Secure Door Control System using RFID Card

Htay Myint[1] and May Zaw Tun[2]

[1-2] Lecturer

[1]Department of Engineering Physics, Technological University (Mandalay)

[2]Natural Science Department

[2]University of Computer Studies (Mandalay)

Mandalay, Mandalay Division

Myanmar

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ABSTRACT

The proposed system is an automatic identification and authentication system which can be deployed at the doors of the building to authenticate authorized people. The keypad requires that a person desiring to gain access enter a correct code number. Where access control keypads are used in place of card readers, only a correct code is required to allow entry. This system is also known as the barcode system. So Door Security System is necessary for every home, office, campus and buildings. In this system, a door lock can be controlled by an RFID card. Radiofrequency identification (RFID) is a wireless technology that can be used to develop the access control system. It will be the intent to expand and implement an electronic system that will allow campus police/ administration to automatically secure access to building rooms in buildings across all campus locations in case of emergency and to have views into areas when emergencies may occur while helping to alleviate placing anyone in harm's way. This approach not only reduces the cost but also enhances the reliability and ease of maintenance of the authentication system.

Key Words: *Secure Door, Arduino, ServoMotor, RFID.*

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1. INTRODUCTION

Radio Frequency Identification (RFID) technology is a non-contact, automatic identification technology that uses radio signals to identify, track, sort and detect a variety of objects including people, automobiles, transportation and assets without the need for direct contact (as found in magnetic stripe technology) or line of sight contact (as found in bar code technology). Radio frequency identifier (RFID) is one among the series of wireless technology gaining faster and wider and popular adoption in our today society.

The system of RFID and servo-motors are adopted for door control. A servo-motor is an actuator with a built-in feedback mechanism that responds to a control signal by moving to and holding a position, or by moving at a continuous speed. With the program described running, and connections properly made, the Servo motor will continuously rotate 180º. The person entering into the building is not easily accessed by intruders as the password of the user. In order to develop the advanced system which is more secure and safety RFID technology is applied. Firstly the user needs to confirm that he/she was an authorized person for this system. The system provides the reliable operation by using RFID technology [1, 2]. Radio Frequency Identification (RFID) technology is a non-contact, automatic identification technology that uses radio signals to identify, track, sort and detect a variety of objects including people, vehicles, goods and assets without the need for direct contact or line of sight contact (as found in bar code technology) [3,5].

2. RFID ARCHITECTURE

The RFID system comprises the tag, reader, backend database, and or control unit. The tag comprises a radio frequency chip, encoding and decoding circuitry, antenna unit, and or a memory unit. Depending on power capacity, a tag can be classified into passive, semi-active or active tag. Tags without internal power supply, are called passive tags, tags without internal power supply but only uses the internal supply for its internal memory circuitry are called semi-active, while tags that uses its internal power unit to power both its internal circuitry and the antenna unit for communication are called active tags. Additionally, tags can be categorized based on their frequency of communication. The communication frequency between the tag and the reader determines the energy and read range, and in some instance, the size of the tag. RFID system consists of three components namely transponder (tag), interrogator (reader) and computer containing the database. The interrogator reads the tag data and transmits it

to the computer for authentication. The information is processed and upon verification, access is granted [2, 3, 5]. RFID tag can be classified based on the frequency they operate. Generally, they are classified into three categories namely; the low frequency (LF), high frequency (HF), and the ultra high frequency (UHF). A typical RFID device can be used in the following system [1, 6]:

- Contactless Payment System
- Electronic Article Surveillance (EAS) System
- Container Identification and Tracking
- E-Passport and Document Identification
- Tag Implantation
- Contactless Smart Card

3. MAJOR COMPONENTS USED IN THE PROPOSED SYSTEM

. The following components are implemented in this system:

1. Arduino UNO
2. LCD(16x2) Display (for display door state)
3. RFID RC-522 card
4. 2-Channel Relay
5. 4x4 Matrix Keypad 16-keys
6. Servo Motor

3.1 Arduino UNO R3

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards [4, 7].

3.2 RFID RC-522 and Master Card

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. Active tags have a local power source such as a battery and may operate at hundreds of meters from the RFID reader. Unlike a barcode, the tag need not be within the line of sight of the reader, so it may be embedded in the tracked object. RFID is one method for Automatic Identification and Data Capture (AIDC) [2, 3].

