

Attendance Control System based on RFID-technology

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Abstract

In Kazakhstan, checking students' attendance is one of the important issues for universities, because many universities evaluate students' attendance and while giving the final grade, professors consider their total number of appearances on classes during the whole semester. This brings to the idea of having some tool to control students' attendance. Some universities prefer to use paper sheet for controlling attendance, whereas some universities prefer to use paper sheet for checking students' attendance and after this, fill out these information into a system manually, like Kazakh-British Technical University does. However, this is not an efficient way since there will be spent much of time for calling students names and putting marks like "presence" or "absence" if the class is a lecture class, and in this class at least 5 groups are presented. Moreover, some students may call his/her friend as "presence" even though this student is currently absent. After thinking all these issues, authors of the following research paper decided to create a system that makes easier to check students' attendance automatically, and this system is implemented in Suleyman Demirel University, Kazakhstan. Actually, this is the first time when such kind of system is being used in educational system of Kazakhstan. The system is based on RFID technology, and in this paper, details of this system are presented.

Keywords: RFID: Radio Frequency Identification; RFID-tag; RFID- reader; attendance control system.

1. Introduction

Radio-frequency identification(RFID) is a technology that uses radio waves to transfer data from an electronic tag – called an RFID tag or label, which is attached to an object – through a reader for the purpose of identifying and tracking the object. Some RFID tags can be read from several meters away and beyond the line of sight of the reader. RFID systems have been widely used in many different application areas, such as: product tracking through manufacturing and assembly , control of inventory, parking lot access and control, container tracking, ID badges and access control, equipment tracking in hospitals, etc[1]. Compared to other automatic identification technologies, such as optical barcode systems, RFID-technology has several advantages. Tag

data can be read automatically beyond the line of sight, though certain materials, and from a range of several meters [2].

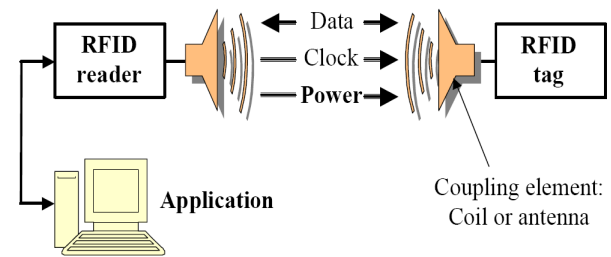


Fig. 1 The workflow of RFID technology.

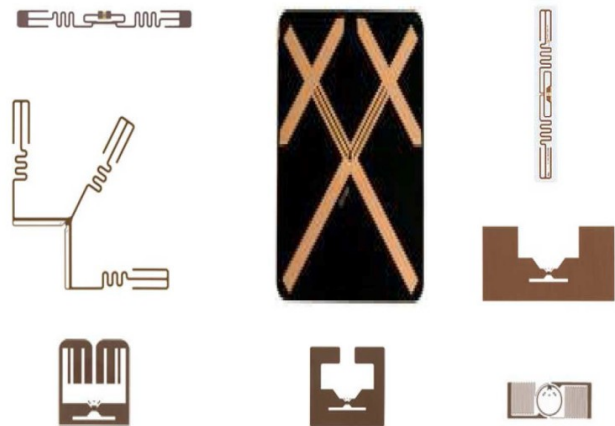


Fig. 2 Types of RFID tags.

An RFID tag should be chosen according to its intended use. Several frequencies are available, including LF, HF, UHF, and microwave. The frequencies may vary depending on the country in which the RFID tag is being used. In [3], RFID- technology was used as an automatic monitor of student classroom attendance. Incorporating the architecture and prototype of a RFID system transmitted over Ethernet, it demonstrated how to automate an entire student-attendance registration system within an educational institution. In [4], authors proposed different view for attendance checking system. They designed and implemented wireless iris recognition

attendance management system. However, checking more than 70 students based on their iris pattern is time-consuming, and mainly expensive, and for universities this is not the best choice. Systems based on iris recognition are used in many areas, such as access control for high security installations, credit card usage verification, and employee identification [5]. The reason for the popularity of iris recognition verifying is the uniqueness, stability, permanency and easily taking, and because of this, there are some iris recognition verification approaches that have been proposed till now [6]. Moreover, the probability of finding two people with identical iris pattern is almost zero [7], so it shows that for security side using iris recognition is perfect one; however the cost is too much for any institution in order to build attendance checking system. Also, there was some research work done [8] in Europe, in which authors proposed attendance management system extended with computer vision algorithms. They used real time face detection algorithms integrated on an existing Learning Management System (LMS), which automatically detects and registers student attending on a lecture. Our system relied on a MIFARE RFID-tag, specifically, the MIFARE MF1ICS50 typed RFID-tag. This type of tag was developed by NXP to be used in a contactless smart card according to ISO/IEC 14443 Type A. The MIFARE MF1ICS50 IC is used in such applications as public transportation ticketing, which major cities of the world have adopted as their e-ticketing solution. The MF1ICS50 chip consists of a 1 K-byte EEPROM, a RF-Interface and a Digital Control Unit. Energy and data are transferred via an antenna comprising a coil with a few turns directly connected to the MF1ICS50 [9].

