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# Computer aided school administration system using RFID technology

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## Abstract

The RFID technology has been received a growing attention and has gotten a wide range of applications. Administration systems for automatically managing routine have-to-do works of school staff and students with the aid of computers are one of them. This study focuses on implementing an automation/management system which eases the supervision of students and reduces the burden on school administration staff. In this study a sample school administration system using RFID tags/readers is developed. This system is capable of automatic person identification, class/laboratory/library attendance management, static/dynamic authorization, submission of warnings/announcements, e-money usage, logging and reporting. Due to provide robustness and long lasting run a more server independent structure is designed.

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## 1. Introduction

In education not only the content but also the administration is important. When taking decisions, instructors and school administration staff must have accurate and fast data about current state of the school and students. If there is no an automation system, the data is not stored on computers therefore access to necessary information is either difficult or time consuming. To obtain the information fast and accurate an automation system is required. Nowadays a lot of technologies exist to accomplish that. Radio frequency identification (RFID) assisted systems are one of them and in this study RFID is used.

RFID is a term that is used to describe a system that transmits the identity of an object or person in the form of a unique serial number, using radio waves. As shown in Figure 1, a basic RFID system contains three main components which are an antenna, RFID reader and RFID tag. Usually RFID reader is connected to a host computer that runs an application to process the data passed by it.

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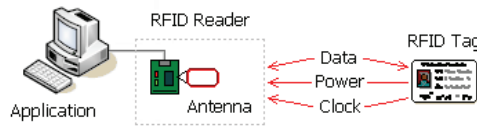


Figure 1. A basic RFID system

In automation systems RFID technology is preferred, because it has many promising features including:

1. No line of sight is required,
2. Long read range and high reading speed is achievable,
3. Multiple tag read/write is possible (Raza, 2005),
4. Tracking of people, items, and equipment in real-time can be done,
5. An RFID tag can be encapsulated or be implanted within a product so it can stand in a harsh environment,
6. The tag is programmable, therefore can be used as a portable database,
7. No extra power supply is needed (for passive RFID tags). The power is supplied by the reader.

Taking the advantages into account, RFID is used in wide range of applications including: human identification and tracking, access management, tracking of goods and animals, toll collection, contactless (Meints, 2007, Magrassi, 2001) and Airport Baggage Tracking Logistics (Harrison, 2009).

In the educational area, RFID is used for studies like attendance management (Qaiser, 2006) and online student supervision (Kadir, 2008).

In this study, to maintain a more effective educational administration, RFID usage is extended to provide automatic person identification, class/laboratory/library attendance management, static/dynamic authorization, submission of warnings/announcements and e-money usage.

## 2. System Overview

The developed system contains hardware and software components. In the hardware side there is a database server interconnected with workstations as shown in Figure 2.

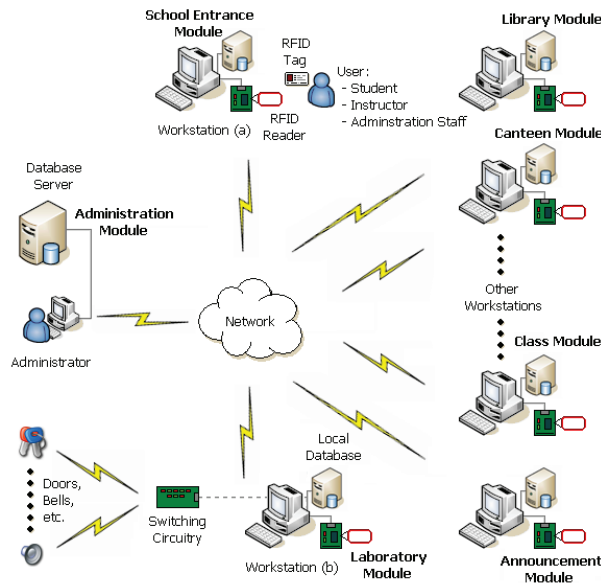


Figure 2. Block diagram of the designed system

Every workstation is equipped with an RFID reader. Some of the workstations might be connected to extra circuitry to provide control over devices. In the software side, an application with a graphical user interface is designed to ease the management, querying and reporting. The developed software is also responsible for maintaining the communication between server and workstations over network.

