HASIL CEK37_60010313

by Sunardi 60010313

Submission date: 15-Dec-2020 10:22AM (UTC+0700)
Submission ID: 1475400928
File name: CEK37_60010313.pdf (1.52M)
Word count: 4201
Character count: 21032

Development of Door Safety Fingerprint Verification using Neural Network

Development of Door Safety Fingerprint Verification using Neural Network

Anton Yudhana[1,*], Sunardi[1] and Priyatno[2]

[1] Department of Electrical Engineering Universitas Ahmad Dahlan Yogyakarta, Indonesia
[2] Department of Informatics Technology Universitas Ahmad Dahlan Yogyakarta, Indonesia

[*]Email: eyudhana@mti.uad.ac.id

Abstract. Fingerprints can be used as natural keys. The unique fingerprint of a human being is potential for the security system. This research develops the door safety fingerprint verification using Neural Network. The component used in this research is fingerprint C3 as input processed by Arduino Uno ATMega 2560. After a fingerprint scanning process is done, the microcontroller identifies the fingerprint image. From the microcontroller forwarded the relay module process with solenoid output. Arduino can be read by a computer using the Arduino IDE. Identification during registration via C3 sensor verified using the MATLAB application with the Neural Network method. The design created produces forward and backward solenoid motion, after being given an electric current between 5 to 12 Volts. The MATLAB application will verify the fingerprint image and display the image from the results of the verification done with the user. Research has been tested 10 times with various types of fingerprints with 100% verified so that this study was declared successful.

1. Introduction

The biometric system is mostly developed for security technology because it can fulfill two functions, namely identification, and verification. Biometry has characteristics that cannot be lost, cannot be forgotten and is not easily falsified because its existence is inherent in humans, one another will not be the same so that the uniqueness is guaranteed. Among the systems of fingerprint biometry technology, hand geometry, retina (eye), sound and face systems that have been widely used are fingerprint systems.

Fingerprints are lines that are found on the skin of the fingers of the right hand or the left hand of a person. Fingerprint security systems were used in the United States by E. Henry in 1902. Henry used the fingerprinting method for his workers to identify them in overcoming multiple wages. Henry's system uses a ridge pattern (Ridge is the groove in the skin of the fingers), which is centered on the finger pattern, especially the index finger. Many studies prove that someone's fingerprints with others have unequal ridge patterns. The ridge pattern is also not the same as the offspring even though in one family. Ridge pattern is formed in the sixth and seventh weeks or when the fetus. When a 13-week-old fetus will look clear and will not change for life. Ridge patterns can change if scratched due to injury, burns, disease or other causes. [1]

Fingerprint patterns have a high level of security, this system has been widely used in offices, companies, schools, government, hospitals and so on. Besides having a high level of security, the fingerprint system is also easy to use. Safety using a biometric system is rarely found. The safety of the door using a biometric system as safety is rarely found.

Most in Indonesia, securing the door still uses a manual key, if the key is lost, it takes time to open it. When using fingerprints, one of our fingers will become a key without a forgotten effect or left somewhere. In the market, many types of equipments that use biometric systems have been sold, but most are fingerprint attendance. In fingerprint presence, the sensor with programming has become one. So the function of the fingerprint attendance tool is only used for attendance. Many companies that have produced fingerprint presence are FingerPrint.

This research makes door safety using a fingerprint sensor. The sensor used for the security of this door stands alone meaning it has not been programmed from the company. The components that will be used are a set of microprocessors contained in the Arduino Uno ATMega 2560, the input process using Fingerprint C3 and to verify the fingerprint used when the input is required for the Neural Network system which is included in the Soft Computing science category. Neural networks actually adopt the ability of the human brain that can provide stimulants or stimuli, the process carried out, and provide output. Acquisition of output comes from variations in stimulation and processes that occur in the human brain. Humans are capable of processing information is the result of the complexity of the process in the brain. For example, by children, they are able to learn to recognize friends, even though they don't know what algorithms are used. The extraordinary computing power carried out by the human brain is an advantage in the study of science.

Neural Network was first done in 1943 when Warren McCulloch and Walter Pitts had introduced the calculation of the Neural Network model. They do a combination of several simple processing units together which can provide overall development improvements in computing power. [2]

From the background above, the author will examine "making fingerprint identification machines as door protectors". Previous research [1][3]-[13] and have done research on fingerprints or micro-controller. But previous studies have not verified using the software. In this case, the researcher will build and design a system to verify fingerprints that have been scanned and stored.

