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DESIGN USING RFID SENSOR BASED ON ARDUINO UNO

Muhammad Maulana Ilham[1], Muhammad Khairil Ihsan[2], Septian Yofinaldi[3], Paduloh[4]
[1, 2, 3] Muhammad Maulana Ilham, Muhammad Khairil Ihsan, Septian Yofinaldi Program Studi Teknik Industri, Universitas Bhayangkara Jakarta Raya, Indonesia
[4] Paduloh Program Studi Teknik Industri, Universitas Bhayangkara Jakarta Raya, Indonesia
paduloh@dsn.ubharajaya.ac.id

Abstract

The aim of this research is to prepare and also design a circuit that has a function in providing security for doors, and The technology used to reduce insecurity on doors is an Arduino Uno -based Radio Frequency Identification (RFID) sensor which is used to lock doors in opening and closing. RFID is used as a receiver for radio frequency signals that carry data. In this door lock security system, an RFID card is attached to the RFID reader. The results of this research are in the form of a door lock prototype that uses an RFID sensor so that it can run without any errors. The RFID sensor has the ability to work by detecting a code or ID using a card that is attached to the reader at a distance of 3 cm, after which the reader will detect the card for 5 seconds.

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Arduino UNO R3,
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Abstrak

Tujuan dari penelitian ini untuk merapkan dan juga merancang suatu rangkaian yang memiliki fungsi dalam membuat keamanan pada pintu, dan teknologi yang dipakai untuk mengurangi adanya ketidakamanan pada pintu yaitu sensor *Radio Frequency Identification* (RFID) berbasis Arduino Uno yang digunakan untuk kunci pintu dalam membuka dan menutup. RFID digunakan sebagai penerima sinya gelombang radio frekuensi yang membawa data. Dalam sistem keamanan kunci pintu ini menggunakan *Card* RFID yang ditempelkan pada RFID *Reader*. Dari hasil penelitian ini yaitu berbentuk prototype kunci pintu yang menggunakan sensor RFID sehingga dapat berjalan tanpa adanya kesalahan. Sensor RFID mempunyai kemampuan bekerja dengan mendeteksi kode atau *id* dengan menggunakan *card* yang ditempelkan pada *reader* dengan jarak 3cm setelah itu *reader* akan mendeteksi *card* selama 5 detik.

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1. INTRODUCTION

The development of biometric technology is currently developing very well, where this development is more focused on applications in the security sector so that the identification and verification functions can be fulfilled [4]. Technological advances in the 4.0 era have developed very rapidly, making it easier and helpful for humans to control systems and tools [3]. Because of biometric technology and the affordable prices of sensors and microcontrollers, this tool has become easier and more efficient to develop.

There is a lot of research in the field of automation that utilizes sensors as part of the automation series being studied. As has been carried out automation research regarding the Arduino Uno, Max 6675 and GSM SIM 800L temperature sensors [14]. The application used to design a temperature control device for the R301 stirrer to prevent overheating is using the Fritzing application. The physical circuit created successfully operated the temperature control output. After conducting research regarding the results of design using the AHP and QFD methods, visualization of the tool system was created using the IoT concept and is based on Node MCU [5]. After conducting research regarding the proposed new solution for a temperature control system that prevents overheating using Arduino Uno and Thingspeak based on IoT [15].

Security is one of the things that is very important to pay attention to and prioritize in our daily lives, and the most important part of the security system is the digital key [1]. There are various security systems that can secure the door of the house. Examples include using sensors RFID card and fingerprint sensorRadio Frequency Identification technology is often used to identify locks on doors which provide a security system. Radio waves in RFID function to identify an object. RFID is a system that uses radio waves to send and receive data. The RFID system has two parts, namely the tag or transponder and reader.

In this system we can use E-KTP as a substitute for RFID cards because the E-KTP has a chip that stores the ID number, this door lock tool can use E-KTP to open the door. To read the E-KTP ID number, the reader used is a 13.56 MHz reader, and as an introduction to the input and output circuit, the Atmega328 microcontroller is used [6]. The technology for accessing a room has undergone development, initially opening the door with a manual key, now just attaching an RFID card [2]. In the hospitality sector, door locks with RFID sensors are widely used. RFID sensor technology can be useful for maintaining room security and privacy.

In this problem, many house door locks still open the door with a manual key, where the manual lock can be forced open by thieves Therefore, a key is needed that is more efficient and practical to be used by most people. Especially in relation to sensors that resemble human intelligence. From the problems in this research, the author tried to create and also design A door lock uses an RFID card attached to an RFID reader. By making a door lock that uses an RFID card, it is hoped that the door will not be easily opened by thieves or other people who do not have access to the room.

