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DESIGN AND CONSTRUCTION OF A DOOR SECURITY SYSTEM USING RADIO FREQUENCY IDENTIFICATION BASED ON THE INTERNET OF THINGS AT THE MAIN POWER HOUSE WAREHOUSE OF JUANDA AIRPORT SURABAYA

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Abstract- Juanda International Airport, located in Sedati District, Sidoarjo, Indonesia, ranks as the country's third busiest airport. This study focuses on enhancing security at the airport's Main Power House, which houses critical electrical equipment and valuable maintenance items. Currently secured by a basic manual lock, the office has experienced losses, prompting the development of a more robust security system. The proposed system integrates Radio Frequency Identification (RFID) technology with an Arduino-based control system to automate access control. Upon RFID tag detection, the system verifies and logs access via an LCD display and the Blynk application, ensuring accountability. Testing confirmed the system's functionality, including the RFID reader's capability to detect tags up to 1.8 cm away. This research contributes a practical solution for improving security and operational efficiency at critical facilities within Juanda Airport.

Keywords— RFID, Airport, Portable.

I. INTRODUCTION

Juanda International Airport is an international airport located in Sedati District, Sidoarjo. This airport is the third busiest airport in Indonesia (after Soekarno-Hatta Airport and Ngurah Rai Airport). This airport is located approximately 12 kilometers (7.5 miles) from the center of Surabaya and serves the Pintukertosusila area. Juanda International Airport is operated by PT Angkasa Pura I.

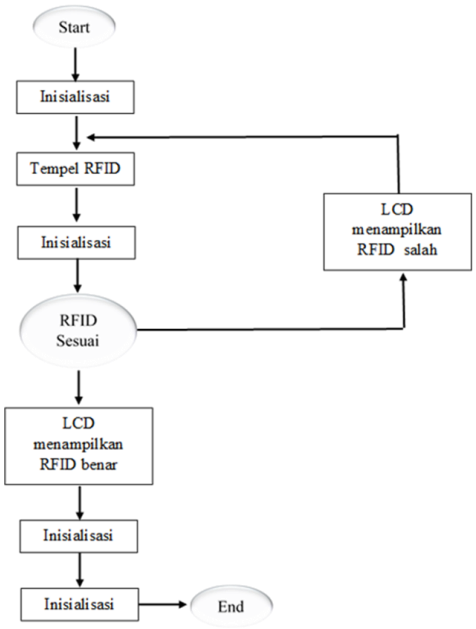
One of the offices at Juanda Airport is the Main Power House, where this place is specifically for the main electrical equipment for Juanda Airport such as transformers, electrical panels and generator sets. Apart from that, there are also valuable items which are office facilities for maintenance purposes and personal items. When in the field technicians find it very difficult if there is a cable fault problem at each feeder and have to use manual methods with measuring instruments to find out the location of the cable fault point.

However, the security system in this office still uses a very simple method, namely by using a manual door lock. Therefore, several times the office lost items for maintenance purposes such as grounding cables, Mini Circuit Breakers, lights. So, a security system is needed in offices where there are valuable items, both personal property and office facilities, so security must be increased to prevent unwanted things.

II. METHODS

Design is a creation to obtain an end result by taking a clear action, or a creation of something that has physical reality. In the field of engineering, this still involves a process where scientific principles and technical tools such as computer switches and language are used, to produce a design which, if implemented, will meet human needs.

2.1 Tool working system



The first stage, namely the Arduino design, must be declared first. If there is an RFID module input, the Arduino will analyze the input, whether the input data matches the data that has been stored on the Arduino or not. If there is no input then the Arduino waits until there is an input from the RFID Reader scanning data serial port.

When activated, the RFID system which includes an RFID reader will carry out its function of scanning data entering

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through the reader. The input data will be processed by Arduino and adjusted to the ID database in the program. If the RFID Tag input is not appropriate then the LCD will display incorrect. If the password and tag input data match, the Correct command will appear on the LCD screen, then the solenoid key will open and the servo will open the door. RFID data that has been used to access the room will be recorded in the Blynk application to monitor who has accessed the room.