2. Methods

Fingerprints have a periodic orientation and structure in the form of a composition of dark lines of rising skin (ridges) and bright lines of furrows that twist around form a different pattern. Although the lines of the hand flow are formed differently, the special properties of the fingerprints called minutiae are unique to each individual. These characteristics form a special pattern consisting of termination or branching of the groove. To check whether two fingerprints are from the same finger or not, experts detect the minutiae. Automatic Fingerprint Identification System (AFIS) The Automated Fingerprint Identification System will retrieve and compare these characteristics to determine compatibility. Dermatoglyphics or fingerprint patterns are defined as parallel images of dermal tendrils on the fingers and toes, and the palms and soles of the feet. Anatomically dermatoglyphics make rough surfaces on the palms of the fingers, soles of the feet, and toes which function in helping the process of holding or resting so as not to slip [6]. The formation of dermatoglyphics begins with the proliferation of volar epidermal basal epithelial cells around the 10th to 11th weeks of pregnancy. The cells then form folds and become epismetic.

2.1. Main Form of Fingerprint.

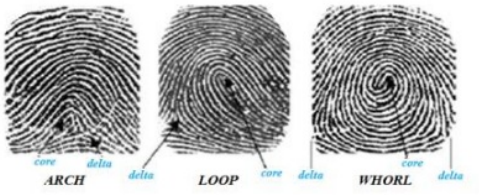

Figure 1. Fingerprint Form

There are three forms of fingerprints, namely arc (arch), hook (loop), and circle (whorl) as in Figure 1. The principal form is divided into several sub-groups, namely the shape of the arc divided into a plain arch and tented arch, the form of divided being Ulnar loop and Radial loop, while the circle form is divided into Plain whorl, Central pocket loop whorl, Double loop whorl, and Accidental whorl. The main difference between the three basic forms lies in the existence of cores and deltas in the fingerprint painting [5].

Each person's fingerprints are different from others, although there are so many fingerprints found in this world that the form of fingerprints is divided into three forms. But these three forms of fingerprints are not the same between one person and another. This is due to differences in embryo formation. As with the retina of the human eye, although many eyes are similar the retina of the eye is not the same as one person with another.

A Whorl is the main form of fingerprints, has 2 deltas and at least one circular line inside the pattern area, runs in front of both deltas. This type of whorl consists of Plain whorl, Central pocket loop whorl, Double loop whorl, and Accidental whorl. Fingerprint patterns can be seen in Figure 2.

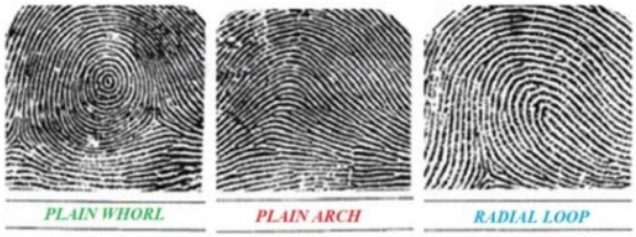

Figure 2. Fingerprint Pattern

2.2. Focus Point

The presence of focal points in fingerprints plays an important role in determining the classification of fingerprints. In classification, there are two types of focus points, namely the delta which is the outer focal point (outer terminus) and the core which is the inner focal point (inner terminus). Not all fingerprints have a focal point depending on the type/classification of the fingerprint.

A core is a midpoint that is located on the deepest loop fingerprint line and furthest from the delta as in Figure 3. It can be said that the core is the midpoint or center of the fingerprint painting. In determining the location of the core, the following provisions apply:

- The cores are placed in the loop line whose position is the deepest.
- If the innermost line does not contain an end-line or a short line that rises until the shoulder height of the core is placed on the shoulder of the cradle whose position is further from the delta position.
- If the deepest contain contains n (odd) line-end fruit that rises until the shoulder of the core is placed at the end of the center line.
- If the deepest link contains n (even) end-line fruit that rises to the shoulder of the loop core is placed at the end of the line with the middle position and is located farthest from the delta position.

The display of the midpoint of the fingerprint can be seen in Figure 3.

