Design of A Laboratory Assistant Presence System Using Rfid Sensor and Web Based Esp8266 Microcontroller

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Abstract— **A computer laboratory is a facility that provides space and hardware (computers, printers, monitors and other equipment) as well as software for teaching, research and development purposes in the field of information and computer technology. The computer laboratory has assistants whose job is to assist lecturers in implementing practical learning. Laboratory assistants accompany lecturers in practical courses based on a predetermined schedule. Apart from that, there is a picket schedule that must be carried out regularly to prepare replacement assistants if an assistant is unable to attend. After completing the practical lecture, the laboratory assistant writes the summary results on a sheet of paper. This causes a lack of efficiency in monitoring picket schedules and assistance carried out by laboratory assistants. There are several innovations carried out, such as research conducted by [1] regarding the use of radio frequency identification (RFID) technology for employee attendance systems. Researchers use RFID as a sensor to perform employee attendance, nodemcu esp8266 as a microcontroller and the data obtained is displayed on the web. Based on the background of existing problems, in order to improve monitoring of laboratory assistant attendance, the author built a laboratory assistant attendance system with RFID sensors using Web-based ESP8266. From the system that has been created, monitoring of laboratory assistance and picket activities can be monitored by the laboratory coordinator via the website in real time so that it is easier and faster. Apart from that, it becomes easier for laboratory coordinators to discipline assistants who are often late for attendance.**

Keywords— Presence, RFID, Esp8266, Laboratory, Web

I. INTRODUCTION

The presence system is a system used to record a person's presence. The aim of the attendance system is to make it easier to manage attendance and calculate salaries, as well as ensure that people who must attend an activity actually attend. Attendance systems usually use technology such as barcodes, fingerprints, identity cards, or facial recognition systems to record a person's presence. The recorded attendance data is then stored in a database that can be accessed by authorized parties, such as HRD or school administrators. This attendance system is implemented to discipline employees to be more organized. One example that uses a presence system is a computer laboratory in which there are service personnel, namely laboratory assistants.

A computer laboratory is a facility that provides space and hardware (computers, printers, monitors and other equipment) as well as software for teaching, research and development purposes in the field of information and computer technology. Computer laboratories are usually used by students, lecturers or researchers to carry out experiments, practicums, testing and developing computer programs.

In the world of education, computer laboratories are very important to support learning in the field of information and computer technology, because through computer laboratories students can practice the theories they have learned in class and develop skills in using information and computer technology.

As in every unit in the world of work, there are administrative processes. The administrative process in the laboratory section is carried out to record laboratory assistant assistance activities using an attendance book. In its implementation, this experienced several obstacles, including the arrival and departure times of the companions when carrying out the picket. There are still many of them who are late for their picket and many also go home at an hour when they are not supposed to go home. There needs to be innovation that involves technology so that these activities can be monitored and carried out well so that the mentoring process can run well and smoothly.

With the development of technology, there is currently a lot of research that utilizes technology to help users' work, including research conducted by [1] regarding the use of radio frequency identification (RFID) technology for employee attendance systems. Researchers use RFID as a sensor, Nodemcu ESP8266 as a microcontroller and display it on the web. Apart from that, research [2] regarding the design of an employee attendance system using RFID which is integrated with a web-based database on the eternal focus of CV. Researchers use RFID as a sensor and ESP32 as a

microcontroller. The resulting data is displayed on the local web.

With the development of this technological system, it is very possible to innovate to make it easier to handle several problems in the laboratory. The existing problem is that it is difficult to monitor and control laboratory assistants in carrying out picket attendance and assistance in practical courses. Based on the problems existing in the Darmajaya laboratory, the author took the initiative to design a laboratory assistant attendance system using RFID sensors and a web-based ESP8266 microcontroller. This will make it easier for the laboratory coordinator to monitor laboratory mentoring activities properly so that the mentoring process in practical lectures can run well and smoothly. Apart from that, the attendance monitoring system can be used as a decision support system for disciplining laboratory assistants to be more disciplined.