Software Design Stage The software design stage is carried out directly on the mechanical design and hardware tools that have been completed, in order to know firsthand the work of each component that will be controlled by the microcontroller. The following is a flow diagram of the tool system that will be made

2.2 Block Diagram

The block diagram mentioned in this text is part of the method used in research to design an RFID-based door security system at the Main Power House of Juanda International Airport. This block diagram depicts the main components and the relationships between them in the proposed system. The following is an explanation of the function of each component in the block diagram:

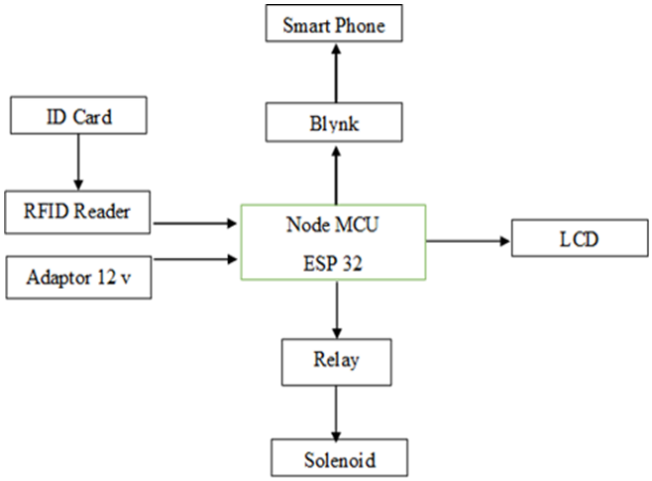

Fig.2 Block Diagram

The function of the system block diagram above can be explained as follows:

1. The MCU node functions as the overall system controller and has been programmed first.

2. The RFID card functions as a frequency wave input.

3. RFID reader functions as a receiver in the form of frequency waves.

4. Blynk functions to monitor personal who have accessed the room.

5. Power Supply as a supply of electric current to all components.

6. LCD (Liquid Crystal Display), the display used by the M16x2 has a display of 16 characters in 2 lines. This LCD will display a display namely Correct and Incorrect.

7. This solenoid functions as an actuator, the principle of the solenoid itself will work as a lock and will be active when a voltage of 12V is applied.

8. The relay functions as an automatic switch for the Solenoid.

2.3 Data Collection Techniques

The technique used in data collection in this study is to test the product. Where in this product test is to determine the performance and to measure the ability of these tools.

2.4 Data Analysis Techniques.

The analysisused in this research is an experiment of the accuracy of the tool through the right components after the measurement trial is carried out. Besides, descriptive analysis to describe the results of the experiment through:

a. Measure the reading distance between the RFID Reader and the RFID tag by using a ruler (cm) toopen and close the locker door.

b. Testing per component tools, so that each component of the tool can work in accordance with a predetermined program to achieve more accurate data results.

III. Results and Discussion

3.1 Testing The Whole Circuit

This test is carried out to ensure that the system used in the research is in good condition and ready to operate the program.

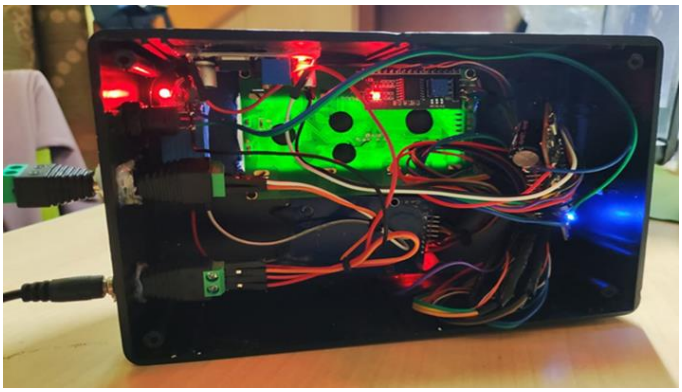

Fig. 3 Testing The Whole Circuit

3.2 RFID Reader Sensor Distance Testing with RFID tag

Testing the reading distance of the sensor with a FRID tag was carried out using a ruler (cm) and the RFID reader was in a plastic box with a thickness of 2mm. Measuring the distance between the RFID tag and the RFID reader aims to determine the distance the RFID reader can read the ID on the RFID tag

