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An Automatic Sliding Doors Using RFID and Arduino
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I. INTRODUCTION Today, people want an everyday life that is completely automated. Along with the increasingly rapid development, it encourages people to innovate by creating a tool that is more effective and efficient [1].

The sliding door is one type of door used in a building as access in and out [2]. This door has a function for home security in a building. People use sliding doors for spaces that are narrow enough to look more comfortable. The problems discussed in this paper are the absence of applications to open and close sliding doors using one RFID card, and the absence of a conventional door security system that can strengthen building security. The existing sliding door application is now applied conventionally and automatically. Conventional sliding doors are done by sliding the door when you want to enter or exit.

The automatic sliding door does not require human power to open or close the door, because it is equipped with an infrared sensor, so the door will open and close immediately. The Smartcard system for opening and locking doors uses Arduino- based RFID technology, which replaces the manual lock [3]. In previous studies, RFID technology was used to control microcontroller-based classrooms. In this study, RFID is only used to open or lock doors, turn on, or turn off devices in a room.

Weaknesses in the study are, the door does not open automatically when the RFID tag

scan process, and to turn on the device must still scan RFID with different access [4]. This study uses a Wifi network connection to open a sliding door with Android technology automatically. But this research has not discussed the system security side [5]. Subsequent studies used RFID and keypads only to open doors [6]. Bluetooth technology to control automatic sliding doors using an Android Smartphone and Arduino Microcontroller [7]. The door security system uses a servo motor as a door lock made with RFID technology based on Arduino Uno R3 Microcontroller [8].

Previous research that has been done by the study still does not exist that uses a 12 volt DC motor on RFID technology to open and close the sliding door automatically on one door. Radio Frequency Identification (RFID) is a technology that uses radio frequencies to identify objects [9]. The sensor will recognize the intended object by equipped with a microcontroller controller device in the form of Arduino Hardware and a microcontroller by adding a naming pin to be easily remembered.

Arduino software is open-source software, so it can be downloaded for free. This software is used to create and enter program code into Arduino devices [10]. With the development of today's microcontroller technology, security systems can use electronic devices to replace conventional key security systems [11]. The purpose of this paper is to design an automatic sliding door that can detect an RFID card to open and close the door automatically, and use an RFID system to strengthen the security level of a building's access.

The idea in this research is the development of an automatic sluice system in a river flow [12]. A B S T R AC T The door is an important component in a building as security. It is used as access in and out of a room. People in the modern era now want everyday life that is completely automated, so that the work can be done easily without wasting energy and can shorten the time. Along with the rapid development, the need for effectiveness and efficiency is prioritized in various fields.

The purpose of this paper is to design an automatic sliding door that only detects one Radio Frequency Identification (RFID) card to open and close. The use of RFID systems can strengthen the security level of building access. This study uses a data processing method in the form of an ID number generated from a tag. Specifications in the discussion of the results in this study include a motor that uses a 12-volt DC motor, a maximum door weight of 5 kg, can only detect one RFID to open and close the door, and the sliding door used is one door.

The results of system testing are obtained to open a door that is without load, and the door can move 14 cm from the distance of the door hole so that it opens. Doors with a

load of 1-1.5 kg also move 14 cm from the distance of the door opening when open. Doors with a load of 2-3 kg only move 12.5-9.5 cm from the distance of the door so that it opens. When the door gets heavier 3.5-4 kg, the door moves only 7.5-3 cm from the distance the door hole remains closed. Keywords: Automatic Sliding Door; RFID; Arduino; Microcontroller.

The discussion of the results of this study starts by testing the automatic door security control system that has been built based on testing a hardware-based system. The test is carried out to determine the feasibility of working hardware and programs of the automatic sliding door control system. The criteria tested include, First, the performance efficiency test of the automatic sliding door control system.

The results of tests conducted by the system maker show that system performance is quite efficient. This can be known by testing the input and actions of the system being built. When conducting trials eight times, it was found that the distance between the door holes was similar in the first to the third experiment. Second, the security aspect of the card used in this system can only use one card. If using another card, the system continues to run, but the system cannot execute an order because the card is not registered. II. METHOD A. Automatic Sliding Door Block Diagram In Fig.1

is a block diagram of the entire Automatic Sliding Door Implementation System Using Arduino-Based RFID, the input block has a sensor that is an RFID reader. Whereas in the process block, there is a microcontroller that functions as a brain working process tool. On the output block, there is a DC motor as a door mover, LCD 16x2, which serves to display notifications about the condition of the door. Fig.1. Automatic Sliding Door Block Diagram B. Automatic Sliding Door System Architecture The system architecture presented in Fig.2 explains the workflow of the system being built.