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II. LITERATURE REVIEW

A. *NodeMCU Esp8266*

NodeMCU ESP8266 is a popular development board based on the ESP8266 Wi-Fi module. The ESP8266 is an inexpensive Wi-Fi chip with a complete TCP/IP stack and microcontroller capabilities, which makes it ideal for Internet of Things (IoT) applications [3]. The NodeMCU board includes a microcontroller, flash memory, and a USB-to-serial interface for programming and debugging.

B. *RFID*

RFID is an abbreviation for Radio Frequency Identification, which is an automatic identification technology using radio waves [4]. RFID technology uses a device called a tag or transponder, which contains an electronic chip and an antenna to transmit and receive radio signals.

C. *XAMPP*

XAMPP is a software package used to create and run web applications locally on a computer [5]. XAMPP consists of several important components, including the Apache web server, the PHP programming language, the MySQL database, and also several other utilities such as phpMyAdmin, FileZilla FTP server, and Mercury Mail server.

D. *ARDUINO IDE*

Arduino IDE (Integrated Development Environment) is a software development environment used to program and upload code to the Arduino board [6]. This IDE has a code editor, compiler, and debugging tools that are useful for simplifying the application development process on the Arduino board.

E. *PHP*

PHP stands for "PHP: Hypertext Preprocessor". PHP is an open-source programming language used to develop dynamic and interactive web applications [7]. PHP was first developed in 1994 by Rasmus Lerdorf as a set of scripts to track visitors to his website. Later, PHP was developed into a more complete and popular programming language.

F. *HTML*

HTML stands for "Hypertext Markup Language". HTML is a standard markup language used to create web pages [8]. HTML uses tags and attributes to define the structure and content of a web page. HTML consists of a series of tags that are used to format and display content on a web page. For example, the "p" tag is used to indicate a paragraph, the "h1" tag is used to indicate a level one heading, and the "img" tag is used to display an image.

G. *MYSQL*

MySQL is a popular and widely used opensource database management system. MySQL uses SQL (Structured Query Language) to manage and access databases [9]. MySQL can be used to store and manage various types of data, such as text, images, and numeric data. MySQL can also be integrated with programming languages such as PHP, Java, and C++, making it easier to develop web applications that require databases.

H. *HTTP*

HTTP is an abbreviation of Hypertext Transfer Protocol, which is a communication protocol used to transfer data from a web server to a web browser or vice versa via the internet [10]. HTTP is an important component of the World Wide Web (WWW) which allows users to access and interact with various web pages and resources around the world..

III. RESEARCH METHOD

A. *WATERFALL METHOD*

The waterfall method or what is often called the waterfall method is often called the classic life cycle, where it describes a systematic and sequential approach to software development, starting with the specification of user needs and then continuing through the planning stages (planning), modeling, construction (deployment) which ends with support for complete software [11].
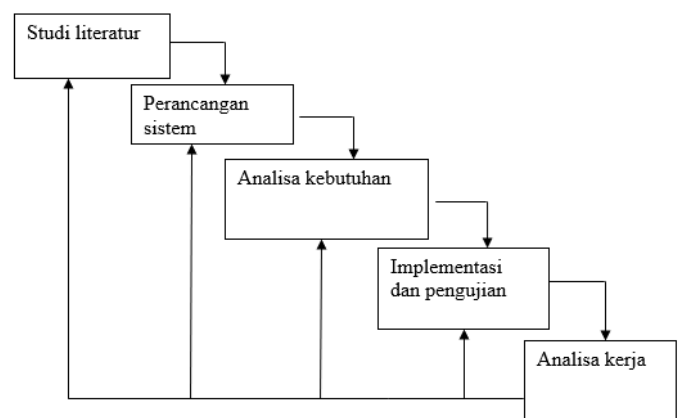

Fig. 1 Waterfall Method

B. *SYSTEM DESIGN*

Software design is a multistep process that focuses on the design of a software program including data structure, software architecture, interface representation and coding procedures. This stage realizes hardware and software requirements from the needs analysis stage to design representation so that it can be implemented into a program

at the next stage. The software design produced at this stage also needs to be documented.