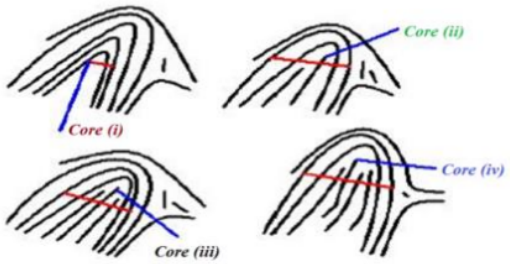

Figure 3. Middle Fingerprint

But in practice, the location of cores cannot always be determined by the rules mentioned in Figure 3. There are two cases which generally can obscure in determining the location of these cores. The first case is an additional line (appendage). The appearance of this appendage can damage the fingerprint line if the appendage appears on the fingerprint line which is located on the curved area between the shoulder of the hook line. This Appendage is considered as a stop line for hooks that are right outside. The second case is the existence of the deepest loop line (line of connection) which intersect each other (interlocking loop). In this case, the two intersecting lines are considered to be one of the hooks where the lines inside areas if the lines are rising up to the shoulder height of the loop.

Delta in the everyday sense is a cluster found in the mouth of a river of water that flows into the sea or lake always carrying mud and rock so that over time a group of islands is formed called a delta. Delta on the fingerprint is a point/line found in the center of the line type line. Delta is a focal point located in front of the center of the separation of the main lines (type lines). The main line of the painting is the two most innermost lines of a number of lines that are parallel (parallel) and separate and (inclined) to cover the principal of the painting (pattern area). The main painting is an area / white room surrounded by a line of type lines which is a place for fingerprint lines. In fact, not all fingerprints have deltas but there are also fingerprints that have more than one delta. Delta fingerprint can be seen in Figure 4.

Figure 4. Delta Fingerprint

Figure 4. is a fingerprint delta image. The conditions that must be considered in determining the position of the delta are as follows:

- Delta cannot be placed on a splitting line that does not open towards the core.
- If you have to choose between dividing lines and possible deltas, then the splitting line is selected.
- If there are two or more lines that meet the delta requirements then select the one closest to the core.
- Delta must not be placed in the middle of the line between the main lines but must be placed at the end of the line that is closest to the center of the baseline.

2.3. Ridge Counting

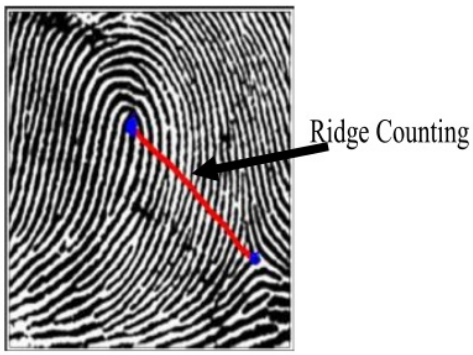

Figure 5. Ridge Counting

Ridge counting as shown in Figure 5 is a line number that touches or crosses the shadow line drawn between delta and core (delta and core are not included in the calculation of line numbers). The lines that look very fine (thin) are cracked by thick lines called insipient ridge, and this line is not counted because it usually does not always exist, however small the size of the dot (short ridge) must be treated as a line fingerprints that are counted, if they are as thick as the other lines.

2.4. Fingerprint Formula

Fingerprints are unique and different forms for each person so the fingerprint formula will be different for each person. The fingerprint formulation (classification formula) is the affixing of marks on each column of the fingerprint card showing the interpretation of the principal form, the number of line numbers, the shape of the loop, and the course of the line.

3. Proposed System

The component used in this study is a series of electronic devices combined with Arduino default software and fingerprints will be verified using the MATLAB application with the Neural Network method.

3.1. Tools and materials

Tools and materials are components needed in the manufacture of door safety identification machines using the Neural Network method. In general, the fingerprint identification system to open the door automatically consists of input, process, and output.

The input part of this system is the fingerprint sensor, which uses a C3 sensor. The process part of this system is the Arduino Uno ATMega 2560 with the help of a computer. The computer is used as a bridge from the Arduino IDE application to the Arduino Uno ATMega 2560 device in order to understand the commands given by the computer. The power supply is used as a power supply or electric power so that the device remains in a standby condition. The output part is used by Relay to drive a DC motor using solenoid. Tools and materials can be seen in Table 1.

