NEAR FIELD COMMUNICATION (NFC) MODEL FOR ARDUINO UNO-BASED SECURITY SYSTEMS OFFICE SYSTEM

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ABSTRACT

Currently, many offices or companies that start growing rapidly in a company or office should have a very limited room to enter only people entitled to enter the room and use the facilities contained in it, for example, Files in it must have many files and documents very important because to reduce the abuse of files and irresponsible person. Because it will be made room door security system by using Near Field Communication on android smartphone. Software used is Arduino IDE. The tools used in this system are Arduino Uno R3, NFC shield, pear sensor, bell, led, servo, 16x2 LCD, and Near Field Communication (NFC) in android smartphone. This system runs based on 2 inputs of a new technology that is Near Field Communication (NFC) in android smartphone. And also use pear sensor to detect unauthorized person entering the room. If the correct password is entered then the door will open and the pear sensor will light off if wrong then the bell will light up.
Keywords : *NFC, Android, Smartphone, Mikrokontroler, Arduino*.

1. INTRODUCTION

Near Field Communication (NFC) is a short-range wireless technology that can be used for data exchange between devices. NFC on Smartphone is a development of Bluetooth and RFID. NFC is a standard specification for smartphones and similar devices to build radio communications between devices by attaching or closing the two devices. NFC is designed to transmit various types of information, such as phone numbers, pictures, MP3 files, or digital authorization between two NFCs, between mobile phones or between mobile phones with RFID chip / reader cards that have close proximity to each other (Curran 2012).

Nowadays a lot of office offices or a company that began to grow rapidly in a company or office must have a room that is very limited to enter only the right people to enter it into the room and use existing facilities therein,for example the file space in it must be a lot of files and documents are very important because to reduce the misuse of a file, files and facilities in it.

This research will discuss about Near Field Communication (NFC) model for arduino uno office file security system with NFC input and process using arduino uno to generate servo output to move the door and buzzer for error notification if there is no access rights to enter indoors and a PIR Sensor that will detect that a person will enter into the room so that the light or LED will be automatically turns on.

2. THEORETICAL BASIS
2.1. Definition of *Near Field Communication Shield* (*NFC*)

NFC Shield is a Near Field Communication interface for Arduino building around the popular NXP PN532 integrated circuit. NFC is a short-range radio technology that allows communication between devices held close together. The NFC traces its roots in RFID technology and open platform technologies are standardized in ECMA-340 and ISO / IEC 18092. The NFC Forum develops and declares compliance devices with NFC standards. NFC operates at 13.56 MHz ISM Frequency. NFC has 12Mhz crystal and 12 Volt power supply. Pin I / O from PN532 can be accessed easily using communication via SPI (seeedstudio 2015).
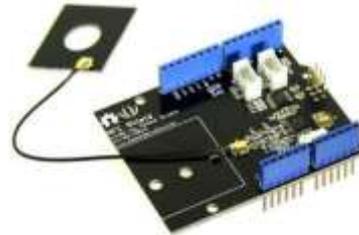

Figure 1. NFC Shield

2.2 Definition of Motor Servo

Servo motor is a motor with a closed feedback system where the position of the motor will be informed back to the control circuit in the servo motor. This motor consists of a DC motor, a series of gears, a potentiometer and a control circuit. Potentiometer serves to determine the angle limit of servo rotation. While the angle of the servo motor axis is set based on the width of the pulse sent through the signal foot of the motor cable. In general there are 2 types of servo motors. That is a standard servo motor and Continous motor servo. Standard type servo motors can only rotate 180 degrees (Suranata 2015).

Figure 2. Motor Servo

2.3 Definition of *Light Emitting Dioda* (LED)

Light Emitting Diode or often abbreviated as LED is an electronic component that can emit monochromatic light when given the forward voltage. LED is a family of Diodes made of semiconductor materials. The colors of the light emitted by the LEDs depend on the type of semiconductor material they use.

Figure 3. LED

2.4 Definition of Switch

Switches are fundamental components in electrical circuits and control system circuits. Its main function is to connect, disconnect and change the direction of the connection on electricity.