The system architecture is used to define components that are more specifically structured so that they can address current and future needs. The system architecture flow explains the process flow consisting of data input, data processing, and data output. Fig 2. Arsitektur Sistem Pintu Geser Otomatis International Journal of Artificial Intelligence & Robotics (IJAIR) E - ISSN : 2686-6269 Vol.2, No.1, 2020, pp.13-21 15 DOI: 10.25139/ijair.v2i1.2706 C. Automatic Sliding Door Algorithm The automatic sliding door algorithm presented in Fig.3 is based on the program design stage as a detailed step that is shown for a system in solving a problem.

This is processed based on a process model and formulated with artificial intelligence. Fig.3. Flowchart Automatic Sliding Door System Algorithm D. Overall Schematic of the Automatic Sliding Door System The overall scheme of the automatic sliding door system and device, starting from the connection between the Arduino pin, sensors, and other devices as described in Fig.4. Fig.4. Block Diagram of the Automatic Sliding Door System E. Design of Sliding Door Mechanical Hardware The design of the mechanical hardware presented in Fig.5 is a form of the tool to be made.

This design consists of several electronic series to make sliding doors that are driven automatically using RFID. This circuit has an RFID component as a sensor and a DC motor as the door mover. Based on Fig. 5, the function of each component is explained in Table I. Arduino IDE is an International Journal of Artificial Intelligence & Robotics (IJAIR) E - ISSN : 2686-6269 Vol.2, No.1, 2020, pp.13-21 16 DOI: 10.25139/ijair.v2i1.2706 editor used to write programs, compile, and upload to Arduino boards [13].

Arduino IDE uses the Avrdude program to convert executable code into a text file in a hexadecimal encoding that is loaded onto the Arduino board by the loader program in the board firmware [14]. Arduino uses the Java programming language. Arduino IDE consists of a program editor and compiler. TABLE I. DESCRIPTION AND FUNCTION OF TOOLS No Nama Bagian Keterangan 1 LCD 16x2 Functioning as a data viewer in the form of text. 2 Outer Thread Functioning as a door mover. 3 Internal thread Functioning as a door mover. 4 DC Motor Serves to move the outer thread. 5 Sliding door Serves as access in and out of the room. 6 12 Volt Power Supply Serves to provide additional power to the DC motor.

7 Motor Driver Serves to provide additional power to the DC motor. 8 Arduino Functioning as a controller of the entire tool. 9 Breadboard Serves as a connector for all devices. 10 Level Logic Converter Serves to change the voltage of 5 Volts to 3.3 Volts. 11 RFID Reader Functioning as a reader ID number. Fig 5. Schematic of the Automatic Sliding Door System (a). Sliding Door (b). RFID Tag dan RFID Reader (c). Arduino Board (d). Motor DC 775 (e). Logic Level Converter International Journal of Artificial Intelligence & Robotics (IJAIR) E - ISSN : 2686-6269 Vol.2, No.1, 2020, pp.13-21 17 DOI: 10.25139/ijair.v2i1.2706 (f). Driver Motor L298N and Breadboard (g). Outer and Internal Threads (h).

LCD (Liquid Crystal Display) 16x2 (i). Lithium Ion 18650 Battery (j). Modul i2C (k). Jumper Cable Fig. 6. Hardware for Automatic Sliding Door Systems The Sliding Door in Fig. 6 (a) is a place where people give boundaries or areas that can provide insider understanding, entry and exit, and here and there [15]. The sliding door is one type of door used in a building. In addition to being a security, the door also shows the

character of a building. The sliding door is a door that opens the lid by sliding the door left or right. For movement, rails and wheels are installed above and below the door.

With a sliding system, this type of door is the right solution to make the room look more spacious. Radio Frequency Identification (RFID) is a wireless system that allows tag information to be read by bringing the magnetic field closer [16]. RFID is a general terminology for non-contact technology that uses radio waves to identify objects automatically. The combination of antenna and microchip is called an RFID transponder or RFID tag and works in conjunction with an RFID reader. The form of RFID tags and RFID readers can be shown in Fig. 6 (b). The Arduino Board in Fig.6 (c) is a type of electronic board that is very popular as a learning material as well as material for various electronics projects and involves programming.