Before making a system design, we must study the flow of the running system. This is done to make it easier to create the flow and design of the system that will be created. After we study the flow of the process that is already running, the next step is to design the system that will be created. The following is the block diagram design of the system that will be created as in Figure 2 diagram block system.
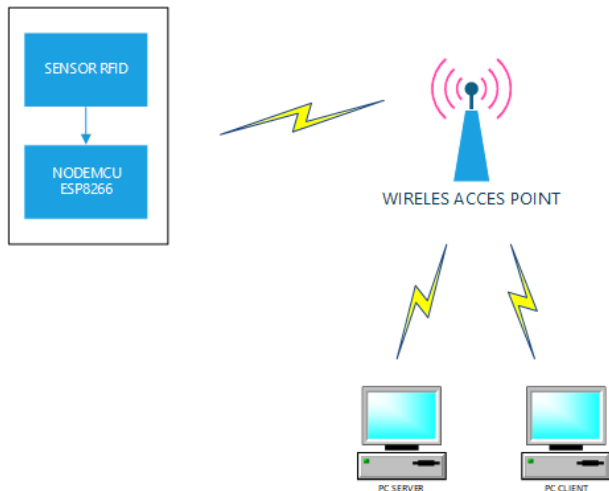

Fig. 2 Diagram block system

The way the system works is based on Figure 2, namely that this system works using an RFID sensor. This RFID sensor functions as a sensor that will read a person's personal data using the unique number on the card. This sensor works using radio frequency. The data originating from the ID card will be read by the RFID sensor and then the resulting data or numbers will be processed by the nodemcu esp8266 microcontroller to be sent and stored in the database on the PC server. The data that has been sent to the database is then displayed in an application in the form of a website display according to data requirements for monitoring the presence of laboratory assistants.

Apart from system design, there are other supporting designs, namely hardware and software design. The following are some of the system designs that will be created.

- Hardware Design
  This design was carried out to make it easier to arrange the circuit on the hardware. This hardware design consists of an RFID sensor and a nodemcu esp8266 microcontroller. The design can be seen in Figure 3.
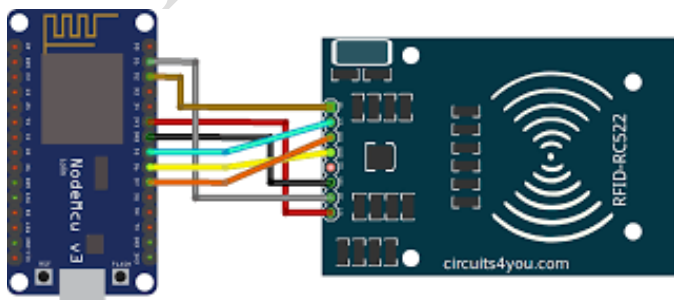

Fig. 3 Hardware design

- Designing the appearance of the attendance application
  This design was carried out to make it easier to create the appearance design for the application. There are several website display designs including the following.

Fig. 4 Login design

Fig. 5 Design asisten menu

Fig. 6 Piket Design

Fig. 7 Absensi design

Fig. 8 Card scan design

- Designing the program code
  The design for creating this program code is done by creating a flowchart diagram first. This flowchart diagram is created to make it easier to create program code for the system. The following is a system flowchart diagram for hardware as in Figure 9.
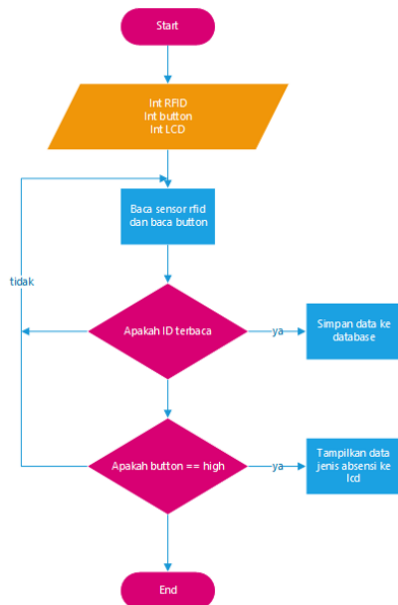
Fig. 9 Flowchart system

Based on Figure 9, the following is a reading of the program flow:

a. Start
b. Initialize the pins used
c. Read data from RFID sensors
d. Entering the condition, is there an ID that can be read from the RFID module? If there is none then it will return to the instructions to read the ID but if there is it will save the ID into the database and the program will always repeat
e. End

