Automatic Safety Electronic Saving Box

Khairul Fikri, Umi Fadlillah
Teknik Elektro
Universitas Muhammadiyah Surakarta
Surakarta, Indonesia
Email: Khairulfikri017@gmail.com   uf138@ums.ac.id

Abstraksi— **Pada era modern saat ini tidak sedikit orang menyimpan barang barang berharganya dalam rumah, seperti harta (perhiasan dan uang) maupun file-file penting. Maka dari itu brankas merupakan pilihan yang tepat dan efektif untuk menyimpan dan melindungi barang barang penting jika suatu saat nanti terjadi perampokan atau pun kebakaran. Tugas akhir ini merancang sebuah brankas dengan menggunakan sistem yang berbeda pada umumnya. Perancangan sistem ini terdiri dari beberapa bagian seperti Wemos D1 R1 (ESP8266), telegram, sensor suhu (DS18B20),** *keypad*, *power supply*, **android,** *buzzer* **dan LCD. Di dalam perancangan ini, pengguna dapat mengakses (buka) brankas dengan mudah, seperti mema-sukkan kode ke dalam** *keypad*, **dan pengguna juga dapat mengontrol brankas melalui smartphone berbasis android dengan metode** *Internet of Thing*. **Kemudian apabila terjadi perampokan brankas, sistem akan mengirimkan sebuah pesan kepada pengguna. Sedangkan apabila terjadi ke-bakaran, sensor suhu akan mendeteksi dan juga akan mengirimkan pesan kepada pengguna. Perancangan ini diharapkan agar pengguna dapat memenuhi kebutuhan akan brankas yang lebih aman.**

Kata Kunci— **Keypad, Sensor DS18B20, Telegram, We-mos D1 R1 (ESP8266).**

Abstracts— **In this modern era, many people save valuable items in their houses, such as assets (jewelry and money) and essential files. Therefore, saving box is the right and practical choice for protecting valuable goods if robbery or fire occurs someday. This final project is designing a saving box using a different system than the general. The design of this system consists of several parts such as Wemos, D1 R1 (ESP8266), telegram, temperature sensor (DS18B20), keypad, power supply, android, buzzer, and LCD. In this design, users can access (open) the saving box easily. The first step is entering the code into the keypad and then controlling the saving box through an Android-based smartphone with the internet of things method. Therefore by this method, users can enter the code in any range both far or near. Then if a safe box gets robbery, the system will send a message to the user. Meanwhile, if a fire occurs, the temperature sensor will detect it and also send a message to the user. This design is expected to fulfill the user's need for a safer saving box.**

Keywords— **Keypad, Sensor DS18B20, Telegram, We-mos D1 R1 (ESP8266)**

I. INTRODUCTION

In the modern era, technology has developed very rapidly, so that we can find many new technologies in our life, such as smartphones, home appliances, and other sophisticated tools. With the rapid development of technology in the current era, the author takes advantage of our daily needs, especially as a home appliance, such as saving box. The function of saving box is to save money, jewelry, documents, or other essential files that are kept at home or offices. Nowadays there are many crimes in Indonesian, especially in big cities, from some burglary, theft of valuables, robberies in minimarkets and many more.

The high number of crime cause many people worries about it and make restlessness in society. They become victims because of many robberies and burglaries to community assets of upper classes as well as lower classes people. The items that are often targeted by criminals are money, jewelry, and other valuables. To overcome people's concern about frequent crime and anticipate it not to occur again is by storing valuables in a safer place. As happened a few years ago, there was a burglary in Sleman, Yogyakarta. The perpetrator broke a saving box using artisan equipment by damaging the padlock of saving box. Therefore, in this study, the author wants to make a more modern saving box by following technological developments that exist in the contemporary era. By adding more security and practical use, it can be easily accessed and controlled even from a distance. (Tribunnews.com, 2018). Many researchers have studied research on automatic doors. One of them is Farezi [2] entitled "Prototype Keamanan Brankas Berbasis Arduino dan Android." This study has similarities with the author that explains about automatic door security using Arduino and Bluetooth HC-05, but in this paper, the author using Wemos and Android application that is Telegram.

The other is Arifin Retha Dinar Hayu and Riyanarto Sarno [1], entitled "Door automation system based on speech command and PIN using Android smartphone." This study explains the automatic door security using a door unlocks system through speech or pin using a smartphone. Therefore, to control the system is not only through open buttons from smart-phone applications but also through interfaces for commands or fasteners that can also be used as security.

