization of the RFID tag with the Reader.If the Synchronization is correct is right, it sends the unlocking request to the student’s mobile. When the generated password is entered the lock opens. If the synchronization of the RFID tag and the reader is not correct a message will be generated to the student’s mobile that an Illegal activity is happening at his locker.the corresponding flow chart is show in figure5.

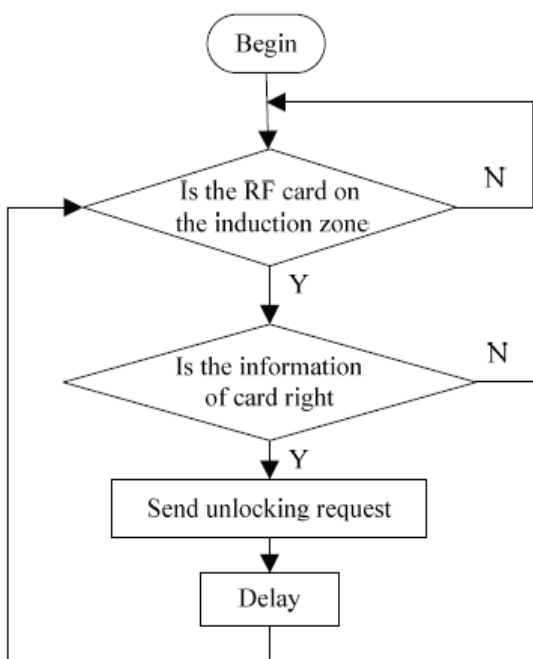


Fig5.Flow chart for RFID flow

The figure6 shows the One time password generated to unlock the student locker in a student’s mobile.

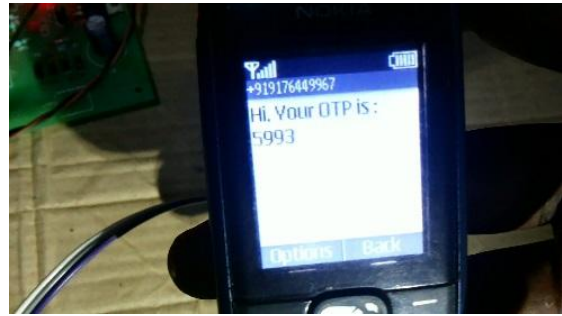


Fig6.OTP code received by the student

V. CONCLUSION

The project which we have proposed has a RFID tags which ensures ensures only authorised people can have access to the locker. This System can also be used in offices, Examination centres, etc.This project is highly reliable and when unauthorised tries to access the locker a message will be intimated to the owner of the locker. The results were positive when built the prototype of this project.This is implemented using java and can be extended using android and other operating platformsIdea Theft can be prevented if this projected is implemented in real time.

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