Article

Implementation of Fingerprint Sensors for Fingerprint Reader Prototypes Using a Microcontroller

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Abstract:

This study aims to create a Fingerprint Sensor Implementation System for a Fingerprint Reader Prototype Using a Microcontroller. Implementing the Fingerprint Sensor for the Fingerprint Reader Prototype is run by an application connected by a USB cable. The Fingerprint Sensor Implementation System for the Fingerprint Reader Prototype is made for fast and more accurate attendance and cannot be manipulated. The Fingerprint Sensor Implementation System for the Fingerprint Reader Prototype is the problem. Namely, the attendance problem, which is still manual using books; after that, the design and manufacture of the Fingerprint Reader prototype using a Microcontroller or applications through NetBeans. Then implementation and testing. Then at the trial stage, the Arduino application was carried out. The result of this study is the Fingerprint Sensor Implementation System for the Prototype Fingerprint Reader Using a Microcontroller and development in the Internet of Things.

Keywords: Prototype, NetBeans, Arduino Nano, Microcontroller, Internet of Things

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1. INTRODUCTION

One of the crucial developments in information technology is the increasing need for data processing tools to produce the required information. Companies that want to develop their business and achieve success must follow the information age by using data processing support tools, namely computers [1]–[9], [10]–[13],. The role of information systems in education is a communication process that contains the transformation of knowledge, values, and skills outside the environment. If the information system is applied in the world of education, a relationship or relationship will be established that has a positive impact on the institution itself [14]–[21], [22], [23].

According to Yudiantika (2012), biometrics comes from the Greek bios, which means life, and metron, which means measure, which is a method for recognizing humans based on one or more parts of the human body or the human behavior himself, which is unique. Biometrics is universal, unique, and not easily falsified, so biometric identification is widely used. In the world of information technology, biometrics are relevant to technologies used to analyze human physiques and behavior for authentication, such as fingerprint recognition, retina, iris, voice, and facial patterns. At this time, fingerprint recognition

technology is developing [24-26] because it is also much cheaper than other biometric technologies apart from being very accurate.

One application of technology that is useful for improving student attendance discipline in the '*MurniSadar'* English Course Pematangsiantar is a fingerprint-based attendance system. This system can provide reports on student arrival and departure times according to the time on the computer so that the process carried out to produce a student attendance report can be made correctly. Data regarding student attendance can also be processed into information that can be accessed via the internet quickly because the data has been computerized.

'*MurniSadar*' English Course Pematangsiantar students usually attend by filling the attendance list book with signatures or placing a checkmark on the attendance list. Moreover, a tool was designed to make it easier to fill in the attendance list of existing students using a fingerprint sensor [27-30] using a microcontroller. This system was built by combining the tool with a web application to provide student attendance information that can be accessed via the internet.

This attendance data processing system using a fingerprint has several advantages compared to the old system: it has a very high level of security because each student's fingerprint is different or unique. So, students cannot entrust each other's attendance as is done when using signature attendance or cards. Students do not need to carry student cards or attendance papers as was done before because students can take attendance using registered fingerprints. The price of a fingerprint is lower when compared to the price of an attendance machine using a barcode or other biometrics. In making student attendance reports, there is no need to recap manually one by one because the data has been computerized.

2. METHOD

Location This research was conducted at Murni Sadar English Course at Sriwijaya Street No. 9 C-E Pematangsiantar, North Sumatera, Indonesia. The attendance system offered is entirely computer-based and can be well integrated because the data is stored in a database storage medium. Using fingerprint identification in attendance is also an appropriate choice to reduce the manipulation of student attendance data.

2.1 Overview of attendance data processing system using fingerprint.

The attendance data processing system using fingerprint was built using java as a database converter from Ms.access to MySQL, PHP as the programming language, MySQL as the database, and the Windows 7 operating system on a computer that is compatible with the fingerprint used. For a more detailed description of this system can be seen in Figure 1.

