

# Implementation security system using motorcycle fingerprint identification and notification Telegram

Eki Ahmad Zaki Hamidi, Mufid Ridlo Effendi, Edi Mulyana, Rina Mardiaty

Department of Electrical Engineering, Faculty of Science and Technology, UIN Sunan Gunung Djati, Bandung, Indonesia

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## ABSTRACT

A motorcycle security system using fingerprint recognition and Telegram notification is a solution to solve motorcycle safety problems and reduce motorcycle loss cases by using fingerprint sensors attached to the owner's motorcycle and Telegram application as a monitor connected to the motorcycle. The microcontroller used is the Wemos D1 mini connected to the Telegram application as a communication line between the user and the motorcycle. The sensor used is the fingerprint sensor. There are differences in data obtained from the fingerprint sensor response results and the response of the Telegram notification system by testing fingerprints that have been registered and that are not registered on the fingerprint sensor with the measurement results using the stopwatch. Measurement differences on the fingerprint sensor have errors with an average time dispute of 0.27 seconds. Measurement differences in Telegram notifications have errors with an average dispute time of 1 second. Hygiene conditions on the fingerprint sensor influence the difference in reading duration. If there is fingerprint oil before it, then the reading tends to be slow. The difference in measurements obtained is small enough that it can be used as a reference.

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## Corresponding Author:

Eki Ahmad Zaki Hamidi

Department of Electrical Engineering, Faculty of Science and Technology, UIN Sunan Gunung Djati

Jl. AH. Nasution 105 Bandung, Bandung, 40614 West Java, Indonesia

Email: ekiahmadzaki@uinsgd.ac.id

## 1. INTRODUCTION

In this modern era, the volume of cars and motorcycles is increasing. The Motorcycle Industry Association (AISI) noted that total domestic sales amounted to 6,487,460 units in 2019 [1]. This shows that the upper class feels the need for motorcycles, but all levels of society depend heavily on transportation.

The large public need for motorcycles is also accompanied by high growth in criminality regarding theft. Based on the Central Bureau of Statistics (BPS) data, there were 27,731 cases of motorcycle theft that occurred during 2019 [2]. The high number of theft cases of motorcycle vehicles above becomes a daily problem that still needs to be sought solutions.

Currently, the motorcycle owners use a double lock to save their motorcycle. But it does not usefull, the thieves could be broken it. So, we need a better security system such as finger print recognition and Telegram notification, which is installed on the owner's motorcycle and the Telegram application as a monitor connected to it. This system is more efficient and effectively. It could be decreased a motorcycle theft.

One solution to secure motorcycles from theft is applying intelligent security system technology (intelligent security system) [3]. Nowadays, intelligent security system technology (intelligent security systems) is developing rapidly and has become necessary in all aspects of modern human life. Some of the methods of motor vehicle security systems that are being developed include the use of smart cards [4], the use of dual

verification with Bluetooth-based smartphones, using face recognition [5], and using fingerprint recognition [6]. This technology is present to help the efficiency and effectiveness of modern human life.

This study designs and implements a motorcycle security system using fingerprints and notification systems as a precaution by utilizing an instant messenger Telegram application. Fingerprints were chosen because they have high security and accuracy of fingerprint recognition. The motor will only be able to start the machine if the person's fingerprint is successfully confirmed fingerprint sensor and fingerprint recognition speed is very fast (only a few seconds).

References related to similar research conducted by Furqan *et al.* [7], in 2021 with the title "application of security system of motorcycle used fingerprint optical sensor and vibration sensor with fuzzy logic based on Arduino Uno R3", made a motorcycle security system using fingerprints integrated with vibration sensor SW-420 use fuzzy logic method. Astuti *et al.* [8] conducted a study entitled "vehicle security system using short message service (SMS) as a danger warning in motorcycle vehicles" in 2020. This study aims to security system to alert and warn when a vehicle is stolen. This system aims to provide information to vehicle owners when a vehicle is in danger by sending coordinate points using SMS and can be displayed right with the Google Maps application to make it easy for vehicle owners to track or know the position of the vehicle. Next research Sutikno *et al.* [9] conducted a study entitled "WhatsApp, Viber and Telegram: which is the best for instant messaging?" in 2016. In this paper explain there are many free instant messengers available now which allow people to communicate, telegram being the most secure platform in the free instant messaging industry.