Table 1. Tools and Materials

No	Name	Information
1.	Mikrokontroler	Arduino ATMega 2560
2.	Motor DC	Selenoid
3.	RTC	Data Logger SD Card
4.	I2C	16x02 Serial LCD
5.	Fingerprint sensor	C3
6.	Current connector	Relay
7.	Resource	Adaptor 5-12 Volt

The design begins with the registration of fingerprints on the C3 sensor which is forwarded to the microcontroller. Registration is done by attaching the fingerprint twice, the first registration will be verified by the microcontroller and the second registration will be verified by the microcontroller the second time each registration and verification will be displayed by I2C. Matching the fingerprint database that has been stored in the microcontroller will be adjusted to the Arduino IDE program. If the admin or user will open the door, the fingerprint can be placed on the sensor to open the door. When the fingerprint is placed on the C3 sensor, the input is a fingerprint image that is matched with the fingerprint database if it matches the database, then the solenoid will open.

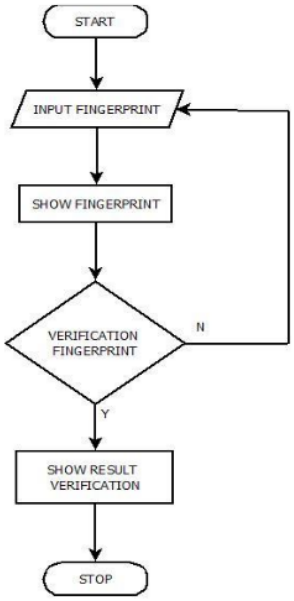

Figure 6. Flowchart Verification

Designing fingerprint verification on the MATLAB application as shown in Figure 6 is that the fingerprint that has been saved will be verified by entering the fingerprint image into the MATLAB application. The image will be displayed according to the fingerprint image selected in the database, the fingerprint image will be verified and displayed according to the selected data.

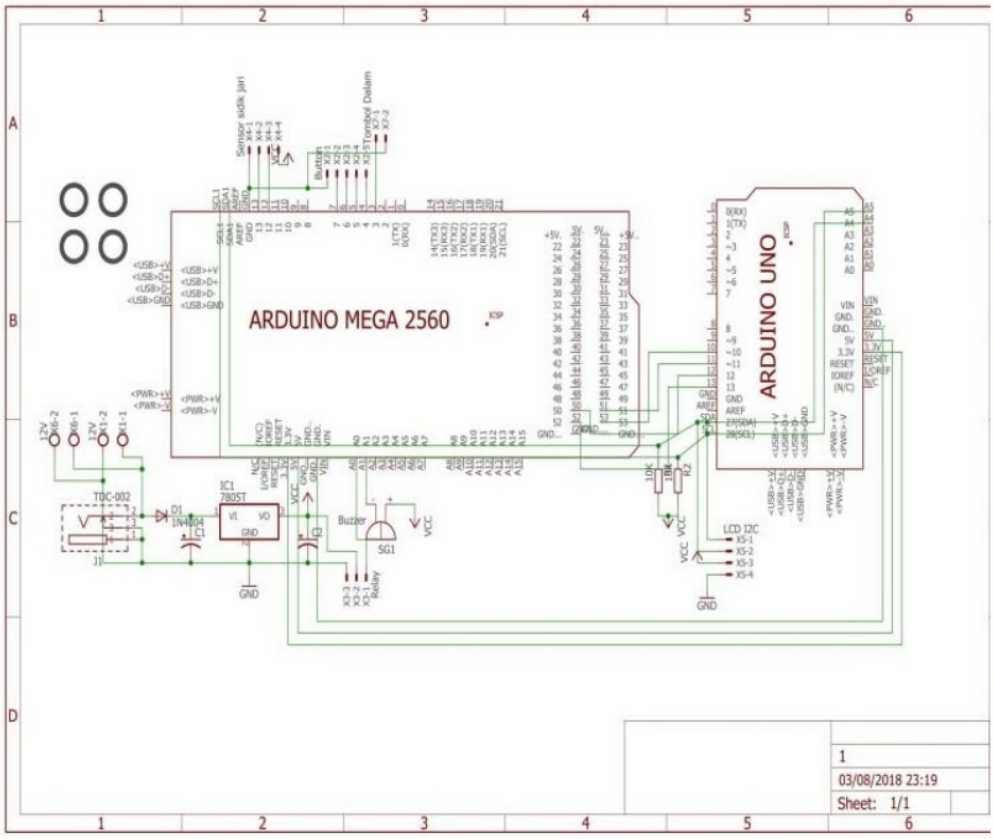

Figure 7. Tool Design

The explanation of Figure 7 is:

1. C3 sensor uses serial communication (RX and TX), RX is placed in PIN code 12 while TX is placed in PIN 13.
2. Buzzer uses A1 PIN.
3. A relay using A0 PIN.
4. Menu button uses PIN 6.
5. The + button uses a PIN 4.
6. Button - uses PIN 5.
7. Exit button uses PIN 7.
8. Open button from inside using PIN 3.

9. RTC uses I2C communication.
10. SDA uses the SDA1 PIN.
11. SCL uses SCL1 PIN.
12. SD Card Module uses SPI communication.
13. MOSI is located at PIN 51.
14. MISO is located at PIN 50.
15. SCK is located at PIN 52

From the system design that has been made to ensure that fingerprints that have been registered in the identified inputs will be verified using the MATLAB application program with the Neural Network method. The verification process is done by attaching a finger to the surface of the C3 sensor which is continued with the fingerprint verification process that is received and will be compared to the fingerprint image on the database. Possibilities that occur when fingerprints have been successfully retrieved as a result of their verification is successful or failed.

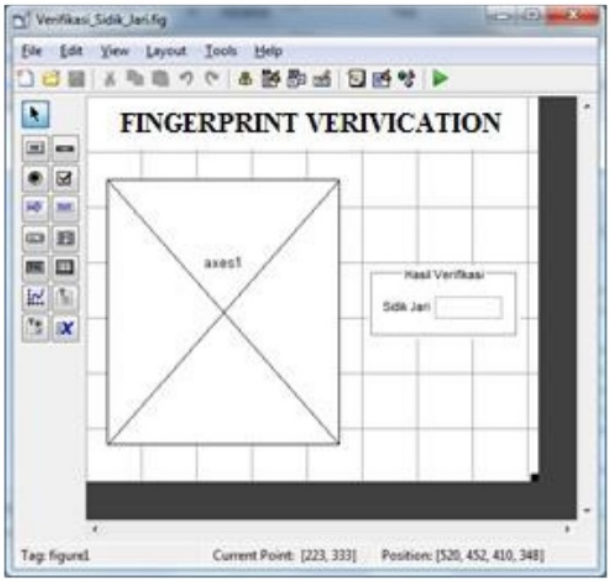

Figure 8. Design of fingerprint verification

The use of a GUI (Graphical User Interface) as shown in Figure 8 in the fingerprint verification design will look for fingerprints that have been used by the user. In this case, the MATLAB application program will search for data that has been used. Design it by pressing the Menu button then select Open. After the image appears, the Process menu is used and select Neural Network, the system will search for the fingerprint data.

4. Result

4.1. Tool testing

Use of the default software from Arduino because its function is simple and user-friendly with the components used in the research. The Arduino IDE software testing is done by entering the initial display program listing as a condition for the Arduino component to be read by the computer and Arduino will be connected to the computer with the source used in the Arduino IDE. First, fill in the program listing or sketch aimed at the C3 sensor so that the C3 sensor can be read by the Arduino IDE. The second program listing is intended for I2C LCD (Inter-Integrated Circuit Liquid Crystal Display), so I2C can read the program listings used in the Arduino IDE and can show whether the fingerprint is received or not received by the Arduino IDE. The next stage is the creation of program listings on the relay so that it can be read by the Arduino IDE and can work if there is an incoming current, the relay will decide the positive and negative pins otherwise if the relay does not receive the current, the relay will connect both positive and negative pins.