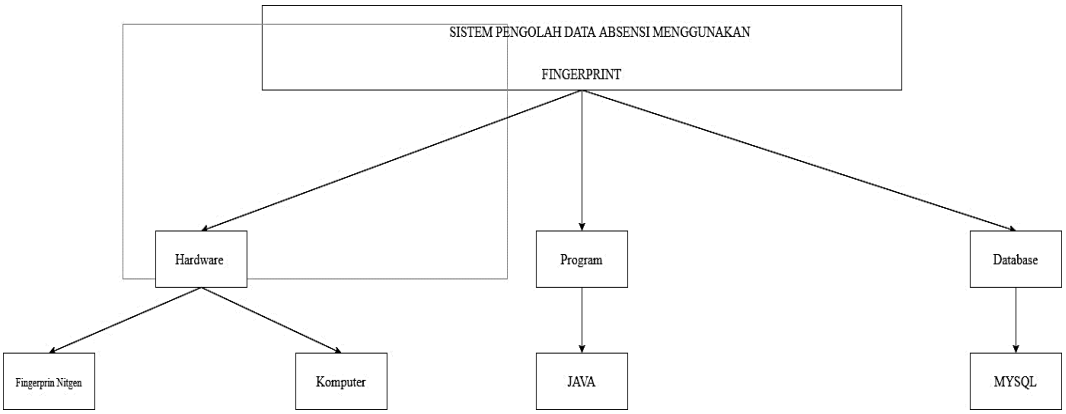

Fig.1. Overview of the attendance data processing system using a fingerprint

From Figure 1, it can be seen that the devices needed to build an attendance data processing system using a fingerprint. The required hardware is a computer that is fingerprint compatible and capable of running an attendance program designed using java. Java is a programming language that supports software development using fingerprints that can be integrated with the internet. By using java, the appearance of the program to be made can be easily determined. Because in this attendance system [31-35], there is student attendance data that will be displayed on a website page, java is used.

2.2 System planning

This section will explain the processes contained in the system, the relationships between these processes, the data flow that occurs, and a description of the processes and data involved. The design of an attendance system using fingerprint begins with hardware design, namely hardware specifications used, and software design by making flowcharts, data flow diagrams, entity relationship diagrams, database design, and application interfaces. This section will explain the hardware needed in the attendance system, namely the computer and the Nitgen NAC 3000 fingerprint. These two attendance devices should be placed in a place that can be monitored, for example, in the teacher's room or main room. Moreover, the UTP cable is a connecting medium between the computer and the fingerprint attendance machine.

Moreover, Understanding LAN is a computer network with a small or limited coverage area. For example, office computer networks, schools, homes, or in just one room. A network is built in a location such as a house or an office building. It can also be interpreted as a computer communication system whose distance is limited to a few kilometers and uses a high-speed connection between 2 and 100 Mbps. Furthermore, The FPM10A fingerprint reader used in this attendance system is the FPM10A. System Configuration Schematic or Flow Arduino And LCD Configuration Flow, Only four pins are connected to Arduino, namely pins A4, A5 GND, and 5V. The LCD voltage is sufficient with the Arduino 5V and GND pins.