Uno is the best board to start with electronics and coding. Arduino Uno is a microcontroller board based on Atmega328P (datasheet). This board has 14 input pins or digital outputs, 6 of which can be used as PWM outputs, 6 analog inputs, 16 MHz quartz crystals, USB connections, power outlets, ICSP headers, and reset buttons [17]. DC motor (Direct Current) is a machine that functions to convert direct current electrical energy into mechanical energy [18].

Direct current motors are used in special applications that require high torque ignition or constant acceleration for a wide speed range [1]. The DC motor construction section is shown in Fig.6 (d). The main parts of a DC motor are the stator and rotor, where the field coil on the DC motor is called stator (the part that is not rotating) and the anchor coil is called the rotor (the rotating part). The working principle of direct current is reversing the voltage phase of a wave that has a positive value by using a commutator, thus the current is reversed with an anchor coil rotating in a magnetic field.

The simplest form of motor has a coil of one coil that can rotate freely between the poles of a permanent magnet. The Logic Level Converter in Fig.6 (e) is required if working with two or more systems that use different voltage levels. The system works at a voltage level of 3.3V and does not have a voltage tolerance of up to 5V will very likely be damaged. Using the system is very simple. Voltage sources on both sides need to be connected. If for example, the 3.3V side does not have its own power supply, then another source is used with the same voltage of 3.3V [19]. Level shifters in digital electronics also called logic level shifters or voltage levels.

Modern systems use level shifting to bridge the domain between the processor, logic, sensors, and other circuits [14]. Motorcycle driver in Fig. 6 (f) is a special circuit that functions to control or control the speed of a DC motor [20]. This circuit is needed

because in general, a DC motor requires a current of more than 250mA for some ICs (Integrated Circuit) for example, Atmega 16 Arduino Uno cannot provide more than this value. L298N is an example of an IC that can be used as a motor driver. This IC uses the H-Bridge working principle. Each H-Bridge is controlled using TTL voltage levels originating from the microcontroller output [21]. L298N can control 2 (two) DC motors.

The voltage that can be used to control the robot can reach 46 Vdc and the current reaches 2 Amperes for each channel. International Journal of Artificial Intelligence & Robotics (IJAIR) E - ISSN : 2686-6269 Vol.2, No.1, 2020, pp.13-21 18 DOI: 10.25139/ijair.v2i1.2706 One part of the bolt and nut is the thread in Fig.6 (g). A screw is an object that is rotated around a cylinder with a certain tilt angle. Threaded shape can occur if a triangular sheet is rolled up on a cylinder [22]. In use, threads always work in pairs between external threads and internal threads. LCD (Liquid Crystal Display) is one type of electronic display that can be made using CMOS logic technology. The physical form of the 16x2 LCD can be seen in Fig.6 (h).

LCD as an electronically modulated optical device that can be made of many segments filled by liquid crystals arranged in front of a light source or a light reflector to produce a colored or black-and-white Fig. 22. LCD functions as a data viewer in the form of characters, letters, numbers, and graphics [24]. LCD module with 16x2 lines displays with low power consumption. This module is equipped with a microcontroller specifically designed to control the LCD. Breadboard or often referred to as the project board (circuit board) in Fig.6 (f) is a type of circuit board that is generally used to try electronic circuits [25].

Most of the electronic components in electronic circuits can be connected by inserting cables or terminals into holes and then making connections through cables if needed [26]. The types of the breadboard are determined based on the many holes found on the board, for example, breadboard 400 holes, 170 holes, and so forth. Assembling is easy because there is no need to solder so the components can still be used for other projects in the future. The power supply is a device that is useful as a source of electricity for other devices [26].

This power supply has a similar circuit construction consisting of a transformer, rectifier, and voltage refiner [27]. The power supply becomes an important part in electronics that functions as a source of electric power, for example on batteries or batteries which can be seen in Fig 6 (i). One type of battery that is widely used today is the 18650 Lithium-Ion Battery. This is a type of battery that can be recharged (rechargeable) [28]. The working voltage of the 18650 battery is 3.7 Volts. The maximum can be a 4.2 Voltage and an empty battery at 3.0 Volts.

