Internet of Things-Based Safe Security System

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Abstract— **The purpose of this research is to create an Internet of Things-based safe security system so that it can help safe deposit owners to store money or personal belongings safely. The results of the research show that the system can function properly and is by the objectives planned by the researchers. The safe can be opened using fingerprint verification and a special color card that only the owner of the safe knows about. Safes can also be opened using Telegram BOT by sending a message in the form of a PIN that has been set in the program. So it can be concluded that the security system works well and is safe for storing money or goods.**

Index Terms— **Security System, Safe, Telegram, Internet Of Things.**

I. INTRODUCTION

The development of digital technology is very influential on human life which is expected to take advantage of the technology that has been created to maintain the security of assets, whether in the form of money or jewelry. Agencies such as banks and offices certainly have important documents, money, or valuables that no one else can know or use except the owner. Therefore, a very good system is needed to prevent theft or misuse [1].

To overcome the problem of theft created a tool called a safe. A safe is a tool used to store valuables including money, jewelry, or valuable assets and documents. The safe is a storage place that is considered practical but has a high risk, because it allows the safe to be easily broken into without the knowledge of the owner. Given this, we need a sophisticated security in accordance with technological developments [2].

Cases of crime, especially theft of both property and documents in Indonesia are increasing every year. Based on the records at the Central Bureau of Statistics in 2019, it was recorded that the number of incidents of crimes against rights/property such as documents in 2018 reached 90,757 [3].

Given the number of cases of theft of valuables that are increasing. In general, the existing safes or safes do not have a good security system and use combination numbers that seem impractical because it takes a long time to find the right number. Based on these problems, an integrated valuable storage technology is needed [4].

Because of these various problems, it is necessary to have a security system that can provide information that is happening in the house to be able to solve problems that occur in the house. And this information must also be accessible anywhere by utilizing the Internet of Things (IoT). Because of these various problems, it is necessary to have a security system that can provide information that is happening in the house to be able to solve problems that occur in the house. And this information must also be accessible anywhere by utilizing the Internet of Things [5].

Thus, researchers will realize a safe security system with 2 locking systems. The first lock can be unlocked by verifying the fingerprint pattern on the fingerprint sensor which has a fairly high level of security because everyone's fingerprints are different. The second lock can be unlocked using a specific color card attached to the TCS230 color sensor. This safe security system is also equipped with a limit switch attached to the bottom of the safe, so that if someone wants to steal the safe, a buzzer will sound and the system will send a notification via telegram that the safe is not safe.

II. METHOD

On the input device, there are two main sensors used, namely the fingerprint sensor and the TCS230 color sensor. The fingerprint sensor is used to verify the fingerprint pattern which functions to open the first lock of the safe then the system will send a notification via Telegram that the first lock of the safe has been opened. The TCS230 color sensor is used to detect certain colors, if the detected color matches the existing data, then the second lock will be opened and then the system will send a notification via Telegram that the safe has been opened. This system is also equipped with a limit switch attached to the bottom of the safe, so that if someone wants to steal the safe, a buzzer will sound and the system will send a notification via telegram that the safe is not safe.

Furthermore, the output devices used are LCD 16x2, Solenoid door lock, and Buzzer. The 16x2 LCD functions as an interface to the safe. Solenoid door lock functions as an electric safe lock. As well as a buzzer that functions as a warning alarm if the safe is in a dangerous condition.

III. RESULT AND DISCUSSION

The physical form of an Internet of Things-based safe security system that has been successfully designed, realized, and tested is shown in Figure 2.

Figure 1. Physical Form of IoT Base Safe Security System

Meanwhile, the chat display on BOT Telegram as a media for information on the owner of the safe can be seen in Figure 3.

Fig. 2. Telegram Bot Chat Display

A. Voltage Test Result

Testing the voltage regulator circuit serves to determine whether the input voltage and output voltage of the regulator are appropriate or not as needed. The results of testing the voltage on the regulator circuit can be seen in Table 1 and Table 2.

TABLE I. Voltage Test on Regulator Circuit Result

Test	Measured Voltage	Display
Vin	11,95 V	
Vout	5,06 V	

TABLE II. Battery Voltage Result

Full Voltage	Low Voltage	Duration
12,3 V	10,3 V	4 Hour

B. Fingerprint Sensor Test Result

The first input and output test using the Fingerprint Sensor as input then Buzzer and Solenoid Door Lock 1 as output. The fingerprint pattern that has been registered is the finger thumb, index finger and middle finger. Results testing is shown in Table 3.

TABLE III. Fingerprint Sensor Test Result

No.	Fingerprint	Detecting Duration	Buzzer	Solenoid
1	Thumb	1,40 s	OFF	ON
2	Index	1,42 s	OFF	ON
3	Middle	1,30 s	OFF	ON
4	Ring (not registered)	1,40 s	ON	OFF
5	Pinkie (not registered)	1,41 s	ON	OFF

C. TCS230 Color Sensor Test Result

Then the test uses the TCS230 color sensor as input then the LCD and Solenoid Door Lock 2 as output. The registered color is white. The results of the test table are shown in Table 4.

TABLE IV. TCS230 Color Sensor Test Result

No.	Color	Solenoid	LCD Display
1	White (color card)	ON	
2	White (origami)	OFF	
3	Blue (origami)	OFF	
4	Black (origami)	OFF	

D. Buzzer and Limit Switch Test Result

Next is testing using a limit switch as input and Buzzer as output, the results of the test table are shown in Table 5.

TABLE V. Limit Switch Test Result

Position	Limit Condition	Buzzer
Lifted	Normally Open	ON
Not Lifted	Normally Close	OFF

E. Telegram Test Result

Next is testing the telegram application that has been installed on a smartphone as input then Solenoid Door Lock as output, the test table is shown in Table 6.

TABLE VI. Telegram Application Test Result

No	Chat Variable	Message Duration	Solenoid
1	/Start	15 s	OFF
2	1234	27 s	ON
3	/tutup	30 s	OFF

IV. CONCLUSION

In research on safe security systems for storing money and goods based on the Internet of Things, it can be concluded that this system is in accordance with the research objectives carried out by researchers, so the conclusions obtained are:

A safe security system for storing money and goods based on the Internet of Things has been successfully developed using ESP32 as a microcontroller, a fingerprint sensor and a color sensor as input to open the safe door, a solenoid door lock as a safe lock. The development of this security system is verification of the fingerprint pattern that has been registered in the program, if the fingerprint pattern that is read does not match then the buzzer will light up and the safe owner will receive a warning notification. Then verify the special color that has been registered in the program to open the safe, so to duplicate the two keys is very likely small. As well as the use of the telegram application as a medium the owner of the safe to find out the condition of the safe if opened or stolen. Limit switches are also used for detects if the safe is lifted, then the buzzer will light up as well as the owner of the safe will get a notification warning. This safe also uses a power supply backup that can last for 4 hours for anticipate in the event of a power outage.

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