Apart from the hardware side, there is a flowchart in the system display section which is used to display attendance data. The following is a flowchart for the application display as in Figure 10 below.
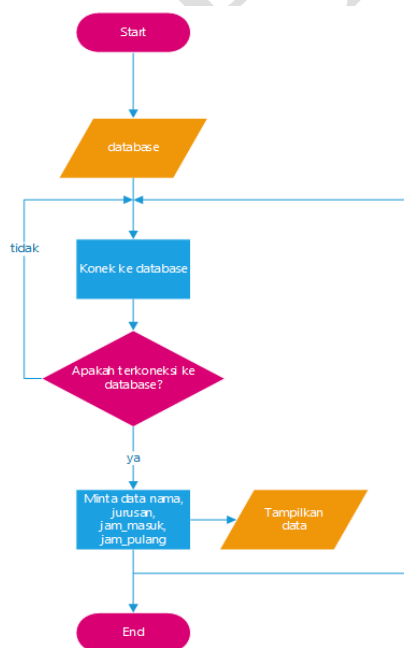

Fig. 10 Flowchart apliacation

Based on Figure 3.11, the following is a reading of the program flow:

a. Start
b. Database initialization is used
c. Enter the condition, is it connected to the database? If it doesn't connect, it will return to the instructions to connect to the database, but if it is connected, it will call up the data in the database and will be displayed in the application. The program will always repeat itself
d. End

IV. RESULT AND DISCUSSION

This chapter contains the steps that must be taken before testing, test results and analysis of test results. Testing begins by ensuring that each component used is in good condition (can work well), then checking that each path connected to the component used is connected, where the circuit is adjusted to the schematic drawing. Tests carried out include testing RFID sensors, testing database connections and sending data from sensors to the website.

A.   System Test Results

After the laboratory assistant attendance system in Figure 4.1 has been created, the next step is to carry out a trial. This system trial is carried out to ensure that the system created can run as designed. The data obtained from the test results will be analyzed to determine the system's advantages and disadvantages. In hardware testing, there are several stages carried out including testing RFID sensors, mode buttons, system database connections, testing data transmission from the microcontroller to the database, testing assistant picket presence and testing laboratory assistant attendance. The following is a picture of the physical form of the tool made as in Figure 11.

Fig. 11 Physical Form of the System

The following is a display of the attendance of pickets and the attendance of laboratory assistants on the website as in figure 12 and figure 13.

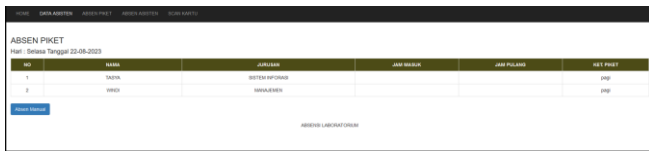Fig. 12 Assistance attendance display

Fig. 13 Assistant picket attendance display

Before testing the system, there are several steps that must be taken, including the following:

- Connect the power adapter voltage to the device.
- Enter the absence assistant website and log in to enter the dashboard.
- After entering the dashboard page, the next step is to select the scan card menu.
- Paste the ID card on the hardware device to start testing the system.

B. *Test Results*

The test results section contains a presentation of the data obtained from each test. The following is data on the results of the system trials carried out.

- RFID sensor test results
  RFID sensor testing is carried out to find out and confirm whether this sensor can detect ID cards or not. The RFID sensor test results can be seen in table 1 below.

TABLE I. TABLE RFID SENSOR TESTING

No	Taq ID	Tampilan pada Website	Keterangan
1	118790	Selamat Datang SARTIKA	Terbaca oleh RFID dan ID sesuai
2	1405000	Selamat Datang TASYA	Terbaca oleh RFID dan ID sesuai
3	1545720	Selamat Datang ROYAN	Terbaca oleh RFID dan ID sesuai

Based on the RFID sensor trials that have been carried out, it can be concluded that the ID on the card can be read by the RFID sensor and the data displayed on the Arduino serial monitor matches the data on the card.