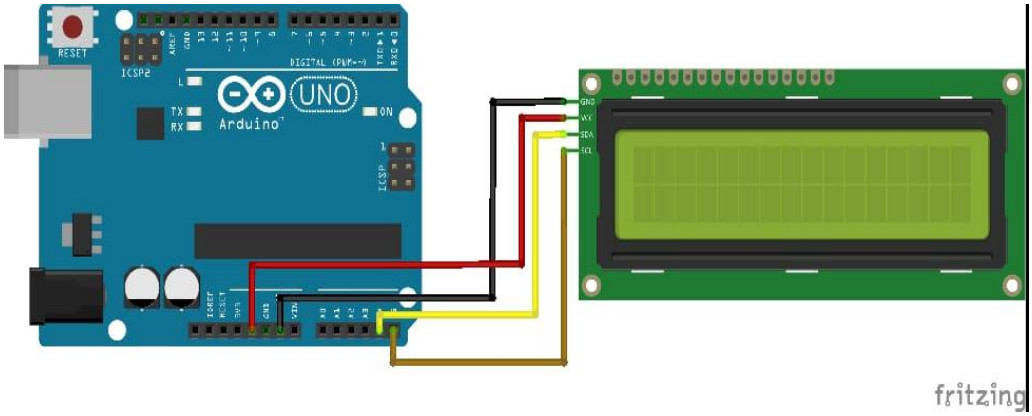

Fig.2 Arduino and LCD System Configuration Flow

Arduino Configuration Flow and Fingerprint Sensor connect VCC and Arduino 5V, GND with GND pin. Serial communication (UART TTL) is free; that is when we use serial software on Arduino.

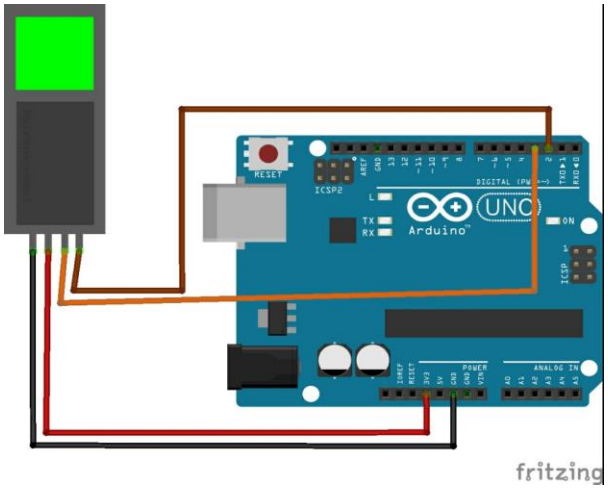

Fig.3 Arduino Configuration Flow and Fingerprint Sensor

Arduino Combined Configuration Flow, Fingerprint Sensor, And LCD connect between VCC and Arduino 5V, GND with GND pins connected to Arduino, pins A4, A5 GND, VCC, Serial, and 5V.

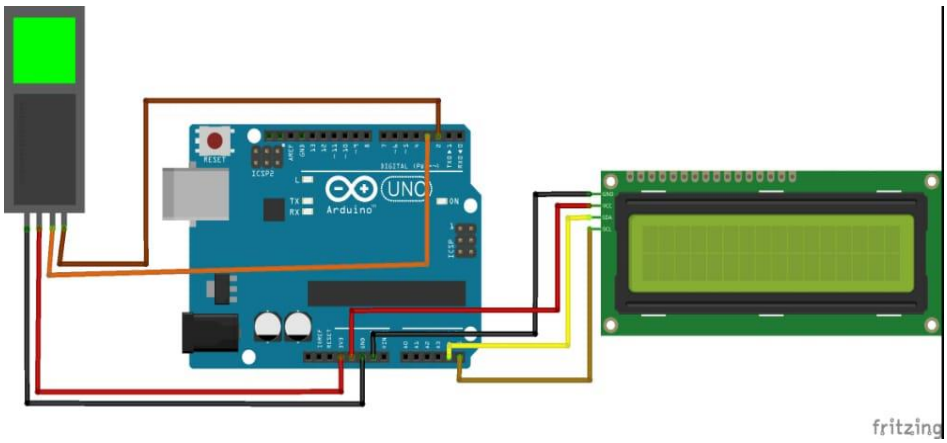

Fig.4 Combined Arduino Configuration, Fingerprint Sensor, and LCD

4. RESULT AND ANALYSIS

After the design of the Fingerprint Sensor tool for the Prototype Fingerprint Reader Using a Microcontroller has been completed, the designs that have been made will be implemented. At this stage it will be divided into two parts, namely the implementation of system hardware and system software implementation.then arduino Component Implementation, The results of the Arduino component implementation can be seen in Figure 5.