Figure 4. Switch

2.5 Definition of Relay

Relays are electro-mechanical components used to operate a set of switch contacts, utilizing electric power as a source of energy. The current required by the relay module is 5V 15-20mA, equipped with high current, AC250V 10A, DC30V 10A.

Figure 5. Relay

2.6 Definition of Arduino Uno

Arduino Uno is a microcontroller board in which there is a microcontroller, the use of different types of microcontroller - depending on the specifications. In Arduino Uno used ATmega 328 based microcontroller Has 14 input pin from digital output where 6 pin input can be used as PWM output and 6 input analog pin, 16 MHz crystal oscillator, USB connection, power jack, ICSP header, and reset button. To support the microcontroller in order to use, simply connect only the Arduino Uno Board to the computer using a USB or power cord with AC-to-DC adapter or battery to run it (Sainsmart 2015).

Figure 6. Arduino Uno

2.7 Definition of Passive Infra Red Sensor (PIR)

PIR motion sensor (Passive Infra Red) is a sensor that works for motion detection that works by detecting a difference / change in temperature now and before. Motion sensor using pear module is very simple and easy to apply because PIR module only requires 5V DC input voltage effective enough to detect movement up to distance 5 meter. When it does not detect motion, the output module is LOW. And when it detects movement, the output will change to HIGH.

Figure 7. Passive Infra Red

2.8 Definition of LCD 16 x 2

LCD (Liquid Crystal Display) is a type of display media that uses liquid crystals as the main viewer. LCDs are used in various fields such as electronic devices such as televisions, calculators, or computer screens. LCD is very functional as a viewer that will be used to display the working status of the tool. (Sainsmart 2015).

Figure 8. LCD

2.9 Buzzer

Buzzer is an electronic component that serves to convert electrical vibrations into vibrations of sound. Basically the buzzer working principle is almost the same as the loud speaker, so the buzzer also consists of a coil attached to the diaphragm and then the coil is flowed so that it becomes an electromagnet, the coil will be pulled in or out, depending on the direction of current and the polarity of the magnet, mounted on the diaphragm then each movement of the coil will move the diaphragm back and forth so as to make the vibrating air that will produce sound

Figure 9. Buzzer

3. RESEARCH METHODOLOGY

3.1 Research Methodology

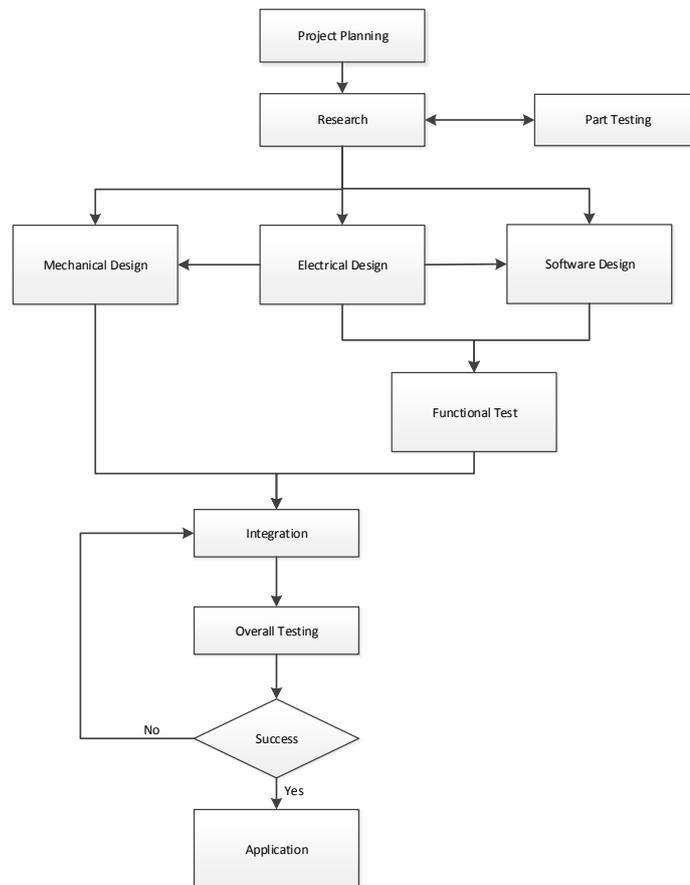The research method used is to use research methods in the field of hardware programing shown in Figure 10

Figure 10. Hardware Programming Research Methods

3.1.1 Planning of Research Design (Project Planning)

In the planning of the research project, there are several important things that must be determined and considered, among others:

1. Determination of Research topics.
2. Estimation of equipment and materials needs.
3. Budget Estimates.
4. Possible application of the application to be designed.

