Prototype Storage Locker Security System based on Fingerprint and RFID Technology

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Abstract: Locker Security System for storing goods is essential in public facilities such as at the bus station, airport, mall or library. Today's commercially available security locker systems require complex system configurations that involve high costs. For that, a more accessible and cheaper alternative is needed. In this study, a locker security system was created using Arduino-based fingerprint biometrics. The purpose of this study is to improve the security of lockers in goods storage services and can reduce theft by using fingerprint sensors and RFID sensors. The research methods in this study include library research, system design, hardware design, and software design. Based on the results testing both on the hardware and on the software that has been made and looking at the objectives of the research, it can be summarized as follows: this equipment can be used as a storage locker for items that have good security.

1 INTRODUCTION

Storage locker is an essential facility in public places such as stations, shopping centres, libraries, and in recreational areas, etc. As we know, the quality of service from luggage storage dramatically affects the level of satisfaction of consumers (Erziana et al., 2018; Arta, 2017). Many things can become service quality standards for goods storage such as in terms of the safety of goods that we will leave, the accuracy of returning goods so that there are no swapped goods, damage to goods and speed in service so as not to make customers wait or queue (Moskowitz et al., 2002).

Several lockers in public area still using process manually. The process is by the sign with paper or a key that has a number that matches with a locker on the items we leave. In this case, the consumer can be harmed if the number he has is taken by someone else. Then the officer is also difficult to remember the owner of the good who left the locker. The officer on duty is only focused on matching the number given by the consumer with the number listed in the locker where the thing is stored (Gangi and Gollapudi, 2013).

With the rapid development of technology, almost all work done by humans is facilitated with the support of electronic devices. In the case of storage of items such as cabinets, drawers, and lockers, many currently use electronic devices as a support level of security. The method is carried out, starting from using passwords, RFID and biometric authentication. Biometric functions are to recognize physical features such as voice recognition, eye retinal scans, facial scans, and fingerprint scans. In order to communicate several security systems with a variety of tools, a microcontroller is needed since easily understood and used by humans. One microcontroller that is widely used today is Arduino (Siswanto et al., 2017; ARZAF and V., 2016). From the background above, it was deemed necessary to build a luggage storage locker with a fingerprint biometric security system (Patel et al., 2016).

2 RELATED RESEARCH

Research related to this area is, (Budiharjo and Milah, 2014) proposed a room door security system with RFID and password using Arduino Uno. The system is made using RFID sensors and finger passwords as input and is processed by the microcontroller to open solenoids. Then Siswanto et al. (2017) created a home door lock security system using fingerprint technology and an Arduino microcontroller.

(Khoirunnufus and Sutanto, 2013) designed a secure security system based on the Atmega8535 microcontroller. The hardware in the system

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consists of a minimum system circuit ATMega8535 microcontroller as a system controller, dc motor driver circuit which functions to control dc motors to drive locks on the safe door, a relay driver circuit that serves to turn on the siren, as well as a power supply circuit that functions as voltage source.

Then the research of DWI UTOMO ARZAF (2016), he proposed a security system for goods storage using microcontroller based RFID and passwords. This safety deposit box security system was built with RFID and password sensors based on the Arduino ATMega 2560 microcontroller that uses LCD as an information medium. To open the item storage box, the user must enter a password and detection of the card, after the password and card are detected correctly it will be processed on the Arduino ATmega 2560 microcontroller. Solenoid is used as an opening and security door closure for the storage box.

3 RESEARCH METHOD

The methodology used in this study is experimental which is divided into five steps (Hossain et al., 2016):

- Analysis Phase

  Analysis of the security system of the place-to-keep lockers that are currently still using manual methods. First, the user goes to the clerk to register. after that the consumer will make a payment for the rental fee for the item storage locker then the officer will provide information on the locker that the consumer will use along with the locker key.

  The solution to dealing with these problems is the need for a system that can improve the security system of luggage storage lockers. Where the process of the user is paid to the cashier to determine the number of lockers that will be used. Then the user will scan the fingerprint which is used as a medium to detect data from the user. The user data will be stored in the Arduino controller for the authentication process if the locker has been used.

- Design system

  In this automatic locker design, the main components consist of Arduino Uno as the system controller centre, fingerprint sensor and RFID sensor as input and solenoid as output. Before designing hardware and software, a functional block design system is needed in the form of block diagrams that explain the work system as in figure 1.

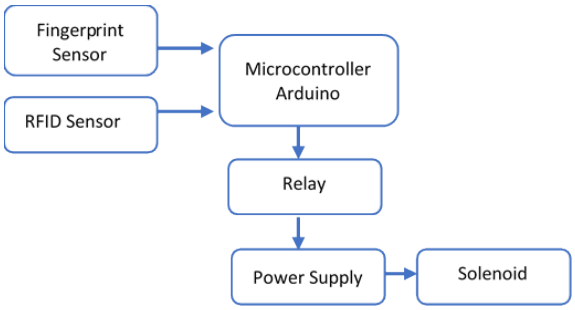

Figure 1: Hardware scheme locker security system.