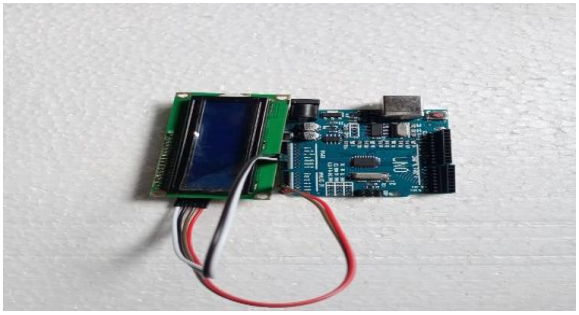

Fig.5 Arduino UNO components

Arduino Component Implementation, Fingerprint, and LCD, The results of the implementation of the Arduino, Fingerprint, and LCD components can be seen in Figure 6.

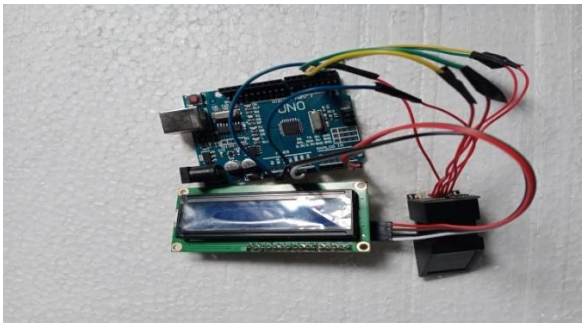

Fig.6 Arduino components, Fingerprint and LCD

Overall Component Implementation is shown in Figure 7.

Fig.7 Overall Component Implementation

2.3 Software Implementation

At this stage, the results of the implementation of the system software design will be explained in the form of a web that has the function to register and view fingerprint results. The following is the result of the tool software implementation. Moreover, the login page consists of two text inputs: username, password, and a login button. The performance of the login page can be seen in Figure 8.

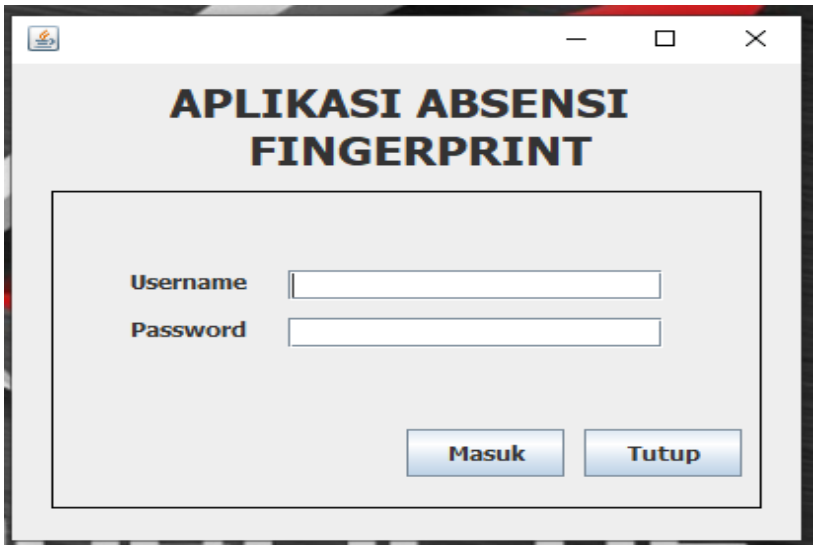

Fig.8 Login Page

Furthermore, about the Home page, When the user has successfully logged in, the home page will appear. The web uses side menus for navigation between pages. The side menu can be hidden by clicking the X (close) button at the top left of the side menu. The following is the result of implementing the home page in Figure 9.