3.1.2 Research

Initial research of the application to be made, from selection and testing of components (tools and materials) to be used, the possibility of the initial and final design of "Near Field Communicatiom (NFC) Utilization Model On Android Smartphone For Space File Security System In Arduino Based Office Uno ".

3.1.3 Testing Components (Part Testing)

In testing component done testing tool to work function of component based on requirement of application to be designed.

3.1.4 Mechanical System Design (Mechanical Design)

In hardware design, mechanical design is an important thing to consider. In general, the application needs to mechanical design, among others:
1. The shape and size of PCB (Printed Circuit Board)
2. Flexibility to the environment
3. Placement of electronic modules
4. Testing of mechanical systems that have been designed
5. Design the size of interface system

3.1.5 Mechanical System Design (Mechanical Design)

In the design of electrical and mechanical systems there are several things that must be considered, among others:

1. Power supply and power division for each component
2. Voltage and current requirements for microcontroller, sensor and actuator
3. Design of circuit sequence

3.1.6 Software Design

The design of the software used in this research is using Arduino IDE, MS office, Visio and Fritzing software, Sketchup 2016.

3.1.7 Functional Test (Function Test)

Functional tests include system functional testing that has been integrated between electrical design and software design.

3.1.8 Integration or Assembly (Integration)

The electrical modules that are integrated with the software inside the controller, are integrated in the mechanical structure that has been designed. Then performed a functional test of the whole system.

3.1.9 Overall System Functional Tests (Overall Testing)

At this stage testing the function of the whole system. Whether it can work in accordance with the concept or not. If there is a system that can not work properly then the process should be re-assembled on each system design.

3.1.10 Application

Application to improve the performance of the applications that have been designed. Optimization is emphasized on mechanical design for maximum usage as well as optimal.

4. PLANNING
4.1 Planning of Research Design (Project Planning)

The research project planning stage is the activity step of the system creation process. Components needed in the design sisitem are Two Arduino Uno, NFC shield, LCD, relays, servo, PIR sensor, buzzer, smartphone and LED.

4.2 *Research*

After system planning, then proceed with the initial research of the system to be created. In the research phase, the initial design of the mechanical circuit and the components of this security system model to ensure that all components can run optimally. This system uses one Arduino Uno. Input system using NFC on android

smartphone. Control system using NFC shield with radio frequency ISM 13.56 MHz. The system output is the door lock lever using servo and led.

4.3 Testing Components (Part Testing)

At this stage testing the components that will be used using multimeter. Testing using Arduino serial monitoring is done by looking at the output of each component connected to the Arduino via USB connection. Tests using multimeters include testing the input and output voltages of each component.

4.4 Mechanical System Design

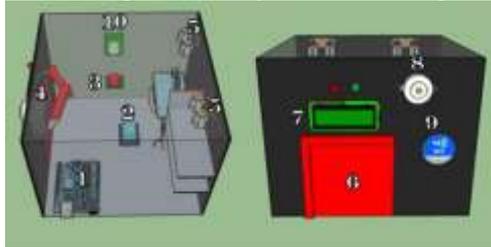Here the mechanical design of the system as in Figure 11 below:

Figure 11. Mechanical System Design

The prototype or model is made of acrylic, with a height of ± 30cm and a length of ± 30cm, the door lock lever using Solenoid.