Other research related to electronic door security is Pakpa-han, Dodi Wicaksono, and Aji Guatama [4], "The Prototype of Automated Doors and Windows by Using Voice Commands." This research is also about automatic doors, but there are several other devices, such as doors, windows, etc. This study discusses the technology that can facilitate our daily lives,

such as some devices at home using an automated system. For example: controlling doors and windows automatically using a smartphone prototype through voice command. Besides, there is also an International Journal of IEEE by Lita Adrian Ioan, Daniel Alexandru Visan, and Alin Gheorghita Mazare [3], entitled "Door Automation System for Smart Home Implementation." This study related to automatic doors, different from the others. This can be seen from those who use the pneumatic control system that enables to speed up work methods and excellent reliability. The application developed is PIC 16F877A, operated using pneumatic offices, controlled through air distributors with solenoid valves based on the multiple working cylinders.

There is also research on the security door Rani Jasmin Paul, Jason Bakhtakumar, Praven Kumaar, and Santosh Kumaar [5], entitled "Voice Controlled Home Automation System Using Natural Language Processing (Nlp) and Internet of Things (IoT)." This study examines the sound-based automatic home system using IoT, Artificial Intelligence, and Nlp, which aims to provide a secure and efficient way to cooperate with home appliances. Another form of technology that can be applied with IoT is individual recognition using the palmprint feature. Some of the following studies have discussed further introduction of the palmprint recognition [6]–[11]. This research uses four necessary home appliances such as fans, lights, coffee machines, and door alarms, which are interpreted by mobile devices through voice commands using Natural Language processing.

II. METHODS

This project creates a saving box security device which is needed in current life to save a lot of essential and valuable items. At this time, many safekeeping still uses padlock systems and rotary code locks. Therefore, the author designed an automatically saving box security device by utilizing current technology that is overgrowing utilizing the internet of things (IoT).

A. System Design

System Design of the safe box in Figure 1, using Wemos D1 R1 as a microcontroller, Dallas sensor, 20 x 4 LCD, Android, Telegram, buzzer, and circuit power supply. The way it works from this system is that the keypad will be in control by Wemos D1 R1 (ESP8266) as a microcontroller, which is Arduino Uno based wireless. Therefore, the output of using the Arduino program is an alarm, LCD 20 x 4, and solenoid door lock. In this way, the work is divided into two ways: by directly using a keypad and controlling from the internet based on Android through the Telegram application. In addition to this design, there is also a temperature sensor. The purpose of this sensor is to detect the room temperature where the user keeps the saving box, so if any fire occurs, saving box will send a message to the owner through the Telegram application, and the fire can be handled.

The diagram design of Figure 2, as known as the initial password in this safe, is '1234' so we can access the safe box using the password '1234'. Then by setting the password user can change it and the new password will be saved automatically. Once the password is changed, then the saving box will open
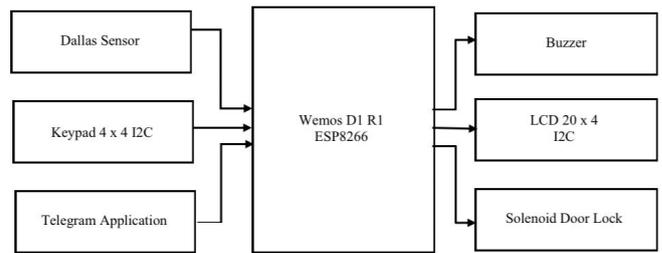
Figure 1. Figure 1. Block Diagram

after the user enters the new password, then if the password is entered correctly, LCD will display "pass accepted," and the door will open. Meanwhile, when the password is incorrectly entered, LCD will display "the wrong password." And if the entered password is wrong three times, then the alarm automatically beeps and sends a message to the user via Telegram.
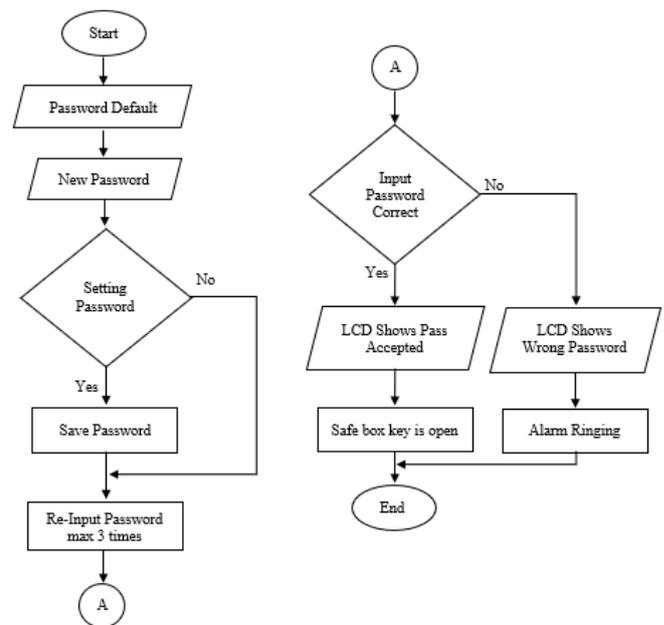
Figure 2. Flowchart