The developed system was used and tested in an occupation high school (Esatpaşa Ticaret Meslek Lisesi) which has 1400 students and 65 instructors, 15 of which are also in the administration staff. The students, instructors and administration staff are provided with RFID tags. Security, cleaning employees and school visitors are also provided with RFID tags when needed.

In the application, when a user passes his/her tag through the reader, designed software takes the input from it and after processing, records the data to the local database. If an action is needed, like ringing a bell, turning a light on/off or unlocking a door it is done. In predefined intervals, general and local databases are synchronized using the improved data exchange algorithm. Even though developed application runs in server-client architecture, this algorithm prevents system crash when server or connection to network is unavailable.

### 3. System Implementation

The developed application is capable of the following:

#### 3.1. Identification check at school entrance

At the school entrance RFID reader attached turnstiles are used to allow one person to pass at a time. When a valid pass occurs, using the information sent by the reader, the developed application identifies the person. As users are asked to use their tags in every pass, system is capable of counting the number of people in the school.

Visitors are provided with temporary tags and their personal information and purpose of visiting the school is recorded. Figure 3 shows a sample user interface of the application’s school entrance module.

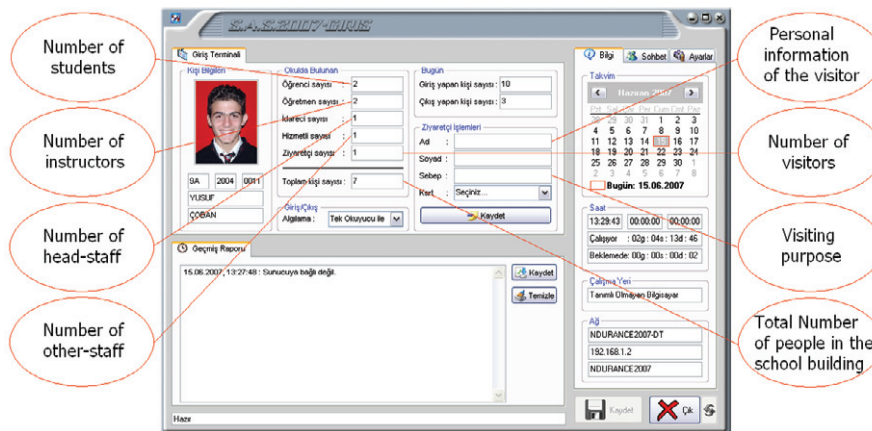


Figure 3. User interface of school entrance module

#### 3.2. Static/Dynamic authorization management

In static authorization management, RFID is used as an electronic key to control access to classrooms or laboratories within school building. Authorization for tag bearers are defined separately or in groups to enable or disable their access to specified area. School administration staff or deployed instructors using the application are responsible for matching the students with suitable classrooms or laboratories according to curriculum.

In dynamic authorization management, authorization of every student is controlled according to rules. Students’ registered course attendance calculations are done in order to check his/her eligibility to sit in an examination.

### 3.3. Class attendance management

To attain the attendance information, an RFID reader is located near the classroom, laboratory or library door and students are asked to use their tags as they enter or exit. Attendance of every student against every course is marked as “Present” or “Absent” after evaluating the collected data by the reader. Unauthorized and duplicate entries are also checked and necessary operations are done to avoid impropriety.

### 3.4. Announcement and electronics information exchange system

RFID reader attached computers with no standard input devices, like keyboard or mouse, are used to exchange information between students and instructors. To be able to get announced information, a student only has to pass his/her tag through the reader. Grades, homework subjects, examination dates and places are shown on the screen during a period of time.