- Button testing
  Button testing is carried out to find out and ensure that the presence mode button can function, where the button choice is in accordance with the information on the website. Meanwhile, the test results for testing the mode change button are in table 4.2

TABLE II. TABLE Testing the Change Absence Mode Button

No	Aksi	Tampilan data pada database	Tampilan pada website
1	Tekan tombol ke 1	1	Masuk Piket
2	Tekan tombol ke 2	2	Pulang Piket
3	Tekan tombol ke 3	3	Masuk Asistensi
4	Tekan tombol ke 4	4	Pulan Asistensi
5	Tekan tombol ke 5	1	Masuk Piket
6	Tekan tombol ke 6	2	Pulang Piket
7	Tekan tombol ke 7	3	Masuk Asistensi
8	Tekan tombol ke 8	4	Pulan Asistensi
9	Tekan tombol ke 9	1	Masuk Piket

Based on the test results of the attendance mode change button, it can be concluded that when the mode change button is pressed once the data sent to the database is worth 1, then when the mode change button is pressed the second time the data sent to the database is added by 1 so it

becomes 2. Pressing the button 3rd, the data sent to the database is added by 1 so that it has a value of 3, pressing the 4th button the data sent to the database is added by 1 so that it has a value of 4. If the next button is pressed, if the value in the database is 4, it will return to 1. So the result This mode change button test can run as designed.

- Testing sending data to the database
  Testing of sending data from hardware to the database is carried out to find out whether the data sent reaches its destination. Because the purpose of creating this system is that data is stored in a database. If the data is stored in a database, it will be easy to manage, for example displaying data from the database on a website and so on. The following are the test results for sending data to the database as in table 3.

TABLE III. TABLE Testing Data Delivery From Hardware to Database

No	Aksi	Tampilan database	Keterangan
1	Pengiriman ID 118790 ke database	ID = 118790	ID 118790 berhasil tersimpan
2	Pengiriman ID 1405000 ke database	ID = 1405000	ID 1405000 berhasil tersimpan
3	Pengiriman ID 1545720 ke database	ID = 1545720	ID 1545720 berhasil tersimpan
4	Tekan tombol ubah mode ke 1	Status ubah mode = 1	Mode berhasil dirubah menjadi "Absen Masuk Piket"
5	Tekan tombol ubah mode ke 2	Status ubah mode = 2	Mode berhasil dirubah menjadi "Absen Pulang Piket"
6	Tekan tombol ubah mode ke 3	Status ubah mode = 3	Mode berhasil dirubah menjadi "Absen Masuk Asistensi"
7	Tekan tombol ubah mode ke 4	Status ubah mode = 4	Mode berhasil dirubah menjadi "Absen Pulang Asistensi"
8	Tekan tombol ubah mode ke 5	Status ubah mode = 1	Mode berhasil dirubah menjadi "Absen Masuk Piket"

Based on the test results of sending data from hardware devices into the database, it can be concluded that sending data on the ID card into the database was successful, and the results stored in the database correspond to the ID card number sent. Sending data to change attendance mode via a button on the hardware can also be saved in the database and the results of the data stored are in accordance with the data sent from the hardware device.

- Presence time testing
  Attendance time testing is carried out to ensure that there is not too much of a difference when the laboratory assistant is absent from entering the picket, returning from the picket, entering the assistance and returning from the assistance. The following is table 4 of presence time testing.

TABLE IV. TABLE Presence time testing

No	Aksi	Waktu Nyata	Waktu presensi	Keterangan
1	Scan ID 385850 untuk absen MASUK PIKET	07.15	07.15	Waktu pada sistem dan hardware sama
2	Scan ID 385850 untuk absen PULANG PIKET	15.00	15.00	Waktu pada sistem dan hardware sama
3	Scan ID 955150 untuk absen MASUK PIKET	07.15	07.15	Waktu pada sistem dan hardware sama
4	Scan ID 955150 untuk absen PULANG PIKET	15.00	15.00	Waktu pada sistem dan hardware sama
5	Scan ID 385850 untuk absen MASUK ASISTENSI	13.00	13.00	Waktu pada sistem dan hardware sama
6	Scan ID 385850 untuk absen PULANG ASISTENSI	14.30	14.30	Waktu pada sistem dan hardware sama
7	Scan ID 955150 untuk absen MASUK ASISTENSI	13.00	13.00	Waktu pada sistem dan hardware sama
8	Scan ID 955150 untuk absen PULANG ASISTENSI	14.30	14.30	Waktu pada sistem dan hardware sama

Based on the results of the presence time trial in table 4, it can be concluded that the time for attendance is the same as the real time for attendance when entering picket, returning from picket, entering assistance and returning from assistance. There is not a very big difference.