As RFID-reader, EHUOYAN's YHU638 was used due to its cheapness and ease of use. This reader enables the contact-free reading and writing of operations and works on a 13.56 MHz frequency [10].

2. Motivation

In most universities, teachers take attendance by calling out the names and surnames of students, and then marking them, while, in others, teachers pass around a sheet of paper, asking students to sign in attendance sheet just next to their surnames. Both practices have their drawbacks. In the first case, if numerous groups attend the lesson, checking all of these students by name and surname might take about 10 minutes out of each lesson; in the second case, friends of absent students may write down their names and surnames. These practices place university teachers and their institutions at considerable disadvantages when it comes to taking attendance.

To rectify these systematic failings, we have decided to put the RFID-card into service. Each card has a unique ID, precluding the duplication of a card. These

RFID-cards are given to students of Suleyman Demirel University, and while entering classrooms, RFID readers will read these cards, identify the students from their respective RFID-cards and send the data to a PC. The PC, in turn, sends all the data it has collected to the server by the end of lesson, or at the end of this day according to the preference of lecturer. This means no class time will be wasted.

3. System architecture

Our aim is to create a system with one server to which all PC's are connected, so all data will be saved in one data base, making the monitoring of the information effortless. All classes must have a PC with a connected RFID-reader that can read student RFID-cards, as well as a Web-camera that can take their photos. The camera is meant to prevent a student from giving his/her RFID-card to a classmate who attends the lecture, scanning the other student's RFID-card to make it appear as if s/he had also attended.

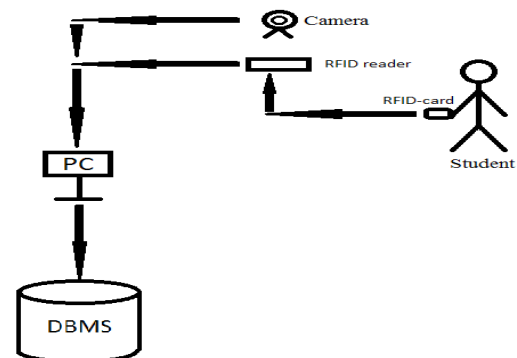


Fig. 3 Architecture of attendance-control system.

When a student enters class, the RFID reader reads his/her student ID card, while the Web-camera simultaneously takes his/her photo and sends it to the PC. After some time, the professor submits all data for storage in a database.

4. Implementation

When the professor arrives in class, he/she logs in and submits a password on the PC to our system, after which our system opens his/her page (See Fig. 4).

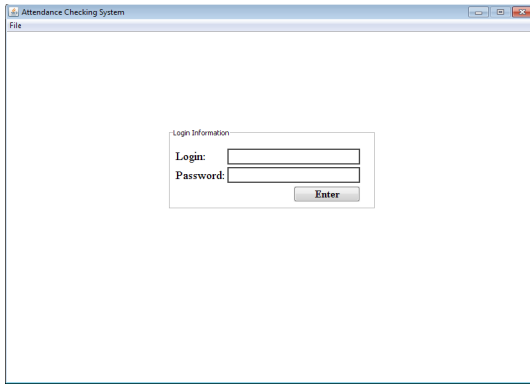


Fig. 4 The main page

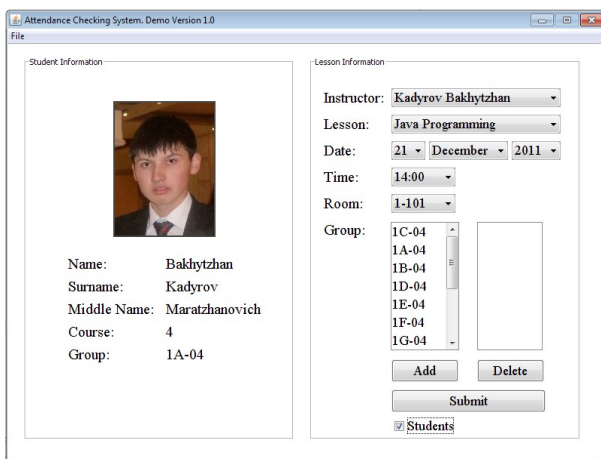


Fig. 5 Student information

When students enter the classroom, the RFID-reader automatically reads their RFID-cards(See Fig. 5) and the Web camera takes their photos. These photos and ID's are sent to the PC, where system will compare their information with information stored on the DBMS according to their ID's that we have assigned to them. Eventually, the professor will submit all the information collected, and the DBMS will have a record of who came and who failed to come to class on any given day.

Professors will be able to use their free time to compare the photos of students who came to lessons with those in the Database, so taking attendance will no longer eat up lesson time. Use of RFID-cards, then, may help to solve attendance-taking problems and any and all related issues.