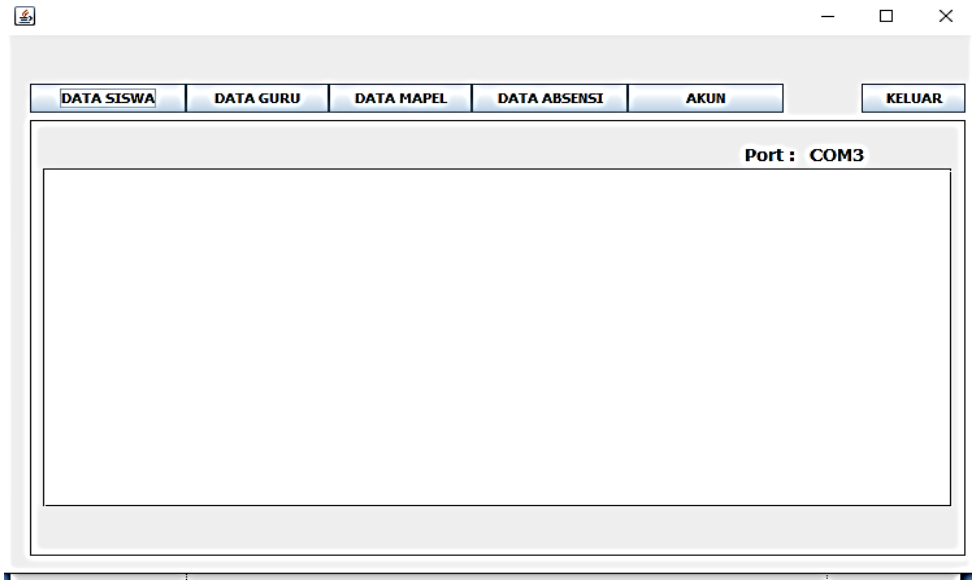

Fig.9 Home Page

Furthermore, Student Data Page, The student data page is the page where student data is input and stored.

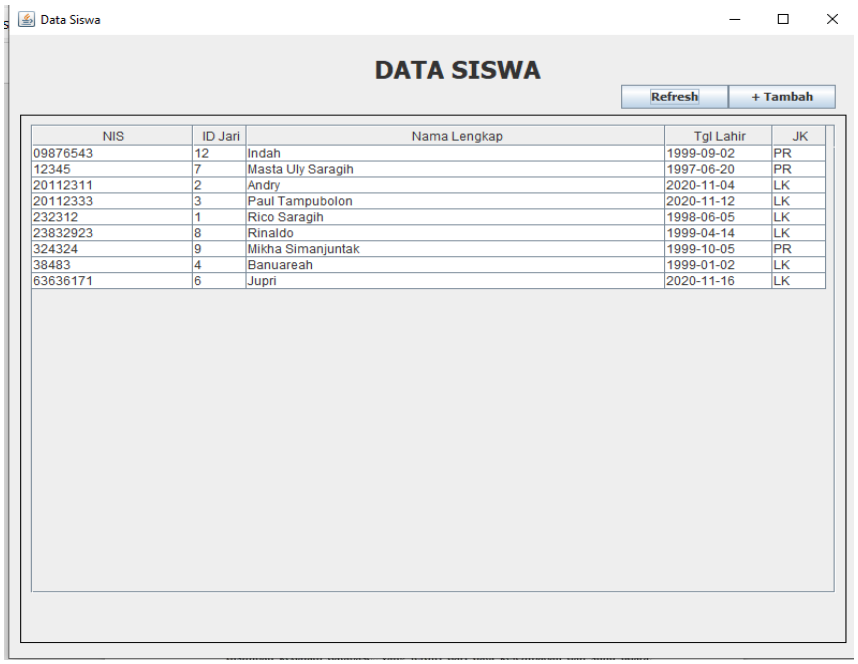

Fig.10 Student Data Page

Next is the Teacher Data Page, this Teacher Data Page stores teacher data such as NIP, Full Name, Date of Birth, JK (Gender), and Education.