B. Hardware Design

Hardware Design of Figures 3 and 4, the saving box adapts all electronic components used. It has a length of 44.6 cm, width 31.9 cm and heights 21.7 cm. This design is made to save goods precisely according to their sizes, such as documents and money. The components used are LCD, Wemos D1 R1 (ESP8266), power supply, switch, sensor DS18B20, solenoid door lock, and keypad. Furthermore, Corel Draw Software is used in designing this saving box design. Description:

1) Handle The safe box door.
2) LCD 20×4 I2C
3) Keypad 4×4 I2C
4) Safety Hook with the floor.
5) Reset button.
6) Switch ON/OFF

7) For Connector between Wemos with the Cable
8) Adapter Power Supply
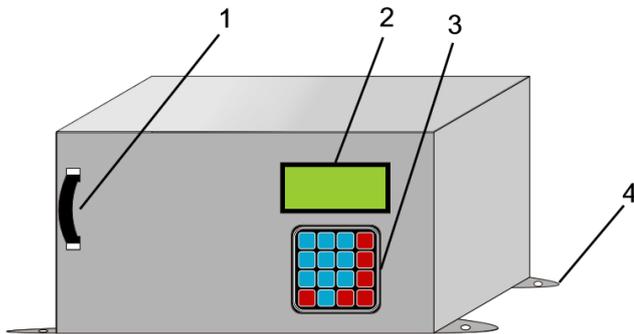
Figure 3. Saving Box Design (front view)
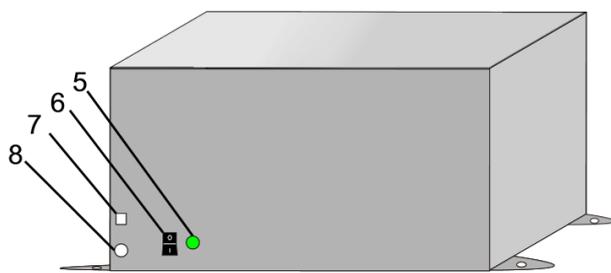
Figure 4. Saving Box Design (rear view)

C. Electronic Circuit

Based on Figure 5, the electronic schematic above is made by using fritzing software. This schematic is used to determine the location of each electronic component. As can be seen in figure 5, there is a 4×4 I2C Keypad that functions as a password input. Then 20×4 I2C LCD used to display output, such as a password number. If the wrong input number then sound buzzer as an alarm. The other sensor is the Dallas sensors to detect room temperature around the safe box. The solenoid door lock