Finally, research was conducted by Hema and Yadav [10] with the title "secure home entry using raspberry pi with notification via telegram". Designing a systems for secure home entry system using internet of things. This study discusses a home security system using Raspberry Pi controller, infrared, camera and other sensors. Raspberry Pi can be connected with smartphones and PCs makes it easy to operate. The infrared sensor triggers the camera to recognize faces. The advantage of this system is the notifications are sent via telegram application.

The position of this research is to create a security system using a fingerprint sensor or the Telegram application, which combines the Wemos D1 mini microcontroller with fingerprint recognition and Telegram notifications for motorcycle security systems. The Wemos D1 mini microcontroller is connected to the "Telegram application" as a communication line between the "user" and the motorcycle, and the sensor used is the fingerprint "sensor". Test results showing score accuracy from the fingerprint sensor response and the Telegram notification system response by testing registered and unregistered fingerprints on the fingerprint sensor with measurement results using a "stopwatch". The difference in measurements on the fingerprint sensor has an error with an average time dispute of 0.27 seconds. The difference in measurements on "Telegram notifications" has an "error" with an average time dispute of 1 second.

## 2. METHOD

This study uses fingerprint system fingerprint sensor, and Telegram as a means of notification security system made. This fingerprint technology is much cheaper and accurate than other technologies. Nowadays, many developers are beginning to develop several technologies that can identify biological characters known as biometrics. Biometrics is a technique for identifying and verifying a person based on his behavior and physical characteristics. Some types successfully developed by developers include fingerprints, facial structures, retinas, sounds, and others. Among these types of biometric technology, fingerprints are the best-selling choice because it has high security and difficult to duplicate hardware examples or tools used. Fingerprint sensors are currently on the market, so getting a finger sensor today is very easy. Fingerprint sensors are commonly marketed and developed. And Telegram is a cloud-based application and encryption system that provides end-to-end encryption, self-destruction messages, and multi-data center infrastructure. The hardness of access given by Telegram that can run on almost all platforms makes it easy for administrators to build a notification system by utilizing the open application programming interface (API) facility provided by Telegram through bots that can be used to send messages automatically. Telegram's cloud base allows for much faster delivery and large storage media [11].

To do research before to do design and implementation, conducted studies literature that is with reading appropriate reference with research carried out for determine position research. Then To identify the problem after knowing the position, a study is next conducted to design and implement. The design and implementation will be made in various stages as shown.

As shown in Figure 1, include literature study, problem identification, needs analysis, design, implementation, testing, and analysis. These stages are prepared to support the research process to be systematic. In solution research, conducted testing to ensure that study succeeds with good. Results are analyzed so that will obtain a conclusion end from the study.

In this study, the design and implementation were carried out after identifying the problem, namely the hardware design with a fingerprint sensor finger as initialization owner vehicles that have been registered and placed on the motor dashboard. Fingerprint sensor finger will be processed by the microcontroller as well as sent to the Telegram server. Telegram servers will send a notification to the smartphone as initialization use vehicle, and if the fingerprint sensor finger no initializes fingerprint fingers that don't register, then the Telegram server will send a notification to the smartphone and sound the buzzer on the vehicle. Figure 2 is a design diagram.

Fingerprint recognition process and Telegram notification are carried out using the Wemos D1 mini microcontroller as a controller in the system. Fingerprint sensor finger used the AS608 sensor is an optical fingerprint sensor which can detect fingerprint wrinkles. AS608 sensor module later connected with Arduino.

In the testing section, testing will be carried out in 2 stages, namely testing the input system and testing the connectivity. In the input system section, testing will be carried out on the sensor, then for the monitoring system, a test for the ability to read data will be carried out, and the output will be notifications on Telegrams and buzzer alarms. Test results he analyzes with comparison conducted for knowing level efficiency and optimization from tested tool so that push for enhancement system motorcycle safety.