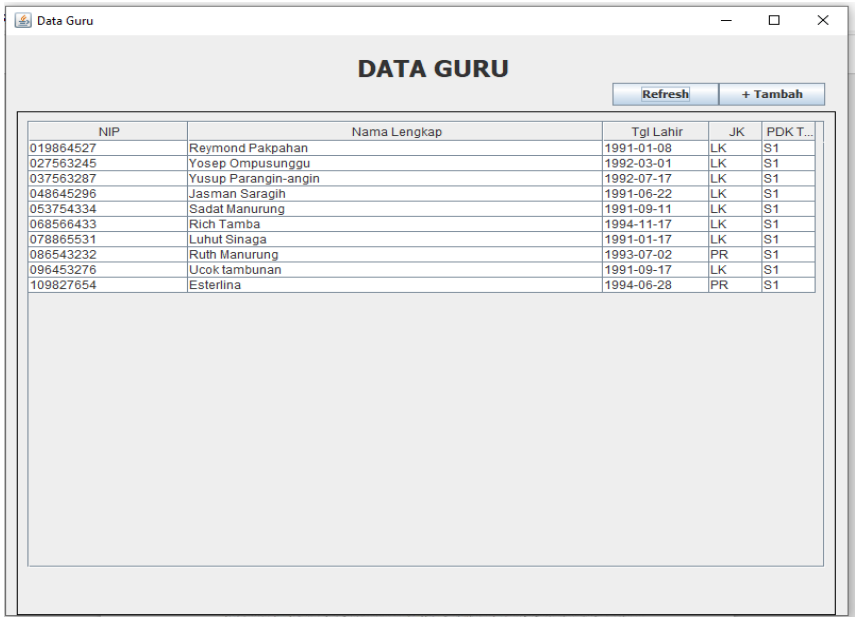

Fig.11 Teacher Data Page

Furthermore, there is an Attendance Data Page, which functions to find student attendance. Starting from students entering until students go home and students are present, and students are not present.

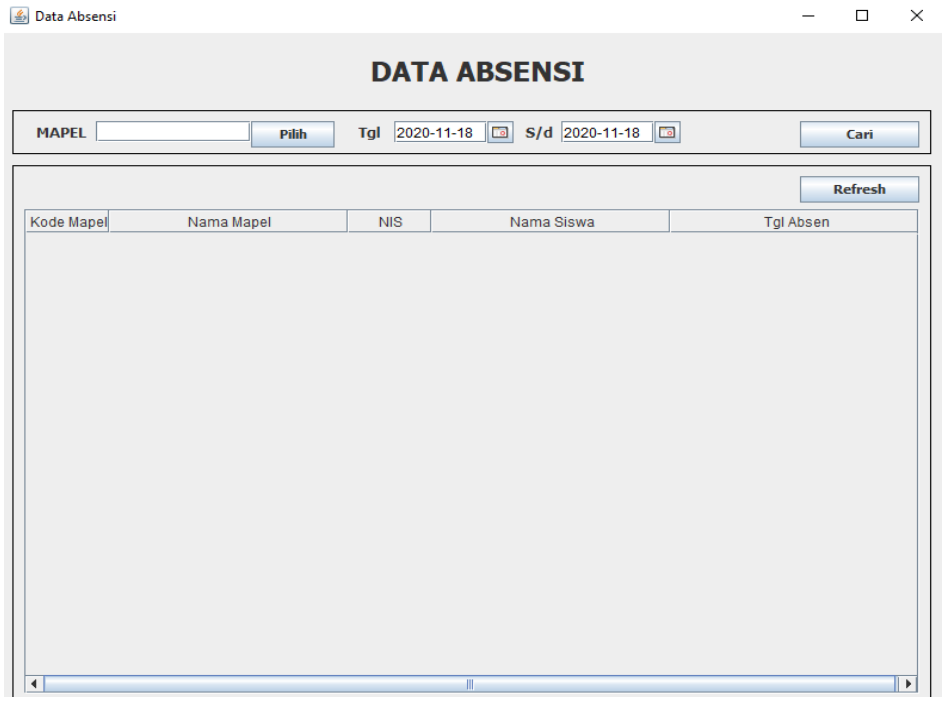

Fig.12 Attendance Data Page

Furthermore, a Coding page on Arduino UNO, This coding page must be input so that Arduino and the application are connected by clicking the upload button.