as a key to the safe. The relay as a voltage converter from AC to DC to move the solenoid door lock. Wemos D1 R1 as a microcontroller to control all electronic circuits in the saving box.
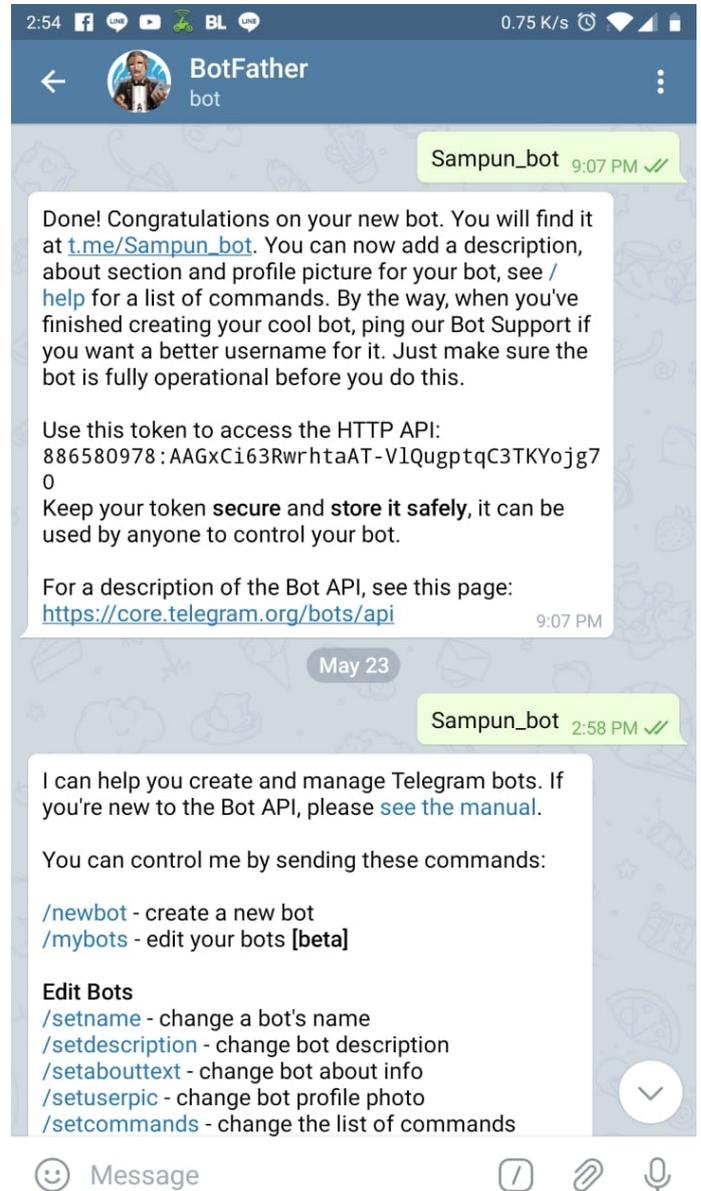
Figure 6. The TelegramBot Creation

D. Software Application Design

In the first step in the process of making TelegramBot in Figure 6, TelegramBot is registered to the BotFather to obtain the token code that will be used in the program via Wemos D1 R1. This TelegramBot making The DS18B20 sensor can be displayed via smartphone. By using Telegram users can open an IOT-based saving box and also get a "Bahaya Kebakaran" message when the room temperature around the saving box increases. Users can also get a "Bahaya Ada Maling" message when the wrong password entered for three times via keypad. The use of the TelegramBot application attempts to deliver the message automatically as a warning.

Figure 5. Schematic Circuit

III. RESULT AND DISCUSSION

A. Saving Box Design

Figures 7 and 8 is the display of electronic saving box made by steel. Number 1 is the LCD 20×4 I2C to display temperature, condition, and password. Number 2 is the keypad 4×4 I2C to input the password, while the number 3 is Switch ON/OFF power supply, and the number 4 is a reset button system Wemos D1 R1.

Figure 7. Saving box (front view)

Figure 8. Saving box (rear view)

B. Input Password Keypad

Figure 9 shows an initial state of the LCD and keypad in the saving box, the initial display of the LCD is "Electronic Safe Box" as the name of this project. The second row is the room temperature and followed by "Temperatur Normal" to give Information that the temperature around is safe. In the last row, there is "Password =====è," which has a function to show the entering password using keypad. Then, on the keypad section, there are numbers from 0 to 9, letters A, B, C, and D, and also the # and keys. The # button serves to change the old password to the new password.

Figure 10 and 11 shows saving box in a blocked state; this happens because the password entered incorrectly three times. After 3 minutes, the saving box will be locked, the alarm beeps, and the system will send a message to the user via Telegram.

C. Testing Telegram

Figure 12 is the result of the testing using telegram. The figure above shows "/260996," which is the code to open the