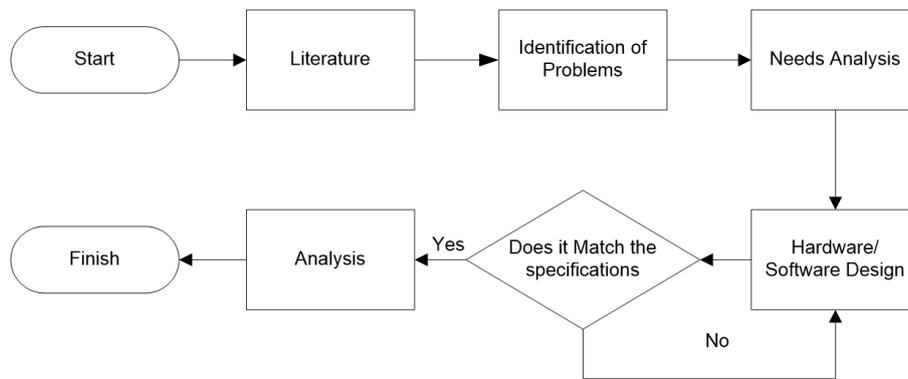


Figure 1. Research flow

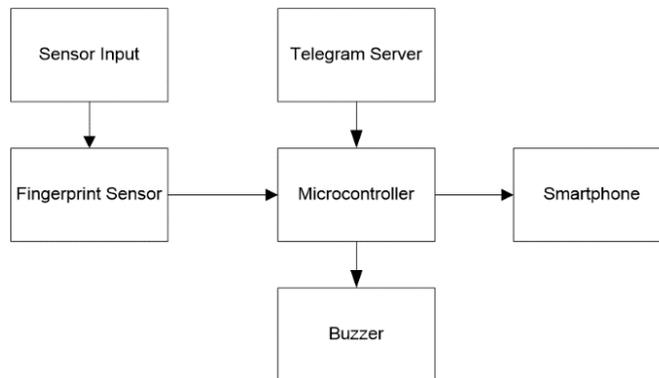


Figure 2. Diagram design

### 3. RESULTS AND DISCUSSION

The design and implementation of a motorcycle safety system using fingerprints are divided into several parts: the implementation and analysis of the test results [12]. In part, implementation consists of system design, hardware and software implementation. In part analysis, fingerprint system testing finger to response time.

#### 3.1. Design system

In security system design, vehicle motorized installed fingerprint connected fingers to the microcontroller from microcontroller connected to the relay on the motorcycle. The buzzer will sound if a fingerprint finger is not recognized and there is a Telegram notification. The design of the motorcycle safety system using fingerprint recognition and Telegram notifications is shown in Figure 3.

Telegram has feedback, be it to the Telegram app on the phone or the microcontroller [13]. Principle of the microcontroller takes the last status on the Telegram server as to whether the microcontroller is given an order or not [14]. The command is an order that is entered/sent via Telegram chat. Directly mobile wireless fidelity (MiFi) (internet) does not have feedback to the microcontroller, but MiFi (internet) is an intermediary that connects the microcontroller with the Telegram server so that when the Telegram server gives feedback to the microcontroller, then the feedback is sent to the microcontroller through the internet connection on the MiFi [15]. The principle of its work, microcontroller waits for orders from the Telegram server to do something based on commands sent through the Telegram application [16]. Except for fingerprint access, the check is done directly on the microcontroller and the results of the check are sent to the Telegram server to be forwarded to the Telegram app [17].

The design for building a motorcycle security system using fingerprint recognition and Telegram notifications is demonstrated by Figure 4. The figure shows that the fingerprint sensor reading at this stage is to customize the fingerprint data that has been submitted and that has not been registered. Then the fingerprint data will be processed if the fingerprint is appropriate then there will be a notification on the Telegram application that the fingerprint is known and if the fingerprint is not appropriate then there will be a notification on the Telegram application that the finger is not known if the experiment is done for 3 times wrong then the buzzer will serve as an alarm [18], [19].