In designing the scheme, the device explains the installation relationship of the device between the fingerprint sensor, RFID sensor, relay and solenoid with the microcontroller so that it can be connected to each other and become a complete system.

After designing a hardware scheme, the next step is to determine the program logic that will be applied to the system to be used. Then make coding that will be implemented on the system. The flowchart of the system work process flow as shown in Figure 2.

4 RESULT AND DISCUSSION

Based on the analysis and design that has been done, the design of goods storage lockers using this fingerprint sensor has been realized, it is necessary to do various tests to find out how the device works, as well as testing based on different fingerprint and RFID conditions, weaknesses and limitations of function specifications. system that has been created.

4.1 Fingerprint Enrolment

This test is done to find out whether this fingerprint sensor can work properly, first the test is done with the author's fingerprint which is using the thumb finger on the left hand, before the testing is done by the author's left hand thumbprint has been registered on the sensor fingerprint

The testing step is to attach the left thumb to the fingerprint sensor area, after the sensor has successfully read and identified the corresponding fingerprint data, the solenoid that was in a defective position or closed will be active so that the door can be opened.

The next step is testing the response of the fingerprint sensor. After testing it can be concluded that it takes as long as 5 seconds for the system to work properly and recognize the fingerprint of the left hand thumb until the door opens.

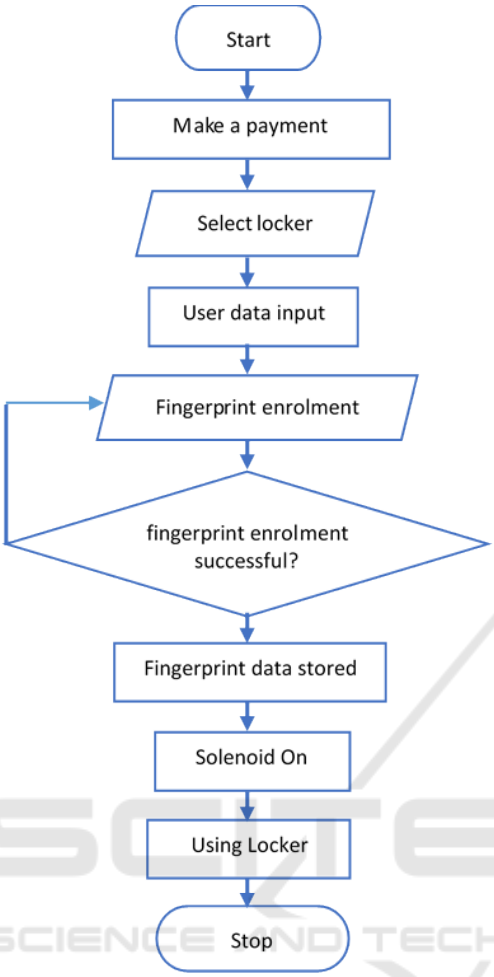

Figure 2: Flow chart locker security system

Figure 3: Embedding Process

4.2 Sensor RFID Testing

This test is conducted to find out whether RFID sensors can work properly, first the author tries to do a test using a card whose ID has been stored on the

Table 1: Result Hand Position

Hand Position	Finger part	Result
Left Hand	Thumb	Success
	Index finger	Unsuccess
	Middle finger	Unsuccess
	Ring finger	Unsuccess
	Little finger	Unsuccess
Right Hand	Thumb	Unsuccess
	Index finger	Unsuccess
	Middle finger	Unsuccess
	Ring finger	Unsuccess
	Little finger	Unsuccess

Table 2: Finger Position

Fingerprint Position	Enrolment time (seconds)	Result
Thumb left hand	1	Unsuccess
	2	Unsuccess
	3	Unsuccess
	4	Unsuccess
	5	Success

Arduino microcontroller.

Figure 4: Testing RFID

The testing step is to attach the RFID card whose data has been registered in the system so what happens is that the RFID sensor successfully reads and identifies the appropriate data, the solenoid that was in a defective position or closed will be active so that the door can be opened.

Table 3: Table Result tes RFID

RFID	Test scenario	Result
RFID card enrolment in system	attach the card that has been registered to the RFID sensor	The system responds and the locker door is successfully opened
Other card	Attach another card that has not been registered to the RFID sensor	The system refuses and the locker door cannot be opened

In the next stage, the distance sensor can be read to the ID card so that the locker can be opened. After

testing is done it can be concluded that at a distance of 1.5cm, the sensor can read the RFID card.

Table 4: Result

RFID	Distance (cm)	Result
RFID Card	4	Unscuccess
	3	Unsuccess
	2	Success
	1	Success
	0,5	Success

5 CONCLUSION

Based on the analysis and discussion of the locker security system using Arduino-based fingerprint biometrics, it can be concluded that Arduino Uno can be used as the main control in assembling several components into an intact system so that the security system of this locker can increase consumers' sense of security and comfort. when you want to deposit goods and also can reduce the occurrence of criminal acts that can harm the consumer.

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