5. Conclusion and Future Work

The authors we have consulted in our research have shown how a system relying on RFID- technology may be developed. This system is flexible, which means that it may be extended by adding more modules. The cards that

have been employed for this specific system are RFID-cards, and the algorithm used has shown stable and reliable results; moreover, this algorithm has secured important data that we have stored on these cards. These cards can be put to use at the university and may replace student ID cards. As demonstrated, personnel and students, alike, can use these cards for many purposes; additional functions can always be incorporated into the system and greater security provided to the cards. RFID-technology continues to develop, and the time has come for us to avail ourselves of its promise and convenience. The main aim of this research has been to demonstrate potential uses of RFID-technology and build a system reliant on it.

For the future work, this research should be extended by adding more modules and making some updates or changes. We are planning to add some new modules, like "Library system", "Control of doors", "Payment system", "Parking lot system", and so on. There was research done in [11], which showed how to build and implement Library Management system based on RFID. Simultaneously, other cards should be checked and be replaced, because cards which were used for this research seemed to be secure less, and new cards should have enough memory size so that we can keep more data inside of them. Furthermore, the possibility of using some additional tools like GPS, GSM and so on is considered, and the project for implementing such a system is started. We plan to use GPS and GSM technologies in educational system, and the work that was done in [12] is an impulse for this project implementation.

Appendix

The main function of reading RFID-tags:

```
package rfid;
import java.io.BufferedReader;
import java.io.BufferedWriter;
import java.io.File;
import java.io.FileReader;
import java.io.FileNotFoundException;
import java.io.FileWriter;
import java.io.IOException;
public class RedDate {
    public String text=null;
    public void getID(){
        File file = new
File("C:\\Users\\user\\Desktop\\rfid\\src\\rfid\\log.txt");
        StringBuffer contents = new StringBuffer();
        BufferedReader reader = null;
        try {
            reader = new BufferedReader(new
FileReader(file));
            text = null;
            // repeat until all lines is read
            while ((text = reader.readLine()) != null) {
                //System.out.println(text);
            }
        }
    }
}
```

```
        break;
    }
} catch (FileNotFoundException e) {
    e.printStackTrace();
} catch (IOException e) {
    e.printStackTrace();
} finally {
    try {
        if (reader != null) {
            reader.close();
        }
    } catch (IOException e) {
        e.printStackTrace();
    }
}
}

public void erase(){
    try{
// Create file
        FileWriter      fstream      =      new
FileWriter("C:\\Users\\user\\Desktop\\rfid\\src\\rfid\\log.txt
");
        BufferedWriter out = new BufferedWriter(fstream);
        out.write("a");
//Close the output stream
        out.close();
    }catch (Exception e){//Catch exception if any
    }
}
}
```

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References

- [1] K. Domdouzis, B. Kumar, and C. Anumba, "Radio-Frequency Identification (RFID) applications: A brief introduction.", *Advanced Engineering Informatics*, Vol. 21, 2007, pp 350-355.
- [2] S. A. Weis, S. E. Sarma, R. L. Rivest, and D. W. Engels, "Security and Privacy Aspects of Low-Cost Radio Frequency Identification Systems." *Security in Pervasive Computing*, 2003, pp 201-212.
- [3] F. Silva, V. Filipe, A. Pereira, "Automatic control of students' attendance in classrooms using RFID", in *3rd International Conference on Systems and Networks Communication*, 2008, pp 384-389.
- [4] S.Kadry and M.Smaili, "Wireless attendance management system based on iris recognition", *Scientific Research and Essays*, Vol. 5(12), 18 June 2010, pp. 1428-1435.
- [5] B. Medien and T.Burghardt, "Report on Identity Verification", University of Bristol, November 2002.
- [6] D. Zhang and A.K. Jain, "Biometric Authentication", *Proc. First International Conference on Biometric Authentication (ICBA)*, Hong Kong: Springer-Verlag, 2004.
- [7] Y. Belganoui, J-C. Guezel, and T.Mahe, "La biometrie, sesame absolu...", *Industries et Techniques*, No.817, July 2000.
- [8] V.Shehu and A.Dika, "Using real time computer vision algorithms in automatic attendance management systems", *Proceedings of the ITI 2010 32nd International Conference on Information Technology Interfaces*, 21-24 June, 2010, Cavtat, Croatia.
- [9] NXP official web-site. For additional information, visit <http://www.nxp.com>.
- [10] Ehuoyan Technology Co, Ltd. Official website: <http://www.ehuoyan.com>.
- [11] M.Dhanalakshmi and U. Mamatha, "RFID based library management system", *Proceedings of ASCNT*, pp.227-234,2009.
- [12] S.B.Patil and R.M.Walli, "Design and Development of fully automatic AT89C52 based low cost embedded system for rail tracking", *International Journal of electronic communication and soft computing science and engineering*", Vol. 1, Issue 1.

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