

## Implementation of RFID - based Computer Access System (CAS) for Kazakhstani University

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**Abstract.** RFID - based Computer Access System (CAS) will allow complete hands-free computer access via RFID card, controlling the computers in the lab and securing these computers from physical interaction, this way no data will be copied from these machines. Moreover, with a help of this system, it is possible to protect parts of computers from steal or change. The proposed system is based on UHF RFID readers, Arduino microcontrollers, and student identification cards containing RFID-transponders that are able to electronically store information that can be read / written even without the physical contact with the help of radio medium. This system is an innovative system, which describes the benefits of applying RFID- technology in the Education System process of Republic of Kazakhstan. This paper presents the experiments conducted to set up RFID based CAS.

### Introduction

RFID-based equipment monitoring and tracking system is a complex, integrated system that offers an effective solution of managing items especially for large scale environment [1]. It combines the RFID technology and security devices to ensure the items are always been monitored and secured remotely. The system enable the organization to track and monitor selected individual to access locations inside the university, permit movement, record the data of arrival/departure and also enable the viewing of record via this system. This paper proposes the different components of RFID technology and focuses on its main core competencies, scalability and security. It will then provide detailed description of RFID – based CAS in Kazakhstan. RFID is wireless automatic identification technology that is gaining attention and is considered by some to emerge as one of the pervasive computing technologies in history. As the technology grows very precipitately, RFID has received considerable attention worldwide and widely used in controlling and tracking objects ranging from human identification to product identification. Previous research has successfully showed that RFID has been increasingly expanded in various fields such as retail supply chain, animal identification, metro pass cards and e-passports, asset tracking, postal and courier services, construction industry, education, medical etc. Developments in RFID technology continue to relinquish capacities of the memory, wider reading ranges, and faster processing. It is not possible that the technology will ultimately replace barcode; however, RFID will continue to grow in its established niches where barcode or other optical and wireless technologies are not effective, such as in the chemical container industry and livestock industry. RFID enables tracking and controlling of items over distances that range from about a centimeter to hundreds of meters. RFID can track any items starting from inventories, mobile handy equipment, and it can track people in real time as the tagged item travels around the organization. Tracking of mobile equipment can include wheelchairs, infusion pumps, and blood supplies. RFID systems have been widely used in many different application areas, such as: product tracking via manufacturing and assembly, inventory control, access to parking lot and its control, tracking of container, ID badges and access control, equipment tracking in hospitals, etc. [2]. Compared to other automatic identification technologies, and especially, compared to optical barcode systems, RFID-technology has important advantages, and among of them, the most important one is the following: tag data can be read automatically beyond the line of sight, through certain materials, and from a range of several meters [3].

## RFID System Components

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.

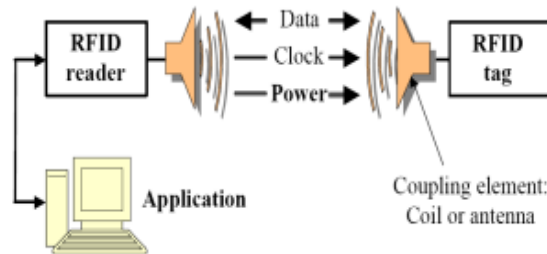


Fig. 1: The workflow of RFID technology

A conventional RFID system consists of four components mainly,

1. RFID Reader;
2. RFID Antenna;
3. RFID transponder (or tag) electronically programmed with unique data;
4. Host computer with appropriate application software.

RFID systems consists of an antenna and a transceiver, which read the radio frequency and transfer the information to a processing device, and a transponder, or tag, which is an integrated circuit containing the RF circuitry and information to be transmitted. The system requires the usage of RF active readers able to communicate with the main station using 3 different communication mediums: serial cable, LAN cable, and WLAN antenna.

Our system relied on a MIFARE RFID-tag, specifically, the MIFARE MF1ICS50 typed RFID-tag. This type of tag was developed by the company 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 [4].

For reading cards, device based on Arduino was developed, and this device acts as RFID-reader, and it enables the contact-free reading and writing of operations and works on a 13.56 MHz frequency.

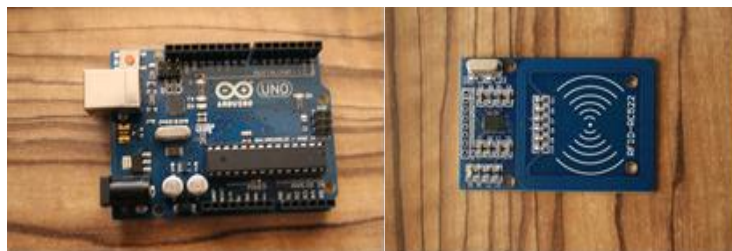


Fig. 2: The components of device: left- Arduino UNO microcontroller, right- RFID- reader

## The description of the CAS

This system is able to allow users to start PC by the use of individual unique RFID card/tag, and to assign which PC's can be used by any users, so that at the end unauthorized person or student cannot start any PC. The most important point of the use of this system is that the safety and security parts of PC from possible steal of its hardware components are provided with the development of this system. Moreover, the data security on the installed hard drives is protected since no one can connect to USB and the only open components of the PC are monitor, keyboard

and the mouse. The idea of this system is to supply every person with an ID-card, which is composed of unique ID. This system based on the idea that every student will have an access to the PC, to which administrator of this system gives permission. This system is capable of the following:

- Accurate control of computers located in the labs of University;
- No loss or copy of data from the computers;
- No possibility of connecting any device to the computers, and no possibility of working on an unassigned computers.