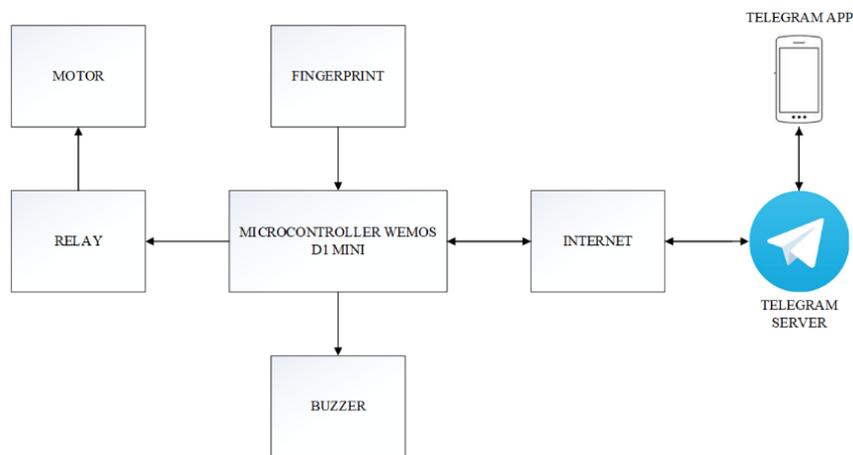


Figure 3. Illustration of support vector machine

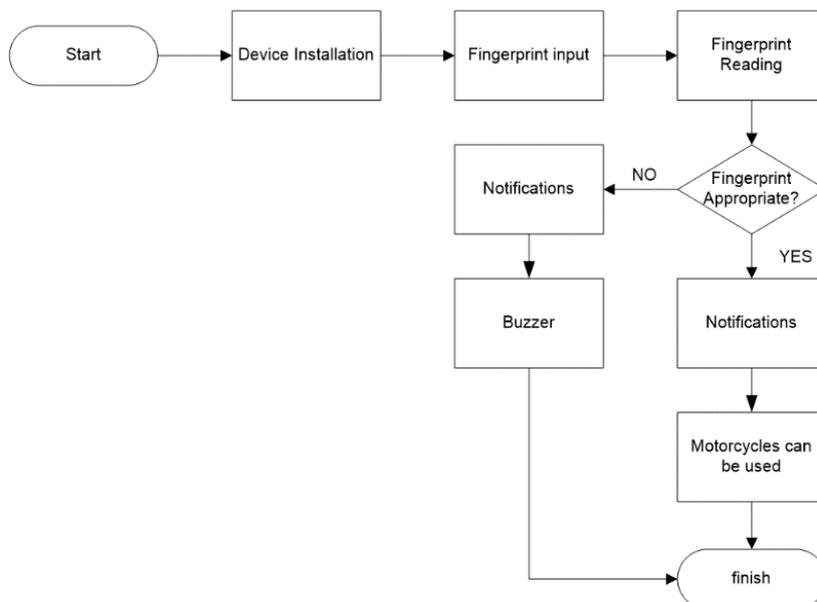


Figure 4. Flowchart motorcycle safety system design

### 3.2. Implementation

In implementing this system, it is divided into 2 parts that are hardware implementation and software implementation. Implementation of this hardware with a combined device that is a fingerprint, Wemos D1 mini, relay and buzzer. Whereas software implementation that is with uses C language. In implementing this system, divided into 2 parts, like shown.

#### 3.2.1. Hardware implementation

After passing the design stage in making the hardware series design, the next stage is the hardware implementation shown in Figure 5. The figure indicates that the fingerprint sensor is connected to the Wemos D1 mini and the relay connected to the Wemos D1 mini. The alarm is connected to the relay, and peripheral interface controller used as a microcontroller [20]. The motor is connected to the relay [21]. At this stage, the user will scan the fingerprint on the fingerprint sensor that will be processed on the Wemos D1 mini. If the fingerprint is appropriate, then the relay will turn on the starter on the motor. If the fingerprint does not match during the 3× experiment, then Wemos D1 mini processes the data to the relay to turn on the buzzer.