Figure 9. Initial state of the LCD
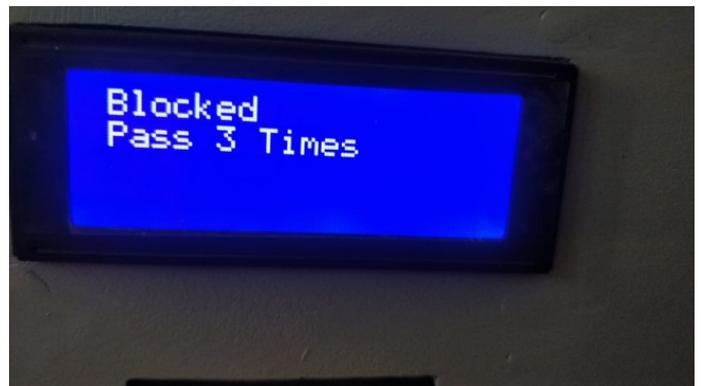
Figure 10. State of the blocked system
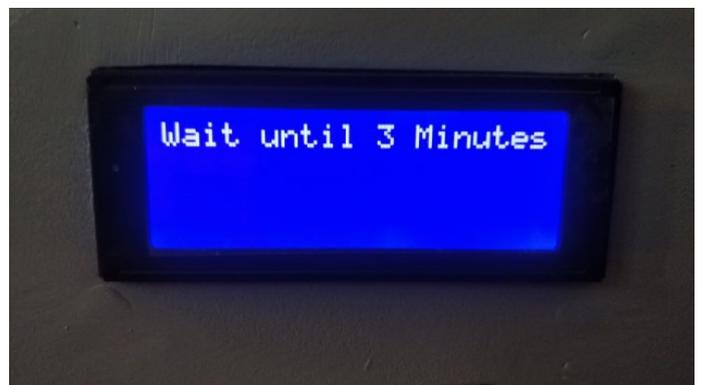
Figure 11. State of the blocked system

safe box using a telegram application. When the door has begun, the TelegramBot will reply to the message automatically to provide information that the key is open before it is closed again in 5 seconds. Then in the figure also displayed the temperature accompanied by the sentence "Bahaya Kebakaran," and there is also the message "Bahaya Ada Maling," which means there is someone who has entered the wrong password to the saving box three times. The users are even able to monitor the condition of the temperature and state of the saving box by entering the "/ status" command so the bot of telegram will provide the information of temperature and saving box state.
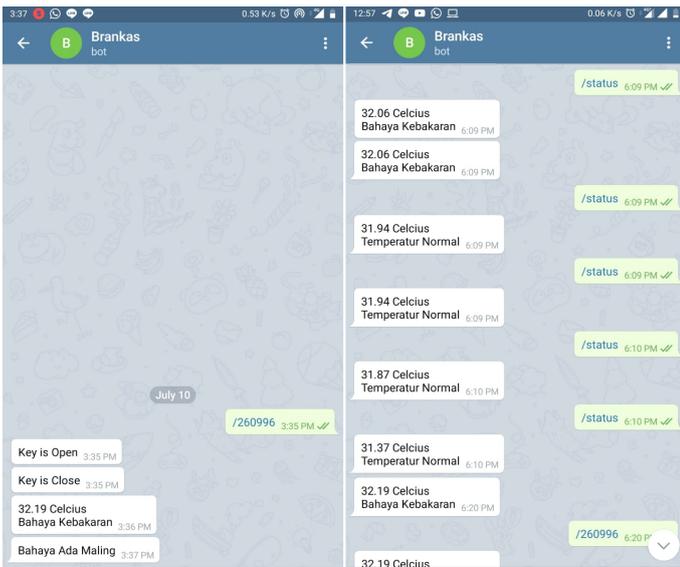
Figure 12. Telegram result

D. *The Result of Testing the Tools*

Time response testing opens the safe box key through a telegram application using four different providers. Shown in Table I, this indicates that the response to the safe box has a different time between one provider and another. As shown in the table, Telkomsel provider has a faster response time than the other providers, and 3 (Tri) provider has the latest response among all. From this testing table, the authors know the accuracy of opening a safe box via wireless is 100% because all of the passes accepted.

TABLE I. Time response of opening Electronic Safe Box

No	Provider	Response	Description
1.	Indosat	1.87	Pass Accepted
2.	Telkomsel	1.77	Pass Accepted
3.	XL Axiata	1.85	Pass Accepted
4.	3 (Tri)	2.31	Pass Accepted

Testing time response warning message is shown in Table II when users enter a password via a keypad, and it is an error for three times, the safe will be blocked for 3 minutes, and alarm automatically beeps. The system will send a warning message "Bahaya Ada Maling" to the user through a telegram. From Table II, it is indicating that each provider has a different time response: Telkomsel provider has the fastest response time compared to other providers, and 3 (Tri) provider has the latest response time between 4 providers.

TABLE II. Time response warning message

No	Provider	Time (s)	Description
1.	Indosat	2.30	Blocked
2.	Telkomsel	1.60	Blocked
3.	XL Axiata	2.20	Blocked
4.	3 (Tri)	3.15	Blocked

Testing in Table III, showing the condition when the saving box is above the average temperature of 32° C. based on this table, the experiment was conducted using four different providers to obtain the response time of the warning message "Bahaya Kebakaran" to the user. As a result, Telkomsel provider has the fastest time in sending messages.