### 3.5. e-Money management

RFID tags are used like a credit card to provide payment without using cash. Canteens, cafeterias and refectories are places in the school building where e-Money could be used. As shown in Figure 4, a student has to pass his/her tag in a period of time to carry out the payment.

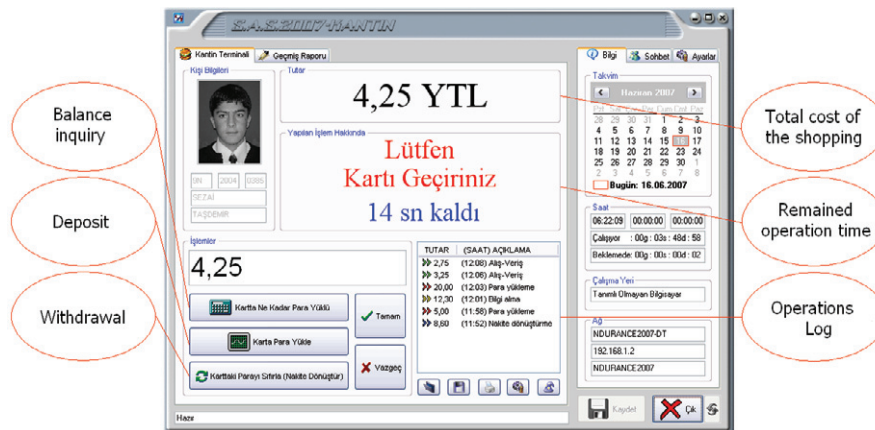


Figure 4. User interface of canteen module

### 3.6. Library automation

Registration of borrowing and returning back of the books are done simply by using RFID tags. Thus using the automation, information about library usage could be kept under record.

### 3.7. Logging, report creation and submission of warnings

System is also capable of creating reports using queries on logs. As every operation in the system is logged, an administrator or instructor might run queries to get real-time or downward information about, classroom/laboratory usage, attendance to courses or unauthorized entries. Because the application is integrated, student grades, weekly lesson plans, and all the information stored about classes could be obtained and reported.

If misuse or constant unauthorized entries are detected system creates warning messages to inform the school administration staff.

### 3.8. Server independent run

System is also capable of server independent run for a period of time. Because RFID tags are programmable, some information, needed to keep system alive is stored on them. Therefore if workstations (clients) cannot connect to the server, information kept on the tag is evaluated and processed. The developed algorithm checks the relevance and resumes standard run, when system is up again.

## 4. Results

The developed system was successfully applied and tested in a real school environment. Observations and experimental results have shown that using the computer aided school administration system a lot of time consuming and difficult tasks were performed quickly and problems were solved easily. Reports created by the system were used by instructors to inspect the students' progress and helped school administration staff to take important decisions more precisely.

Besides the benefits stated above, the developed system provided the following:

- Using identification check at the school entrance, security was improved. Numbers of people within the school building could be determined and personal information of visitors and their visiting reasons were recorded.
- Computer controlled authorization restricted the access of classrooms and laboratories for unauthorized entries.
- A student's classroom/laboratory attendance was determined. Time spent in the school library by every single student was also obtained.
- Electronics information exchange system extended the communication between students and instructors. School administration staff was able to make announcements more efficiently.
- With e-Money management system, shopping and payment within the school were made without using cash.
- Both library usage statistics and book lending information were recorded using the library automation,
- When server crash or network communication problem occurred, with the help of developed algorithm not all the system was affected.

## 5. Conclusion and Recommendation

The developed school administration system is a good example of RFID technology usage in educational area. It is hoped to reduce the manual effort spent on school management and is expected to facilitate the student supervision by providing school administrators with an alternative tool. With the aid of the system, time consuming and repetitive tasks, human-made mistakes are reduced and security is improved.

As the main purpose was to establish a highly functional application, hardware and software misuse are not taken in much consideration. In our future studies, we intend to improve that security issue.

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