Table 3.1 Retrieval of RFID tag distance data with the RFID Reader sensor

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NO.	Tipe ID		Jarak	Keterangan
1.	RFID Tag		0 cm	Terbaca
2.			0,2 cm	Terbaca
3.			0,4 cm	Terbaca
4.			0,6 cm	Terbaca
5.			0,8 cm	Terbaca
6.	RFID Tag		1 cm	Terbaca
7.			1,2 cm	Terbaca
8.			1,4 cm	Terbaca
9.			1,6 cm	Terbaca
10.			1,8 cm	Terbaca
11.			2 cm	Tidak Terbaca
12.			2,2 cm	Tidak Terbaca
13.			2,4 cm	Tidak Terbaca

From the data above it can be concluded that:

• The closest distance an RFID tag can be read by an RFID reader is 0 cm

• The furthest distance an RFID tag can be read by an RFID reader is 1.8 cm

• The average distance that an RFID tag can be read by an RFID reader is 0.9 cm

Table 3.2 Testing of RFID tags with RFID Reader and Selenoid sensors

Tipe ID	Jarak	RFID Reader		Kontak magnetik	
		Membaca	Tidak Membaca	Bekerja	Tidak Bekerja
RFID Tag	0 cm	✓		✓	
	0,2	✓		✓	
	0,4	✓		✓	
	0,6	✓		✓	
	0,8	✓		✓	
	1 cm	✓		✓	
	1,2 cm	✓		✓	
	1,4 cm	✓		✓	
	1,6 cm	✓		✓	
	1,8 cm	✓		✓	
	2 cm		✓		✓
	2,2 cm		✓		✓
	2,4 cm		✓		✓

The table above displays the overall system testing data, which begins with testing the RFID tag towards the RFID reader. The distance tested is from 0 – 2.2 cm and the result is that the solenoid key will open when detected and return to its original position/lock after a 2 second delay.

3.3 Discussion

This test is carried out to determine the work of the system as a whole, starting from the process of designing tools and programming on the microcontroller. In the first test, namely the Atmega328 microcontroller test, which is to control input and output on the locker safety, so that the microcontroller requires an appropriate voltage supply.

Measurement of the input voltage on the Atmega328 microcontroller using an analog multimeter is 5V, from the measurement results with the Atmega328 microcontroller datasheet requires an operational voltage of 1.8-5.5. Then in the relay test which functions to control selenoid. The relay used is songle-RSD which has a voltage of up to 30 with a maximum current of 10A (I = 10A). Then in the selenoid test, which is DC selenoid and has a supply voltage of 12, measurements are made when the selenoid is active with a script to control the relay. and testing the RFID Reader, which is to read the ID on the RFID tag, then the ID will be processed by the microcontroller.

And then measuring the distance of the RFID Reader sensor with an RFID tag using a ruler (cm), which is at a distance of 1.8 cm the RFID Reader sensor reads the ID on the RFID tag.

IV. Conclusion

Prototype design of the RFID-based door security system at Juanda International Airport's Main Power House aimed to enhance security measures for valuable equipment and personal items. The system integrates various components including an Arduino microcontroller, RFID reader, LCD display, solenoid lock, relay, and power supply to create a robust security infrastructure.

By conducting research on a prototype design for a door security system with radio frequency identification based on the Internet of Things in the main power house warehouse at Juanda Airport, Surabaya. so it can be concluded as follows:

1. Automatic doors using RFID are created and operated by Arduino as a circuit control center and programmed using the Arduino application version 8.1

2. The RFID reader's ability to detect RFID tags with a maximum distance of 1.8 cm with the MFRC522 RFID reader sensor which has a frequency of 13.56 Mhz.

3. RFID Reader's ability to detect RFID tags in 1 to 2 seconds from when the RFID tag is attached to the RFID reader.

4. Solenoid key as a door lock to close and open the door can work automatically within 2 seconds

5. The resulting monitoring results can be displayed via smartphone or PC

In real time by displaying the time and identity of individuals who have accessed the room.

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