2. BASIC THEORY

2.1 Arduino Uno

Arduino Uno is a type of board that contains a microcontroller that is the size of a credit card and has several pins that function to communicate with other components [7]. Arduino is a versatile microcontroller that can be programmed. We usually know programs on Arduino as sketches. There are two main parts to Arduino, the microcontroller and software (IDE) which works on the computer as a compiler [8].

2.2 RFID Reader

RFID reader is a device that functions to detect RFID card data. The data detected by the RFID reader is then processed with Arduino Uno [9]. There are two types of RFID readers, namely passive RFID readers and active RFID readers. The passive RFID reader has a range of 600 meters, while the active RFID reader is only able to receive radio signals from active tags.

2.3 RFID Cards

RFID card is a part or component of RFID which inside the card has a chip and antenna which also has an ID number which is then identified by the RFID reader. In the RFID card there is an important component called an Integrated Circuit (IC) whose function is to process radio frequency signals which operate with a DC power supply, and an antenna which functions to send and receive radio frequency signals [10].

2.4 Liquid Crystal Display (LCD)

A type of electronic display created using CMOS logic technology which functions by reflecting light around it towards the front-lit or by sending light from the back-lit [11].

2.5 I2C Module

I2C is a module used to minimize foot wear on the LCD. I2C has four pins that are connected to the Arduino Uno. The I2C module is supported by Arduino Uno, so that Arduino Uno can control 16x2 and 20x4 character LCDs using analog input pin 4 (SDA) and analog input pin 5 (SCL) [11].

2.6 Servo Motors

A servo motor is a device that contains components and sensors. The combination of these two devices is useful for regulating several components of industrial processes, for example controlling machine speed, tilt level, angle, and so on.

2.7 Jumper Cables

An electrical cable that has a connector pin at each end. This cable is usually used to connect each component needed in assembly without using solder [12].

3. RESEARCH METHODS

3.1 Research Stages

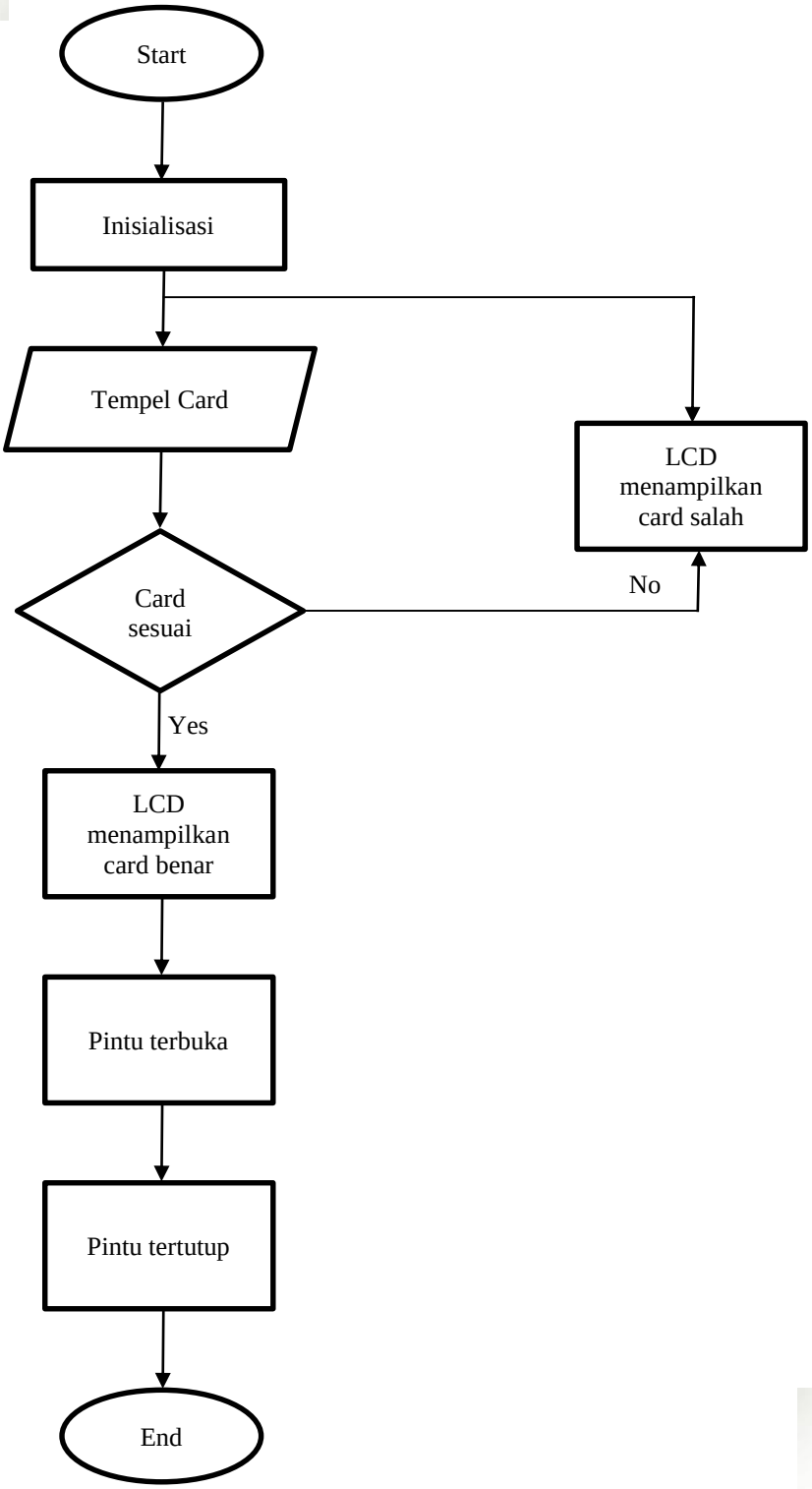
Research stages are a series and stages that must be carried out in order to obtain research results that are correct and meet expectations [13]. Below are the stages that have been carried out in this research:

Figure 3. 1Research Stages

The author identified the problem by making observations using the internet about the homes of residents who experienced theft. After conducting observations, it was found that the most common problem experienced was that many residents still use manual door locks, making house doors easier to break into. The researcher found out the tools and materials needed to make a smart door lock prototype, the author made a smart door lock circuit using Arduino Uno-based RFID as a microcontroller. Making and testing was carried out at Bhayangkara University, Greater Jakarta, after testing several times, evaluation was still needed. After the prototype has been successfully created and is running well, it is continued with creating a report on the experimental results.

3.2 Flow diagram

Flow diagrams are a method or The steps are described and carried out sequentially according to the system [14].



Gambar 3. 2 *Flowchart*

The picture explains how a smart door lock works. Basically, how a smart door works uses an RFID system which is centered on an RFID reader sensor as signal reception, while an RFID card is useful as a signal sender to the RFID reader. To open the door, attach the RFID card to the RFID reader so that the liquid crystal The display (LCD) displays "Door Open" at the same time the servo motor moves to open the lock slot. If it is attached with an RFID that has not been registered, the LCD will give the statement "Wrong Card" so that the servo motor will not move to open the key slot.

4. RESULTS AND DISCUSSION

The process of testing the smart door circuit is carried out in stages on each component to ensure that each component has the appropriate minimum performance or that there are no errors in installation or component damage.

4.1 Smart Door Lock Circuit Design

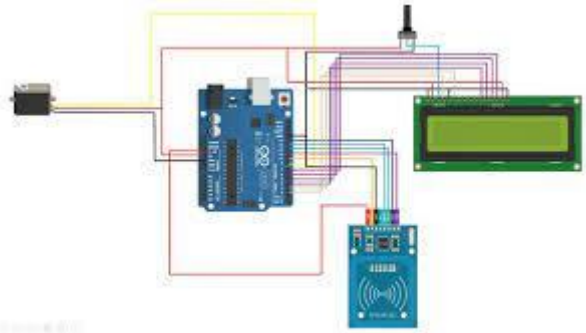


Figure 4. 1*Smart door lock* circuit

The image above is a schematic of the prototype in this research. The design scheme functions to make it easier for researchers to assemble a circuit, starting with a design of the circuit composition before implementing it in physical form [16]. The author created a smart door lock circuit that is operated to lock and unlock the door using a card or E-KTP attached to an RFID reader that uses an Arduino Uno microcontroller as the main chip. This was implemented to reduce the potential for theft or door break-ins at home.

4.2 Arduino UNO R3 Trial

Figure 4. 2Arduino Uno R3 trials

The image above is the test result of a breadboard connected to the Arduino UNO R3 microcontroller. The indicator light on the Arduino lights up red, a sign that the microcontroller is working is when the indicator light on the Arduino lights up when voltage is applied or program data is input via the Arduino IDE software [4]. Similar to the Arduino UNO above, the Liquid display system (LCD) is indicated to be functioning when it can display what has been set in the Arduino UNO R3.

4.3 Smart Door Lock Circuit Test Results

It is important to note that test results may vary depending on the brand and model of Smart Door Lock used. The picture below shows 2 different situations where a smart door system that uses RFID can work well or not work well. In this experiment, an object that uses the wrong RFID card cannot open the smart door, whereas if it uses an RFID card that has been registered it will open the door lock automatically after 5 seconds and re-lock after 5 seconds of opening. The experiment was carried out 2 times with the conditions success in accessing the smart door lock system :

Table 4. 1Test Results

No	Condition	Test results	Attachment
1	**The RFID reader sensor detects the wrong RFID card**	**Not successful**	
2	**The RFID reader sensor detects the correct RFID card**	**Succeed**	

5. CONCLUSION

Based on the process of making and testing the prototype that we have created, namely an automatic door lock that uses an RFID sensor based on Arduino Uno R3. It can be concluded that the function of this tool is to lock the door and open the lock automatically, just attach the RFID card or E-KTP to the RFID reader and then the tool works to open and lock the door. This prototype is useful for increasing security on doors, both house doors, room doors, hotel room doors, and so on. And this prototype can overcome complaints about house break-ins or theft.

