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ACCESS CONTROL SYSTEM USING ARDUINO MICROCONTROLLER AND RFID READER*

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ABSTRACT: *This article presents access control system constructed with single-board Arduino Uno and RFID technology for user identification. Additional web based system is used for user registration, access restriction, and access monitoring by recording data logs into database.*

KEYWORDS: *access control system, Arduino, RFID*

2020 Math. Subject Classification: *68M01, 68M99*

Introduction

Access control has an important role for limiting physical access to buildings, laboratories, offices etc. It is important that the users are granted with access and certain privileges to information and resources only if they provide the necessary credentials. The identification process usually uses hardware devices such as card readers, biometric fingerprint or retinal scan, PIN code, etc.

In this article we present a budget solution for creating access control system by using Arduino microcontroller and RFID reader [1,2,3,4]. The system can be used for electrical unlocking doors by allowing access only to the authorized personal. The system allows registration of users, granting access to different rooms and monitoring of accessed rooms with web based system.

This system is suitable for modifying the locking mechanisms of hotel rooms, laboratories, elevators, building with limited access and for monitoring the compliance with working hours by the employees.

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Hardware components

The control access system uses the following components:

Arduino Uno

The Arduino UNO (Fig. 1) [4] is a microcontroller board suitable for universal use.

Figure 1 – Arduino Uno R3

It has 14 digital input/output pins, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, for battery or AC-to-DC adapter for independent use [5]. The power of the microcontroller can be provided via USB when it is connected to a computer for software configuration with Arduino Software (IDE) provided by manufacturer.

Arduino is a microcontroller platform composed of an 8-bit Atmel AVR microcontroller and complementary components that facilitate programming and connection to other devices. One of the key features of the Arduino is the availability of standard connectors that allow the board to be connected to a large variety of different modules called "shields". These shields are interchangeable modules that can communicate directly with the Arduino through various

connectors. Using the I2C bus, several extensions can be connected and used simultaneously [6].

RFID Reader

RFID (Radio-frequency identification) [7] and an electronic communication technique used to identify objects (Fig. 2).

Figure 2 – RFID Sensor

In our case the RFID reader is used for recognizing the tag IDs of contactless cards. The example connection scheme between Arduino and the sensor is shown in Fig 3.

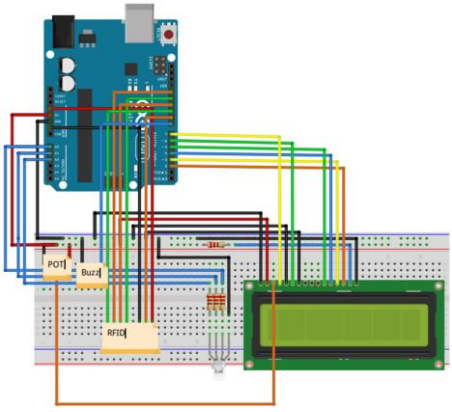


Figure 3 – Arduino and RFID connection

Web based system

The administrative control of the system is performed by administrator with web interface. The administrative functions are available after successful login – Fig. 4.

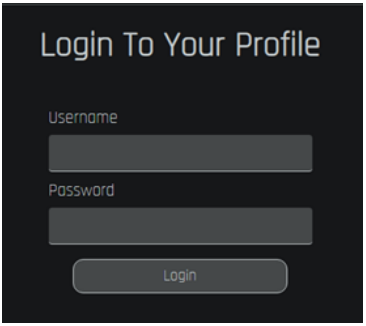


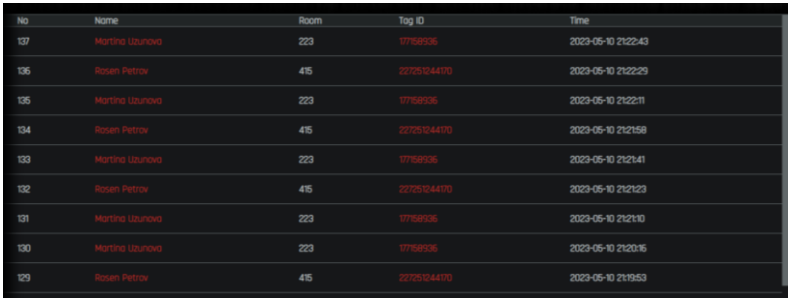
Figure 4 – Administrator login form

The available functions for the administrator are:

- Monitoring access logs.
- Registering users.
- Granting/removing access for registered users.

Monitoring access logs.

This function is available for tracking the records of accessing rooms. In some cases, it is important the certain rooms, laboratories, building to be accessible only for authorized persons. Example logs table is shown in Fig. 5.



No	Name	Room	Tag ID	Time
137	Martina Uzunova	223	177158936	2023-05-10 21:22:43
136	Rosen Petrov	415	227251244170	2023-05-10 21:22:29
135	Martina Uzunova	223	177158936	2023-05-10 21:22:11
134	Rosen Petrov	415	227251244170	2023-05-10 21:21:58
133	Martina Uzunova	223	177158936	2023-05-10 21:21:41
132	Rosen Petrov	415	227251244170	2023-05-10 21:21:23
131	Martina Uzunova	223	177158936	2023-05-10 21:21:10
130	Martina Uzunova	223	177158936	2023-05-10 21:20:16
129	Rosen Petrov	415	227251244170	2023-05-10 21:19:53

Figure 5 – Monitoring access logs

User registration and granting access

This function is used by the administrator of the system for writing the name and card number (tag ID) of every employee. This is important for granting access to the necessary room. The process is shown in Fig. 6.

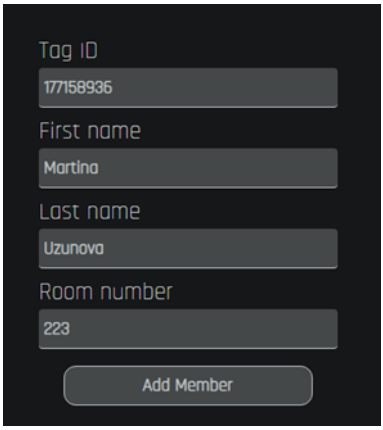


Figure 6 - User registration

Conclusion

The access control system presented in this article is a budget solution using Arduino microcontroller and RFID reader. The electronically locked door can be accessed with contactless cards by recognized tag IDs of the cards. The system has additional web based interface for monitoring the access logs and registering users and their cards for granting access.

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