Fig.13 Coding page on Arduino UNO

Furthermore, the Discussion is about the Fingerprint Registration Stage; at this stage, fingerprint registration will be explained. The test results can be seen in Figure 14. If the fingerprint sticks to the sensor, the sensor will detect and register the fingerprint. The registered fingerprints are presented in figure 15.

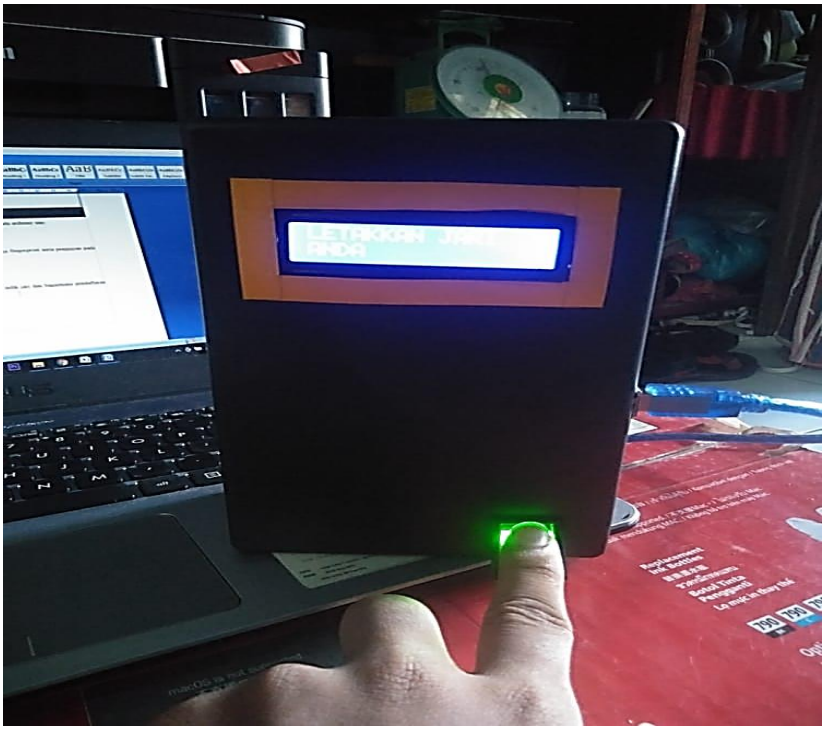

Fig.14 Placing fingerprints

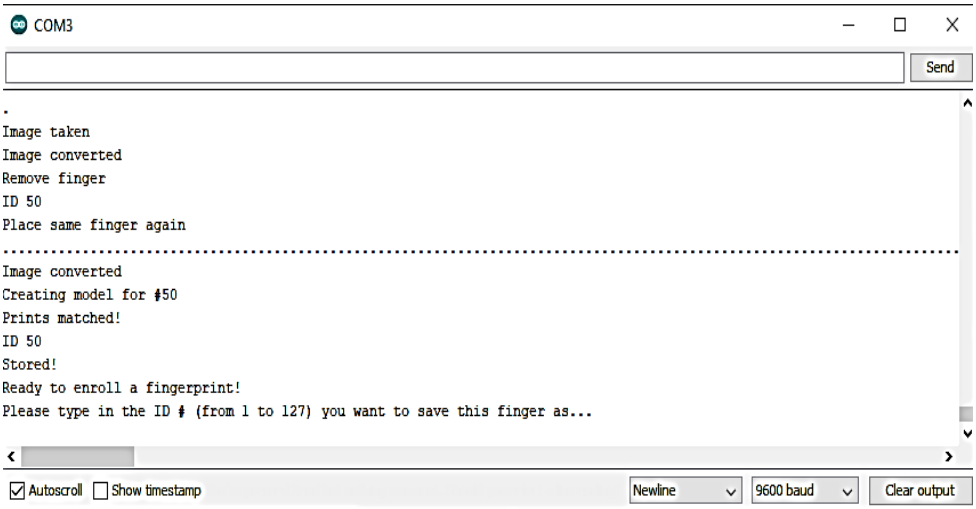

Fig.15 Registered Fingerprints

The next feature is Add Student Data; if fingerprints have been registered, register student biodata such as NIS, Finger ID, Full Name, Date of Birth, and gender. Once filled, then save.

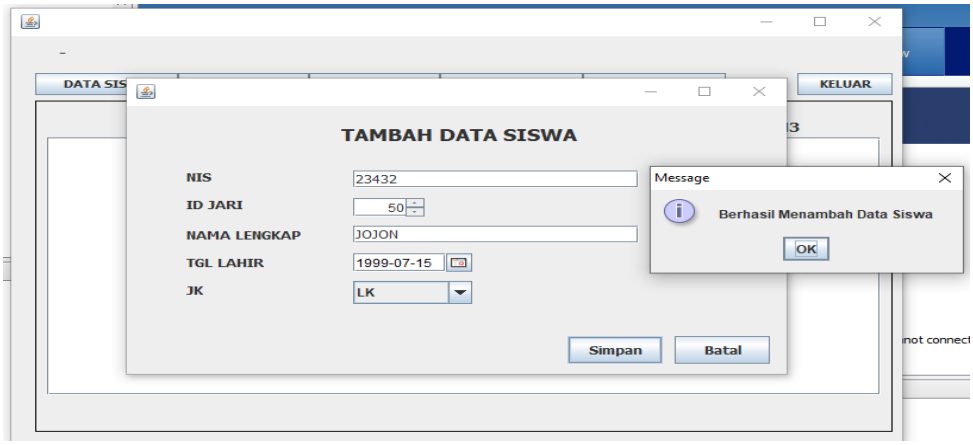

Fig.16 Add Student Data

4. CONCLUSIONS

The conclusions that can be drawn from the attendance system using a fingerprint are as follows: [1] The attendance system uses a fingerprint to record student attendance data, reducing opportunities for manipulating attendance data. [2] This presence application uses fingerprints to input desktop-based presence data. [3] Fingerprint attendance can be used if the user has registered in the database. [4] This attendance system can be accessed locally on the host using Netbeans and MYSQL. [5] This attendance system can manage attendance data to be more organized to increase time efficiency in preparing reports. [6] The fingerprint attendance system can improve the paperless system, thereby reducing operational costs in the work process at the '*MurniSadar*' English Course Pematangsiantar, especially in student attendance.

AUTHOR CONTRIBUTIONS

Conceptualization; Victor Marudut Mulia Siregar [V.M.M.S], Nancy Florida Siagian [N.F.S], methodology;[V.M.M.S],[N.F.S]; validation; [V.M.M.S],[N.F.S]; formal analysis; [V.M.M.S],[N.F.S]; investigation; [V.M.M.S],[N.F.S]; data curation; [V.M.M.S],[N.F.S]; writing—original draft preparation; [V.M.M.S],[N.F.S]; writing—review and editing; [V.M.M.S],[N.F.S]; visualization; [V.M.M.S],[N.F.S]; supervision [V.M.M.S],[N.F.S]; project administration; [V.M.M.S],[N.F.S]; funding acquisition; [V.M.M.S],[N.F.S]; have read and agreed to the published version of the manuscript.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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