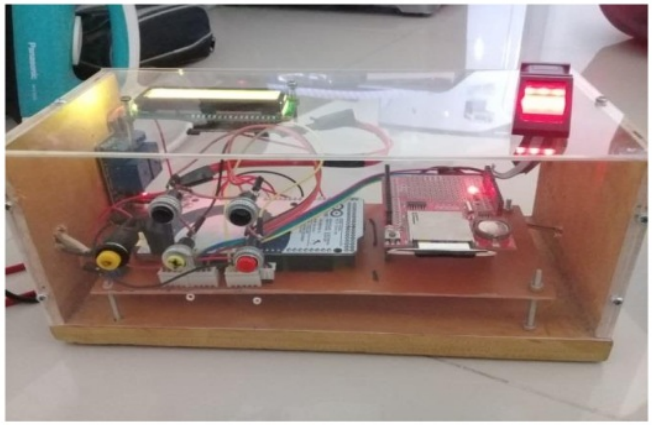

Figure 9. Connect the Arduino component

Testing of Arduino components as shown in Figure 9 becomes one of the objectives in the research. The first step taken is to connect the C3 sensor with 4 pins found in Arduino, I2C connected to the Arduino board both positive terminal and a negative terminal, the relay connected with the logger shield data is forwarded to the Arduino component. Before the sensor is used in the test first enter the current into the Arduino Uno ATMega 2560 with a power of 5-12 Volt and disconnect the USB cable from the PC because the microcontroller has stored the data provided. This system will match the fingerprint database that has been stored in the Arduino IDE program by means of fingerprints placed on the sensor to open the door. When there is a fingerprint placed on the fingerprint sensor, the input in the form of fingerprints will be matched with the database that has been stored, if the fingerprint does not match the database, then the solenoid will not open. After verification of the fingerprint in accordance with the database, the solenoid will open with a duration of 10 seconds.

4.2. Fingerprint verification using MATLAB

The Neural Network Training Process can be seen in Figure 10.

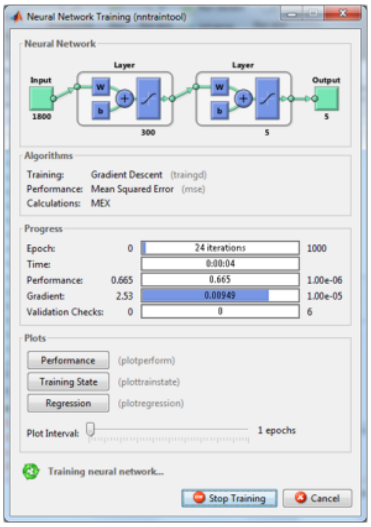

Figure 10. Training Neural Network

The training process was carried out as shown in Figure 10, indicating that there was a training process for 300 times. The next step is to build a network with 1800-300-5-5 architecture, which means it has 1800 input data where the first hidden layer contains 300 neurons and the second hidden layer contains 5 neurons. And has 5 output data. In neurons arranged in the form of layers. The simplest formation of Neural Network is a single layer. The single layer works, the input layer that comes from the source node is projected directly to the output layer of the neuron (computational node), but does not apply otherwise. This capital is a type of feedforward network, but what is meant by single layer is the output of the network. The target data is used in this training class value goal error (MSE) of 0.055494 achieved in the 24th epoch as shown in Figure 11.

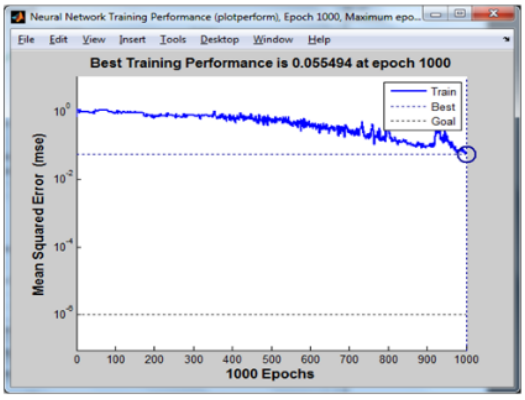

Figure 11. Plot Performance

Figure 12 shows a graph of the MSE (Mean Squared Error) value. The graph is displayed by pressing the performance button shown in Figure 10. While the appearance of the training plot can be seen in Figure 13.