4.5 Electronic Design (Electronics Design)

The schematic design of the circuit using the Fritzing software is based on the block diagram in Figure 12 below.
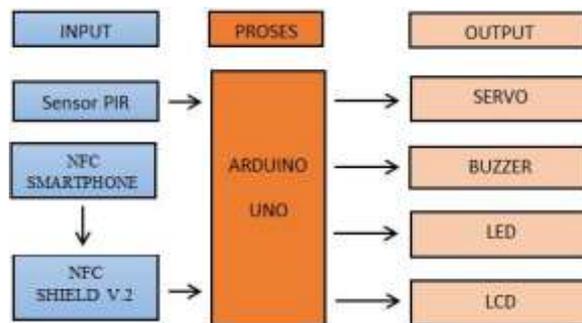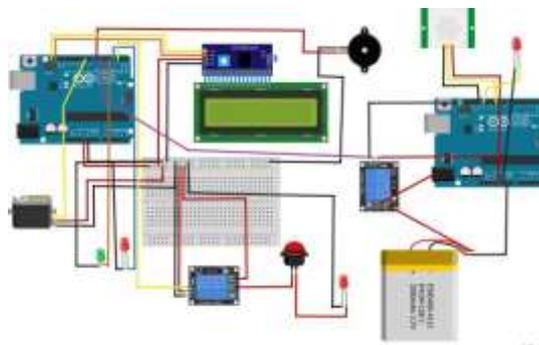

Figure 12. Block Diagram

Figure 13. Network Schematic

The voltage source uses a 12V battery that will supply the current to each component. The voltage that goes into the relay and solenoid is 11,45V. While the voltage flowing to Arduino and NFC shield as much as 5V.

4.6 Software Design

The design of the system software is made with the Processing Language Processing in Arduino Uno based on the flowchart in Figure 14 below:
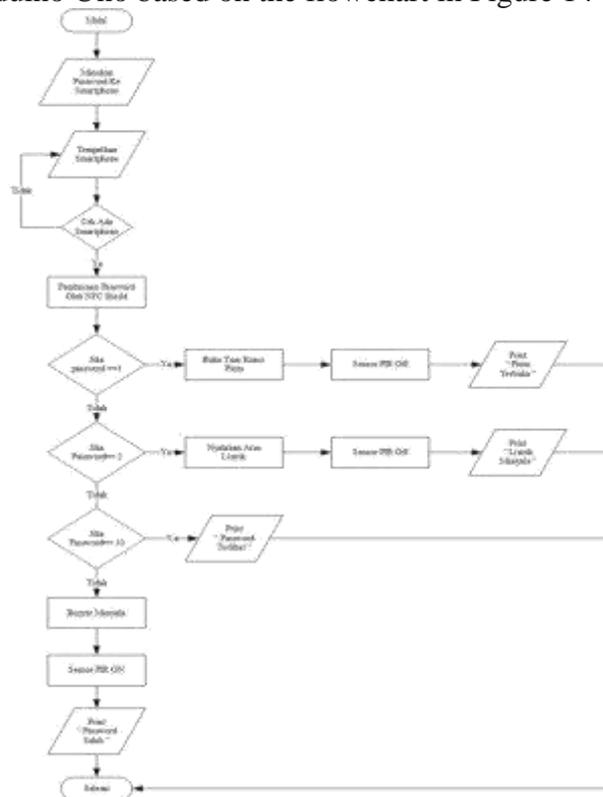

Figure 14. System Flowchart

4.7 Functional Tests

Functional tests are performed on software that has been designed. This test process is done to improve the performance of the software in controlling the electrical design and eliminate and anticipate errors of software made. When the software system has been completed tested then go into the assembly process.

4.8 Assembly

In this process the assembly process is based on the design process, both mechanical design, electronic and software design.

5. DISCUSSION

5.1 Research Results

From the results of this study the authors complete some things that become reference and reference in order to get maximum results with model design is made of acrylic with a height of ± 20cm and length ± 25cm and use two arduino who communicate with each other. Using two arduino arduino paired NFC shield as input from NFC smartphone and another arduino paired with PIR sensor as input from motion or sensor to detect a movement. Use two arduino because NFC shield can not be added any input other than NFC shield itself, therefore using this two interlocking arduino and arduino one not installed NFC shiled then additional input is mounted on this arduino.