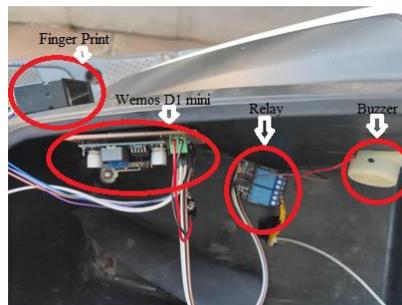


Figure 5. Hardware implementation

#### 3.2.2. Software implementation

Software implementation in research these using libraries. The implementation stage of programming language software used is Arduino based on C language by using several libraries to use fingerprint sensor and access Telegram [22]. Among the libraries used are Adafruit fingerprint for fingerprint sensors and universal Telegram bot to access Telegrams shown in Figure 6(a) and Figure 6(b).

```

File Edit Sketch Tools Help
enroll
*****
This is an example sketch for our optical fingerprint sensor
Designed specifically to work with the Adafruit BMP085 Breakout
----> http://www.adafruit.com/products/181
These displays use TTL Serial to communicate, 2 pins are required to
interface
Adafruit invests time and resources providing this open source code,
please support Adafruit and open-source hardware by purchasing
products from Adafruit!
Written by Limor Fried/Ladyada for Adafruit Industries.
BSD license, all text above must be included in any redistribution
*****
#include <Adafruit_Fingerprint.h>
#if (defined(__AVR__) || defined(ESP8266)) && !defined(__AVR_ATmega2560__)
// For Uno and others without hardware serial, we must use software serial...
// pin 42 is IN from sensor (GREEN wire)
// pin #3 is OUT from arduino (WHITE wire)
// Set up the serial port to use software serial..
SoftwareSerial mySerial(2, 3);
#else
// On Leonardo/M0/etc, others with hardware serial, use hardware serial!
// #0 is green wire, #1 is white
#define mySerial Serial1

```

(a)

```

File Edit Sketch Tools Help
ChatAction
*****
* An example of bot that show bot action message.
*
*
*
* Written by Vadim Slivtsov
*****
#include <ESP8266WiFi.h>
#include <WiFiClientSecure.h>
#include <UniversalTelegramBot.h>
// Wifi network station credentials
#define WIFI_SSID "YOUR_SSID"
#define WIFI_PASSWORD "YOUR_PASSWORD"
// Telegram BOT Token (Get from Botfather)
#define BOT_TOKEN "XXXXXXXXXX:XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX"
const unsigned long BOT_INTERVAL = 1000; // mean time between scan messages
X509List cert(TELEGRAM_CERTIFICATE_ROOT);
WiFiClientSecure secured_client;
UniversalTelegramBot bot(BOT_TOKEN, secured_client);
unsigned long bot_lasttime; // last time messages' scan has been done
bool Start = false;
void handleNewMessages(int numNewMessages)
{
  Serial.println("handleNewMessages");
  Serial.println(String(numNewMessages));
  for (int i = 0; i < numNewMessages; i++)

```

(b)

Figure 6. Library: (a) library Adafruit fingerprint and (b) library universal Telegram bot

For fingerprint using the program in the example of the program given in the library is Adafruit fingerprint, while for Telegram, use the example program in the universal Telegram bot library [23]. After passing the design stage in making a software series design, the next stage is implementing software. The Babatirex bot (a Telegram account for executing commands on pre-created programs) used to build motorcycle security systems using fingerprint recognition, and Telegram notification is shown in Figure 7 [24].

Figure 7(a) is the main display on the Babatirex bot window, Figure 7(b) is the display on the Babatirex bot when a fingerprint has been registered on the fingerprint sensor, it will give notification on the Telegram application, namely "jari dikenal!!!". Figure 7(c) is the display on the Babatirex bot when the fingerprint is not registered on the fingerprint sensor, it will give a notification to the Telegram application, namely "jari tidak dikenal!!!", Figure 7(d) is the display on the Babatirex bot when the system is online which will give a notification to the Telegram application in the form of a message "Babatirex ON !!!", Figure 7(e) is a display on the Babatirex bot when the user disables the "//off" system which will give a notification to the Telegram application in the form of a message that is "Babatirex off!!", Figure 7(f) the display when the fingerprint scanner on the fingerprint sensor is not registered. It conducts experiments 3 times, eating there will be a notification on the Telegram application "Motor dalam bahaya!!! and Alarm sounds!!!".

### 3.3. System testing

The test was conducted by testing the overall test of the AS608 fingerprint sensor and Telegram notifications that will enter the Telegram server by calculating the response time when the fingerprint starts to be scanned on the fingerprint sensor until a notification appears on the Telegram application using the stopwatch as shown in Tabel 1 (known finger or registered finger scales) [25]. As for finger used in testing is point right and thumb right. Unit time used in seconds.