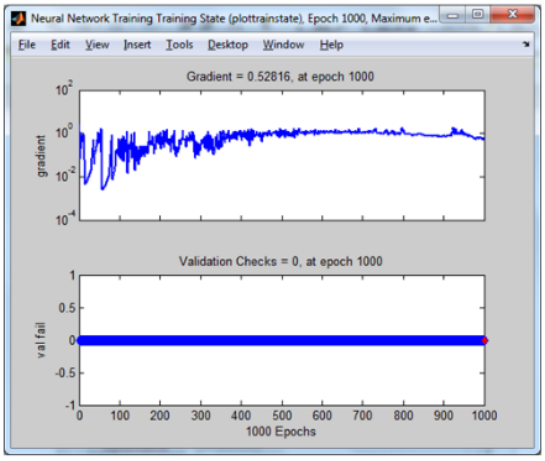

Figure 12. Training State

Figure 13 is a training plot view. The tracking plot is obtained by pressing the training state button in Figure 10. The training process with an epoch number of 1000 can produce a gradient value of 0.52816 and a check validation value of 0. While the correlation coefficient R is 0.81806 as shown in Figure 13 which shows plot regression display by pressing the Regression button in Figure 10.

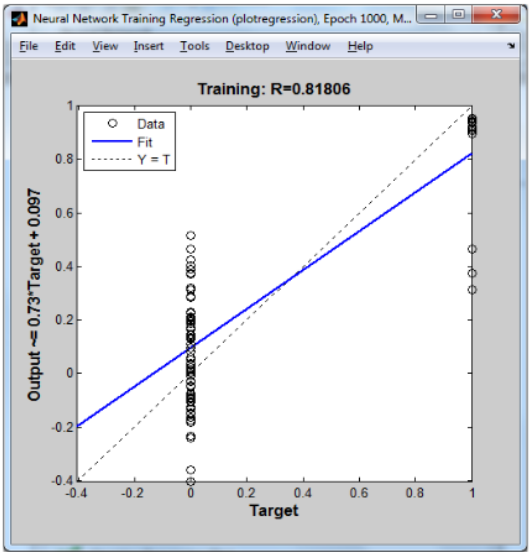

Figure 13. Plot Regression

5. Conclusion

The process of making the fingerprint security door safety machine has been successfully designed and built with the following conclusions (1) The system can be applied to the Arduino component as a door safety device with a fingerprint pattern and (2) Verification made using the MATLAB application with the Neural Network method has been running well.

References

[1] Rintjap A. S, Sherwin R. U. A. 2014 *J. T. Elektro-ft :E-Journal* 1-5.
[2] Atmega M, Yuliza E, and Kalsum T.U 2015 *J. Media Infotama* **11** 1–10.
[3] Ainur A, Hastuti J, and Nugraha Z.S. 2009 *Jurnal Kesehatan dan Kedokteran Indonesia* **1** 2-11.
[4] Nugroho E 2008 *Introduction to Biometrics* [Online]. Available: https://www.scribd.com /document/375278873/pengenalan-biometrik. [Accessed: 30-May-2018].
[5] Hidayati F 2007 *AntroUnairdotNet* **4** 30-41.
[6] Anwar Y.E,Soedjarwanto N, and Repelianto A.S 2015 *Electr. J. Rekayasa Dan Teknol. Elektro* **9** 31-41
[7] Yudhana A, Sunardi, Din J, Abdullah S, and Hassan R.B 2010 *Telkomnika* **8**187–194.
[8] Kusumodestoni R.H and Zyen A.K. 2015 *Prediksi* **6** 7
[9] Muchtar H, Hidayat A. 2017 *Jurnal Teknologi* **9** 1–5.
[10] Fadlil A, Riadi I, and Aji S. 2017 *Int. J. Adv. Comput. Sci. Appl* **8** 42–50.
[11] Yudhana A, and Djalil A. 2017 Int. J. Adv. Comput. Sci. Appl **8** 509–512.
[12] Yudhana A 2018 *The Science and Information Organization* **9** 183–189.

HASIL CEK37_60010313

ORIGINALITY REPORT

7%	5%	2%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	seajbel.com Internet Source	2%
2	re.public.polimi.it Internet Source	1%
3	Submitted to Sekolah Global Jaya Student Paper	1%
4	ulfahxiimm1.blogspot.com Internet Source	1%
5	Submitted to Southville International School and Colleges Student Paper	1%
6	Submitted to President University Student Paper	1%
7	Submitted to City University Student Paper	1%
8	jurnal.umj.ac.id Internet Source	<1%
9	Submitted to Higher Education Commission	

	Pakistan Student Paper	<1%
10	doi.org Internet Source	<1%

Exclude quotes	On	Exclude matches	< 1 words
Exclude bibliography	On		