THANK-YOU NOTE

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BIBLIOGRAPHY

[1] Siswanto, A., Efendi, A., & Yulianti, A. (2018). Home Door Access Control Tool Using Fingerprint Technology in a Smart Home Environment with Encrypted Data. *Journal of Postal and Informatics Research*, *8* (2), 97-107.

[2] Dita, PES, Al Fahrezi, A., Prasetyawan, P., & Amarudin, A. (2021). The door security system uses a fingerprint sensor based on the Arduino UNO R3 microcontroller. *Journal of Computer Engineering and Systems*, *2* (1), 121-135.

[3] Leo, A., & Aziz, A. (2021). Design of an Automatic Door Lock System Using Rfid Arduino Uno. *Ampere Journal*, *6* (1), 43-48.

[4] Anggriawan, R., & Candra, O. (2020). Design and Construction of Lecture Room Door Security Using Fingerprint Sensors Based on Arduino Mega2560. *JTEV (Journal of Electrical and Vocational Engineering)*, *6* (1), 25-34.

[5] Bhayangkara, University, Greater Jakarta, and South Jakarta. 2023. "Monitoring Viscosity of Polymer Products on the Reactor Tank Using IoT-Based NodeMCU." 25(1):53–64. Novianti, T. (2019). Design an automatic door using RFID. *Journal of Electrical and Computer Engineering Triac*, *6* (1), 8-13.

[6] Saputro, E., & Wibawanto, H. (2016). Design and build automatic door security using e-KTP based on the Atmega328 microcontroller. *Journal of Electrical Engineering*, *8* (1), 1-4.

[7] Nadziroh, F., Syafira, F., & Nooriansyah, S. (2021). Arduino Uno Based Light Intensity Detection Tool to Mark Day-Night Changes for the Blind. *Indonesian Journal of Intellectual Publication*, *1* (3), 142-149.

[8] Al'ulla, AC, Alfita, R., & Ibadillah, AF (2020). DESIGN OF AN E-MONEY SYSTEM USING BARCODE SCANNER AND RFID READER BASED ON INTERNET OF THINGS AT SMPN 1 KAMAL. SinarFe7, 3(1).

[9] Bazergan, A., Duyo, RA, Atriyani, A., & Novita, N. (2021, October). Educational Tools for Early Childhood Using Radio Frequency Identification (RFID). In National Seminar on Electrical Engineering and Informatics (SNTEI) (pp. 219-222).

[10] Natsir, M., Rendra, DB, & Anggara, ADY (2019). Implementation of IoT for Automatic AC Control Systems in Classrooms at Serang Raya University. PROSISKO: Journal of Computer Systems Research and Observation Development, 6(1).

[11] Akbar, A., Zaenudin, Z., Mutaqin, Z., & Samsumar, LD (2022). IoT-Based Smart Room Using Web Server-Based Esp32 Microcontroller. Formosa Journal of Computer and Information Science, 1(2), 91-98.

[12] Malau, YGVY, & Nopriadi, N. (2023). DESIGN OF A WATER LEVEL CONTROL SYSTEM USING THE ARDUINO BASED PROTOTYPE METHOD. Computer and Science Industrial Engineering (COMASIE), 9(1).

[13] Rosaly, R., & Prasetyo, A. (2019). Understanding Flowcharts along with the Most Commonly Used Flowchart Functions and Symbols. Purbaya Polytechnic Informatics Engineering Study Program.

[14] Paduloh, P., H. Fatahillah, MA Ramadhan, R. Muhendra, M. Widyantoro, and Sumanto. 2022. "Designing of Temperature Control for Agitator Machine Using Internet of Things." IOP Conference Series: Earth and Environmental Science 1063(1). doi: 10.1088/1755-1315/1063/1/012053.

[15] Paduloh, Paduloh, and Rifki Muhendra. 2022. "Overheat Protection for Crane Hoist Motors Using the Internet of Things." International Journal of Computer Applications in Technology 68(4):332–44. doi: 10.1504/ijcat.2022.125181.

[16] Prasetio, Muhamad Odhie, Agung Setiawan, Rakhmat Dedi Gunawan, and Zaenal Abidin. 2020. "Android Based Household Water Tower Control System." Journal of Computer Engineering and Systems 1(2):53–58. doi: 10.33365/jtikom.v1i2.45.