There are two different approaches of implementing CAS:

- a) It is possible to connect to each computer our developed device, so that each computer will be controlled independently;
- b) One developed device supports up to 10 connected computers (more economical version of the connection), and in this case all computers are controlled by this one device.

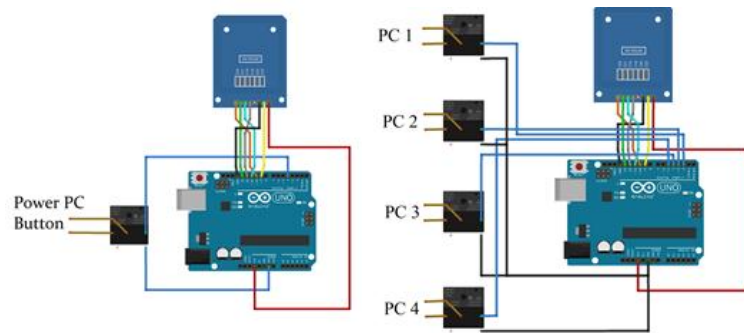


Fig. 3: Components of the system and their inter-connections

The programming of the device is implemented on Arduino programming language based on C/C ++. The microcontroller on the board is programmed by using the language Arduino (based on language Wiring) and the IDE Arduino (based on medium Processing). The pseudo-code for reading cards is as follows:

```

if (uidDec == 3725451044) // if "UID" is not the same
{
  // led is turning on
  digitalWrite (ledPins[0], HIGH) ;
  digitalWrite (Relay, HIGH) ; // Relay close
  delay (400);
  digitalWrite (Relay, LOW); // Relay open

  // Printing in Serial monitor
  Serial.println ("Hello") ;
}

```

The workflow of the algorithm is shown in Figure 4.

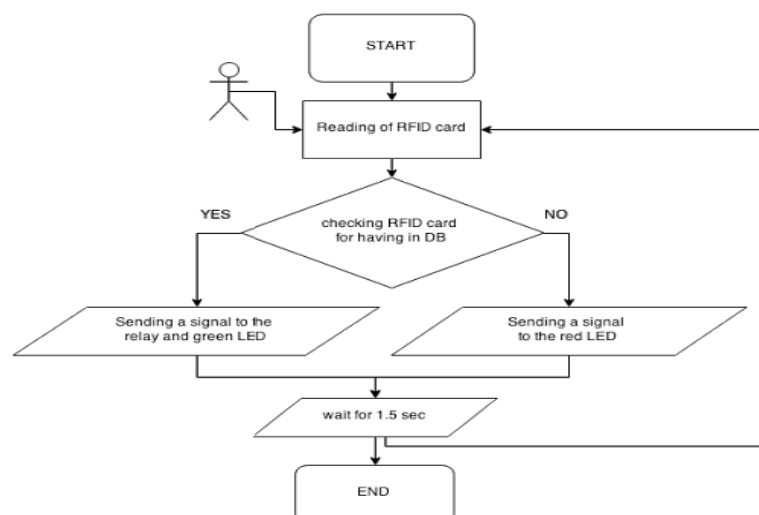


Fig. 4: Workflow of the CAS

Generally, the algorithm of the reading cards is described in Figure 5.

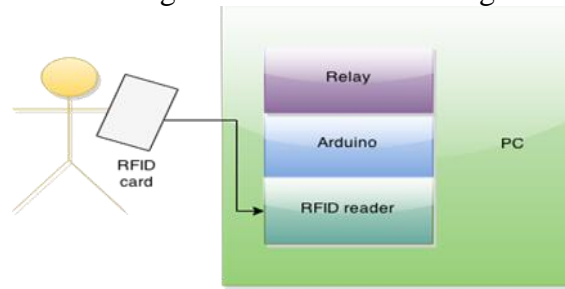


Fig. 5: The algorithm of reading cards

## Conclusion

In this research paper, the idea of implementing the system controlling the computers at the labs of University based on RFID-technology is discussed. 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, the algorithm discussed in research paper [5] can be used for this system to protect important private data. These cards can be put to use at the university and may replace personnel 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. In the research [6-8], the system for checking the students' attendance in Kazakhstan, staff control system, and the Doors access and control system based on NFC-technology are discussed. The idea is similar, however, there were some differences, and this implemented system have shown an importance of using and developing such systems for educational purposes in Kazakhstan. 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 extend this system by adding some new modules, specifically "Library module", "Doors Access Control module", "Payment module", "Parking lot module", and so on. There was research done in [9], 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 was started. We plan to use GPS and GSM technologies in educational system, and the work that was done in [10] is an impulse for this project implementation.

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