Table 1. Registered fingerprints			Table 2. Unregistered fingerprints		
Test	Finger	Respon time (s)	Test	Finger	Respon time (s)
1	Right index finger	1.89	1	Left index	1.17
2	Right index finger	1.32	2	Left index	1.17
3	Right index finger	1.58	3	Left index	1.29
4	Right index finger	1.04	4	Left index	1.2
5	Right index finger	1.39	5	Left index	1.1
6	Right index finger	1.48	6	Left index	1.28
7	Right index finger	2.17	7	Left index	1.09
8	Right index finger	1.16	8	Left index	1.37
9	Right index finger	1.89	9	Left index	1.22
10	Right index finger	1.44	10	Left index	1.09
11	Right thumb	1.3	11	Left thumb	1.31
12	Right thumb	1.33	12	Left thumb	1.17
13	Right thumb	1.29	13	Left thumb	1.6
14	Right thumb	1.33	14	Left thumb	1.57
15	Right thumb	2.44	15	Left thumb	1.07
16	Right thumb	1.46	16	Left thumb	1.73
17	Right thumb	1.39	17	Left thumb	1.29
18	Right thumb	1.14	18	Left thumb	1.24
19	Right thumb	1.24	19	Left thumb	1.21
20	Right thumb	1.52	20	Left thumb	1.3
Average		1.49	Average		1.27

Based on Table 1, the fingerprint sensor's response time on the registered fingerprint (right index finger and right thumb) has an average time of 1.49 seconds. Testing has several different response times, but the difference is not significant. The test is done 10 times, both on the index finger and right thumb right.

The results of the system test can be seen in Table 1 and Table 2, which shows that the fingerprint sensor works with each time difference, in Table 1, that is to test the response of the fingerprint sensor with the registered finger (right index and right thumb) with the average time obtained after 10 times the test is 1.49 seconds. In Table 2 that is testing the response of fingerprint sensors with unregistered fingers (left index and left thumb) with average time obtained after 10 times testing is 1.27 seconds. The time difference in the test system fingerprint sensor response with a time difference of 0.27 seconds, the duration of reading is influenced by the cleanliness condition of the fingerprint sensor if there is fingerprint oil before it then the reading tends to be slow [25].