TABLE III. Fire dangers time response of warning message

No	Provider	Fire response Time (s)	Description
1.	Indosat	29.06	Fire dangers
2.	Telkomsel	9.77	Fire dangers
3.	XL Axiata	11.07	Fire dangers
4.	3 (Tri)	12.16	Fire dangers

In Table IV, it performs three different testing times, environmental temperature changes according to the temperature sensor in the electronic saving box. At noon, the ambient temperature is higher than the temperature in the morning and evening. Time response warning message

TABLE IV. Temperature monitoring

No	Testing	Temperature changing (C)
1.	Morning	27.37 – 28.81
2.	Evening	29.44 – 31.98
3.	Night	27.57 – 29.62

IV. CONCLUSION AND SUGGESTION

This electronic saving based on Wemos D1 R1 and Android, which uses a security system that can send messages via telegram to the owner. This security system uses two methods to open the saving box: via the keypad and the telegram application. With the keypad method, users can change the default password to the new one. When someone inputs the wrong password three times, the system will be blocked. The alarm will ring for 3 minutes, and messages will be sent to users via telegram application. Using IoT method, users can control the saving box with or without obstacle, from any distance. In this saving system, there is a room temperature measurement around the saving box, so that users can monitor the room temperature through LCD, if the room temperature exceeds the average temperature, the buzzer will sound. It will send a message "Bahaya Kebakaran" to users via telegram. This saving box using iron design, which is safer because it has a robust construction. The author has done three experiments to collect the data, from the results of these experiments, it can be concluded that Telkomsel providers have faster responses than other providers.

It uses additional i2c components to make it easier to connect components with wemos When you want to open a saving by using a telegram application, make sure that the internet network is good. If it doesn't, then the response in opening the saving will need more time. Preferably in the process of unlocking the saving box door, press the symbol button on the keypad after entering the password. Also, it would be better to press the symbol on the keypad to close the saving box safely.

REFERENCES

[1] Arifin, Retha Dinar Rahayu., & Riyanarto Sarno. (2018). Door Automation System Based on Speech Command and PIN using Arduino Smartphone. Surabaya : *ICOIACT*.

[2] Farezi, R. M., Fadlillah, U. (2018). Prototipe Keamanan Brankas Berbasis Arduino. Studi, P., Elektro, T., Teknik, F., & Surakarta, U. M.

[3] Lita, Adrian Ioan., Daniel Alexandru Visan., & Alin Gheorghita Mazare. (2017). Door Automation System for Smart Home Implementation. Romania : *SIITME*.

[4] Pakpahan, Reynaldo Lino Haposan., Dodi Wisaksono Sudiharto., & Aji Gautama Putrada Satwiko. (2016). The Prototype of Automated Doors and Windows by using Voice Commands. Bandung : *ISATIC*.

[5] Rani, Jasmin Paul., Jason Bakhtakumar., Praven Kumaar., & Santosh Kumaar. (2017). Voice Controlled Home Automation System Using Natural Language Processing (Nlp) and Internet of Things (Iot). India : *ICONSTEM*.

[6] M Kusban, B Hari P, and A Budiman. Palmprint recognition using the cosine method. *IOP Conference Series: Materials Science and Engineering*, 674:012041, nov 2019.

[7] Muhammad Kusban, Aris Budiman, and P. Bambang Hari. Optimized palmprint recognition with gabor parameters adjustment and matching method selection. *Advanced Science Letters*, 24(12), 2018.

[8] Muhammad Kusban, Aris Budiman, and Bambang Hari P. An excellent system in palmprint recognition. *IOP Conference Series: Materials Science and Engineering*, 403:012037, oct 2018.

[9] Muhammad Kusban, A. Susanto, and O. Wahyunggoro. Excellent performance of palmprint recognition by using wavelet filter. *ICIC Express Letters*, 11:1315–1321, 08 2017.

[10] Muhammad Kusban, Adhi Susanto, and Oyas Wahyunggoro. Combination a skeleton filter and reduction dimension of kernel pca based on palmprint recognition. *International Journal of Electrical and Computer Engineering (IJECE)*, 6:3255–3261, 12 2016.

[11] M. Kusban, A. Susanto, and O. Wahyunggoro. Feature extraction for palmprint recognition using kernel-pca with modification in gabor parameters. In *2016 1st International Conference on Biomedical Engineering (IBIOMED)*, pages 1–6, 2016.