Being the ability to store electric current varies depending on production. Inter-Integrated Circuit (i2C) in Fig.6 (j) is a two-way serial communication standard using two channels specifically designed for sending and receiving data [29]. The i2C system consists of SCL (Serial Clock) and SDA (Serial Data) channels that carry data information between i2C and its controller. Devices connected to the i2C Bus system can be operated as Master and Slave. The jumper cable in Fig.6 (k) is a cable used as a link between components used in making prototype devices without the need for solder. According to their needs, jumper cables can be used in various versions.

Like, the Male to Male, Male to Female, and Female to Female versions [30]. The characteristics of this jumper cable have a length of between 10 to 20 cm. In designing an electronic circuit design, the jumper cable is needed to connect the components. III. RESULT AND DISCUSSION Black box testing is a trial based on the correctness of input (output) criteria, output (output), and also the action of the automatic door security control system and also includes data validation and input error handling. The trial in Fig.7 is a standby system (wherein the experiments to be carried out that the sliding door is in a closed condition and also has not received any input or input from an automatic door control system using RFID tags. Fig 7.

Sliding Door System and Simulation in Standby Test in Fig.8 to give an open door command. The scanned ID number will then be detected by the RFID reader. When the ID number is sent correctly, the LCD will display the notification in the form of "Open Door" and followed by an active DC motor moving the screw to open the door. International Journal of Artificial Intelligence & Robotics (IJAIR) E - ISSN : 2686-6269 Vol.2, No.1, 2020, pp.13-21 19 DOI: 10.25139/ijair.v2i1.2706 Fig.8. System Runs Orders to Open Doors The test in Fig.9 is done by sending an order to close the door.

Previously, the door was open. To close the door, by scanning again the ID number card will then be detected by the RFID reader. If the ID number is correct, then the system will send to the LCD screen a "Closed Door" notification. Then, the DC motor actively drives the screw to close the door. Fig.9. System Runs Orders to Close the Door The system test on the door command cannot be opened or closed can be seen in Fig.10. When the ID number that has been scanned is wrong the system will send to the LCD screen a notification "Incorrect ID" so that the DC motor will not be active and will not be able to move the screw to open and close the door. Fig.10.

The system does not recognize the ID The discussion in this paper uses the ID number "4BEC450B" which has been inputted in the system, which ID number can be used to open and close the door. The results of the RFID tag trial are presented in Table II.

TABLE II. TRIAL RFID TAG TEST No. RFID Tag Detected Value Detection Speed Result RFID R e ade r Front (Second) RFID R e ade r Back (Second) 1 Tag1 9620E9FB 00:06.1 00:01.4 Tag incorrect 2 Tag2 4BEC450B 00:10.9 00:00.9 Tag correct 3 Tag3 76F439F9 00:06.8 00:01.5 Tag incorrect 4 Tag4 EBC3EC0A 00:08.3 00:01.4 Tag incorrect

The results of trials by giving a load can be seen in Table III.

Motor and thread are the system components needed by this system to move the door so that it can open and close, with the help of the motor driver and screw to move the door so that it can open and close. TABLE III. TRIAL TEST RESULTS BY PROVIDING THE LOAD No Load Door Distance to the door opening 1 No Load Opened 14 cm 2 1 kg Opened 14 cm 3 1,5 kg Opened 14 cm 4 2 kg Opened 12,5 cm 5 2,5 kg Opened 10 cm 6 3 kg Opened 9,5 cm 7 3,5 kg Closed 7,5 cm 8 4 kg Closed 3 cm IV.

CONCLUSION Implementation of an automatic sliding door using Arduino-based RFID makes it easy for users to open and close the door without using user power, without using conventional door locks, and the door can be tightly closed and cannot be shifted manually. The heavier the load is on the door, the smaller the sliding power. With the use of this system, the security of the house is more awake. Based on the results of the study, the researchers recommend the implementation of automatic sliding doors to use Arduino-based RFID, by adding an alarm when the ID received by the sensor does not match, adding a fire sensor that is used to open the door automatically when there is a fire and can lift greater loads need to be made using a gearbox. The development of Arduino Mega 2560 can be used for embedded system learning [31]. REFERENCES [1] Zulfauzi. 2016.

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