3.3 RFID tag

A radio-frequency identification system uses tags, or labels attached to the objects to be identified. The RFID tag includes a small RF transmitter and receiver. An RFID reader transmits an encoded radio signal to interrogate the tag. The tag receives the message and responds with its identification information. Since RFID tags can be attached to cash, clothing, and possessions, or implanted in animals and people, the possibility of reading personally-linked information without consent has raised serious privacy concerns. There are two main types of tags: passive and active. Passive tags are currently the most widely deployed as they are the cheapest to produce .

3.4 LCD(16x2) Display and 2-Channel Relay (SRD-05 VDC-S L-C)

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. This is a LOW Level 5V 2-channel relay interface board, and each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It is equiped with high-current relays that work under AC250V 10A or DC30V 10A. It has a standard interface that can be controlled directly by microcontroller. [10]

4x4 Matrix Membrane Keypad 16-keys

This 16-button keypad provides a useful human interface component for microcontroller projects. Convenient adhesive backing provides a simple way to mount the keypad in a variety of applications. Matrix keypads use a combination of four rows and four columns to provide button states to the host device, typically a microcontroller. Underneath each key is a pushbutton, with one end connected to one row, and the other end connected to one column [10].

3.5 Rotation 180 Degree Servo Motor

Servo motors are great devices that can turn to a specified position. Usually, they have a servo arm that can turn 180 degrees. Using the Arduino, we can tell a servo to go to a specified position and it will go there. Servo motors were first used in the Remote Control (RC) world, usually to control the steering of RC cars or the flaps on a RC plane. With time, they found their uses in robotics, automation, and of course, the Arduino world. A servo motor has everything built in: a motor, a feedback circuit, and most important, a motor driver. It just needs one power line, one ground, and one control pin [8, 9].

3.6 Relay Section

 A relay comprises of an electromagnet and a contact unit. The definition is: Activating the contact unit using electromagnetic attraction, which is produced when electric current exceeding the specified value flows to the electromagnet; the voltage and current (input signal) applied to the coil opens or shuts the contact. Relays have been around for a long time and though often now replaced with solid state switches, they have unique properties that make them more robust than solid-state devices and are not going away. The unique properties are high current capacity, ability to withstand ESD and drive circuit isolation.

4. SYSTEM ARCHITECTURE AND CIRCUIT

The design and construction of the proposed security system is successfully implemented using RFID technology. This system can open and close door by using RFID card. When user want to open, user must use RFID card and is checked by the system and then type the correct password. You can these two factors are passed, the door is open. The servo motor and door system are attached together; they constitute part of the output unit of the Access control system. The motor is connected to the switching unit (the relay section) and the power supply unit. If the power supply results in a positive voltage the motor rotates clockwise, if it results in a negative voltage the motor rotates anticlockwise. Access control keypads are devices which may be used in addition to or in place of card readers. The keypad requires that a person desiring to gain access enter a correct numeric code. Where access control keypads are used in place of card readers, only a correct code is required to gain entry.
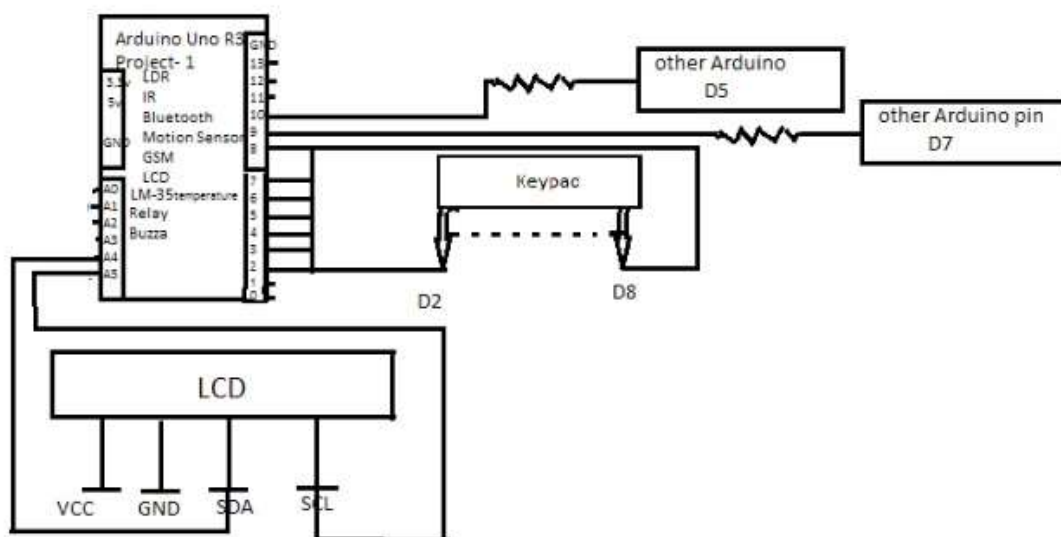