Furthermore, in doing communication using Arduino Uno tool. Arduino uno with 16x2 LCD connected via i2c (Inter Integrated Sircuit). In the use of NFC shield the tool will be connected to the Arduino Uno via SPI

communication (Serial Peripheral Interface) and relay1 is connected to pin 6, riley2 is connected to pin 2, the buzzer is connected to pin 7, the red led is connected to pin 3, the led LED is connected to pin 4 , the servo is connected to pin 9 of the Arduino Uno while in the arduino another PIR sensor is connected to pin 2, the red led is connected to the pin 13 By maximizing the functions of the Tool to provide security to the file room there are 3 (three) security systems:

1. Security of doors by using servo serves as open door closes automatically and locks the door.
2. PIR sensor function to detect a movement in the room.
3. Security of the use of facilities in the room by turning off all electric current contained in the room by using relays to arrange it.

The tool is accessed by using a NFC smartphone with NFC Shield V.2. Function of NFC smartphone to enter or input the password into the tool, the password already entered on the smartphone will be read by NFC shield by attaching the NFC smartphone to the NFC shield after pasted then there is a command to tab the smartphone screen with one tab only if the smartphone screen not tab then there will be no communication between NFC smartphone with NFC shield or password that will not be read by the NFC shield it will fail and can be tried again by reattaching the NFC smartphone to NFC shield.

If the password entered is 1 (one) then if the correct door will open and the PIR sensor will not turn on and if the password entered on the smartphone is 2 (two) then the power will turn on and led is indicator that the electricity in the room is on and can use the facilities contained in the file room and if we inputkan password 2 (two) back then the power will die so password 2 (two) it's function to turn on and off the electricity.

If the password entered is 3 (three) then lcd will display the existing password just in case if user forgot the password to open, turn on the power and turn off the power. If the password is entered in addition to 1 (one), 2 (two) and 3 (three) then the password is false then the door and the electricity will not turn on and open then buzzer will light indicates that the password entered is wrong and if someone is successful enter the room without going through the main door or without entering the password then the PIR sensor will always detect the presence of anyone who is in the room, if there is someone who enter it without permission it will be captured by the PIR sensor and led will also light up as an indicator that an unauthorized person managed to get into the file room of the office.

5.2 Overall System Functional Testing (Overall Testing)

This stage is done testing the function of the whole system. Whether it can work in accordance with the concept or not. If there is a system that can not work properly, it must be done re-assembly process every part of the system. These tests include structural, functional and validation testing.

5.2.1 Structural Testing

At this stage a test is conducted to determine whether the circuit paths are connected properly so that the system can work properly. This test is done by testing the circuit paths using multimeter.

5.2.2 Functional Testing

At this stage a test is conducted to determine whether the voltage flowing in the circuit is in accordance with the required. This test is done by testing the output voltage of each component by using multimeter and program

5.2.3 Validation Test

This stage is done to test the distance from the NFC range as system input. By attaching a NFC shield antenna with a NFC smartphone, testing will be done in the absence of obstructions and barriers. This test is done 10 times, it is assumed n = 10 times test, can describe the optimal test result.

6. CONCLUSIONS AND SUGGESTIONS

6.1 Conclusion

The conclusion of this research, the model of utilization of near field communication (NFC) on smartphone for security system in arduino uno based file room. The system uses Arduino Uno, NFC shield, servo, relay, buzzer, LCD, led and smartphone. Input system using the latest technology that is Near Field Communication (NFC) on android smartphone. The system can receive password input and in continue with NFC input on the smartphone can not vice versa. NFC Shield connection distance and android smartphone that can be achieved at no barrier that is a maximum of 4cm with an average response time of 0.77 seconds. when blocked by acrylic maximum distance is 3cm with an average response time of 0.63 seconds. The system output is the door lock lever using servo and switching the electric current inside using relay.

6.2 Suggestions

The file system security model using Near Field Communication (NFC) on Android smartphones needs further development to improve security by adding functionality and system features such as cameras or indoor sensors anticipating people entering the premises not through the main door so that the security is layered from outside and from within the room as well as adding layered passwords and for obstacle forgotten passwords that for user error can change the password through the internet and no need to re-upload the program into the microcontroller.

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