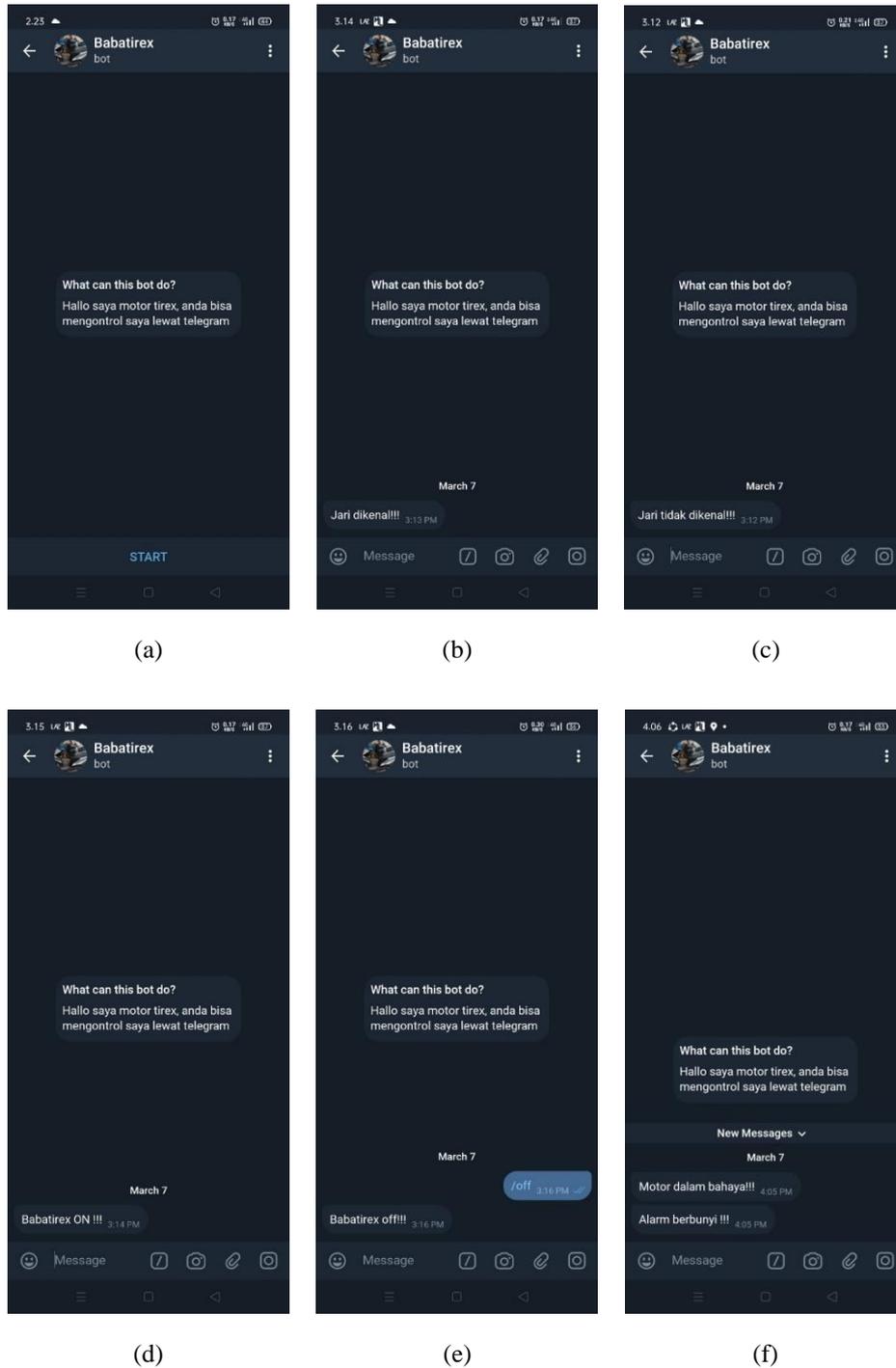


Figure 7. Telegram display: (a) main screen bot Babatirex, (b) fingerprint display is recognize, (c) fingerprint display is unrecognize, (d) system display online, (e) display system off, and (f) motorcycle on danger

#### 4. CONCLUSION

Result of the study is implementation of security motorcycle use introduction fingerprint finger and Telegram notification have feature monitor given motorbike fingerprint finger in the form of information data with Telegram notification. Motorcycle security implementation using fingerprint recognition and Telegram notifications can read the fingerprints of users or non-users. Sensor response has an average difference of 1.49 seconds on registered fingerprints, and unregistered finger sensor responses average an average of 1.27 seconds. System responses have an average difference of 8.09 seconds on registered fingerprints and unregistered finger system responses equally an average of 9.09 seconds.

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**BIOGRAPHIES OF AUTHORS**

**Eki Ahmad Zaki Hamidi**    received his bachelor degree in Engineering from Swadaya Gunung Djati University in 2001. He received his Master degree in Electrical Engineering from Institut Teknologi Bandung (ITB) in 2014. He is now a lecturer in Department of Electrical Engineering, UIN Sunan Gunung Djati Bandung. His research is in the fields of networking and telematics. He can be contacted at email: [ekiahmadzaki@uinsgd.ac.id](mailto:ekiahmadzaki@uinsgd.ac.id).



**Mufid Ridlo Effendi**    received his bachelor degree in Mechanical Engineering from Institut Teknologi Nasional (Itenas) in 2006. He received his Master degree in Electrical Engineering from Institut Teknologi Bandung (ITB) in 2013. He is now a lecturer in Department of Electrical Engineering, UIN Sunan Gunung Djati Bandung. His research is in the fields of networking. He can be contacted at email: [mufid.ridlo@uinsgd.ac.id](mailto:mufid.ridlo@uinsgd.ac.id).



**Edi Mulyana**    received his Bachelor degree in Informatic Engineering from ST INTEN Bandung in 1999. He received his Master degree in Institut Teknologi Bandung (ITB) from two department, informatic engineering in 2005 and electrical engineering in 2013. He is a lecture in electrical engineering UIN Sunan Gunung Djati Bandung and his research field now focus on Machine Learning for Embedded System of Internet of Things. He can be contacted at email: [edim@uinsgd.ac.id](mailto:edim@uinsgd.ac.id).



**Rina Mardiaty**    received her Bachelor degree in Mathematics Education from Universitas Pendidikan Indonesia (UPI) in 2006. She received her Master and Doctoral degree in Electrical Engineering from Institut Teknologi Bandung (ITB) in 2009 and 2019. She is now a lecturer in Department of Electrical Engineering, UIN Sunan Gunung Djati Bandung. Her research is in the fields of mathematical modeling, simulation, traffic modeling and intelligent systems. She can be contacted at email: [r\\_mardiaty@uinsgd.ac.id](mailto:r_mardiaty@uinsgd.ac.id).