Figure1. Circuit Diagram for Door Lock System in Keypad

This system is also known as barcode system. The software used here is Arduino IDE. The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open source software. The Arduino Integrated Development Environment – or Arduino

Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. This software can be used with any Arduino board.
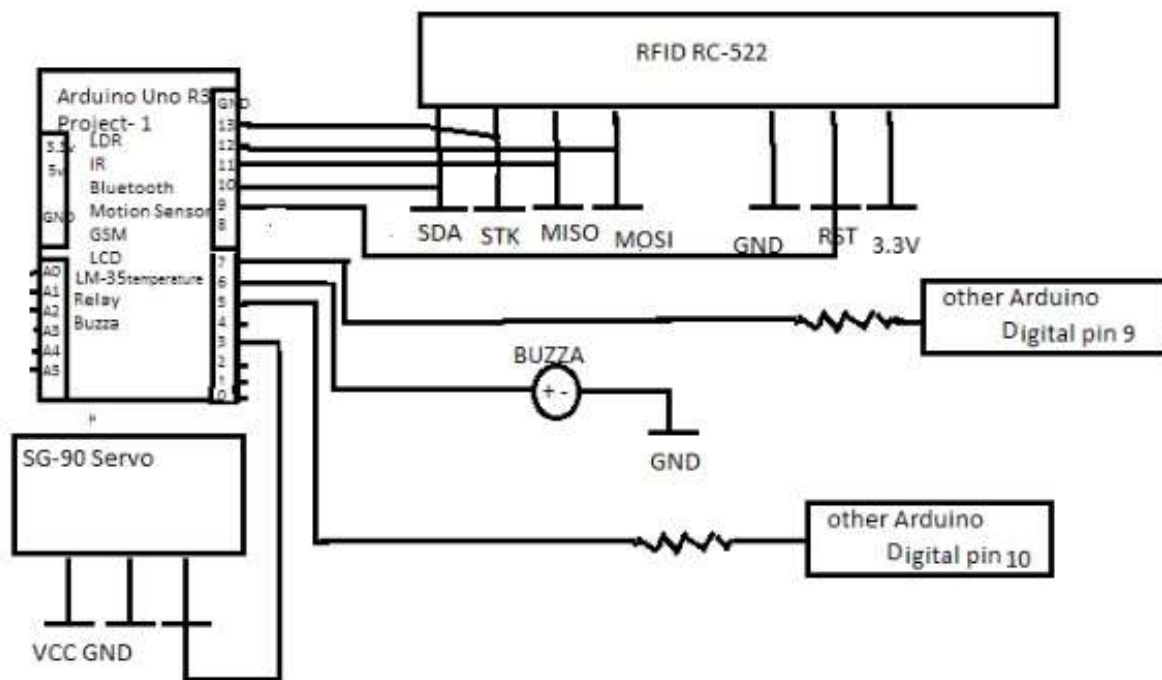

Figure2. Circuit Diagram for Door Lock System (RFID)

5. RESULTS AND DISCUSSION

This system control door lock by RFID card and when RIFD card test is passed, user must type password to open the door. Organizations wishing to use RFID technology need to therefore evaluate the cost and security implications as well as understand the limitations of different RFID technologies and solutions. Using Servo Motor, the system can open and lock the door. This system allows authorized owners because owners have door password. The circuit board is directly installed beside the electrical switches whereby the switching connection is controlled by relay. This system is presented RFID based door control systems. The system intended to control door in building with relatively low cost design, user-friendly interface and ease of installation. It also provides protection system and home security

Figure3. Design and Display message on LCD

6. CONCLUSIONS

Secure Door control system is useful for everybody and necessary for every home, office colleges, campus and etc.. This system can be provided for human being life. This system can extend for remote users represent authorized users who can access the system on their Smart phone app using the Internet via Wi-Fi or 3G/4G network. The beneficiaries of this project include students, faculty, staff, and the general public who utilize the Buildings. If RFID card and password are known by someone, we can change the password. We can extend the controlling the automatically door control with slide door system. Future works will focus on creating a voice command application and can create image recognition by using face or hand.

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