- Testing sending data from sensors to the website

Testing of sending data from sensors to the website is carried out to find out and ensure that the system can work well to read, store and display data from the database to the website. The following is table 5 test results for sending data from sensors to the website.

TABLE V.   TABLE Testing sending data from sensors to the website

No	Aksi	Tampilan pada website	Keterangan
1	Menekan tombol ubah mode 1x	Absen : Masuk Piket	Keterangan absen berhasil diubah
2	scan kartu ID 118790 pada hardware	Selamat Datang SARTIKA	Asisten dengan nama SARTIKA telah berhasil absen masuk piket
3	Menekan tombol ubah mode ke 2	Absen : Pulang Piket	Keterangan absen diubah ke absen pulang piket
4	scan kartu ID 118790 pada hardware	Selamat Jalan SARTIKA	Asisten dengan nama SARTIKA telah berhasil absen pulang piket
5	Menekan tombol ubah mode ke 3	Absen : Masuk Asistensi	Keterangan mode absen dirubah ke absen masuk asistensi
6	scan kartu ID 1545720 pada hardware	Keterangan asistensi berubah menjadi HADIR	Asisten dengan nama ROYAN telah melakukan absen masuk asistensi
7	Menekan tombol ubah mode ke 4	Absen : Pulang Asistensi	Keterangan mode absen dirubah ke absen pulang asistensi
8	scan kartu ID 1545720 pada hardware	Keterangan asistensi tetap HADIR	Asisten dengan nama ROYAN telah melakukan absen pulang asistensi
9	Menekan tombol ubah mode ke 5	Absen : Masuk Piket	Keterangan mode absen dirubah ke absen masuk piket
10	scan kartu ID 242390 pada hardware	Selamat Datang M. RIDO	Asisten dengan nama M. RIDO telah berhasil absen masuk piket
11	Menekan tombol ubah mode ke 6	Absen : Pulang Piket	Keterangan mode absen dirubah ke absen pulang piket
12	scan kartu ID 242390 pada hardware	Selamat Jalan M. RIDO	Asisten dengan nama M. RIDO telah berhasil absen pulang piket

Based on the test results of sending data from the hardware device to the website, it can be concluded that during the process of changing the attendance mode, both for absence from picket entry, return from picket, entry for assistance and return for assistance, it can be done correctly and the results displayed on the website are also in accordance with the instructions at the time. pressing the button changes the attendance mode. The process of scanning ID cards using the mode of entering picket, returning from picket, entering assistance and returning from assistance can work well. The ID data is sent from the card into the database and on the appropriate website display.

- Overall Testing

Overall system testing is carried out by testing all devices that are integrated and connected to each other, both in terms of hardware and software. This test aims to determine the performance of the tool that has been designed. The following is table 6 of the overall system test results.

TABLE VI.   TABLE Overall testing

No	Aksi yang dilakukan	Tampilan Serial monitor arduino	Tampilan pada LCD	Tampilan pada Website
1	Menekan tombol ubah mode 1 kali dan melakukan tap kartu ID 118790 ke reader	Id 118790 berhasil dikirim	Absen Masuk Piket	Mode presensi berubah menjadi "Absen Masuk Piket" & ID 118790 (SARTIKA) berhasil absen masuk piket.
2	Menekan tombol ubah mode 1 kali dan melakukan tap kartu ID 118790 ke reader	Id 118790 berhasil dikirim	Absen Pulang Piket	Mode presensi berubah menjadi "Absen Pulang Piket" & ID 118790 (SARTIKA) berhasil absen pulang piket.
3	Menekan tombol ubah mode 1 kali dan melakukan tap kartu ID 1545720 ke reader	Id 1545720 berhasil dikirim	Absen Masuk Asistensi	Mode presensi berubah menjadi "Absen Masuk Asistensi" & ID 1545720 (ROYAN) berhasil absen masuk Asistensi.
4	Menekan tombol ubah mode 1 kali dan melakukan tap kartu ID 1545720 ke reader	Id 1545720 berhasil dikirim	Absen Pulang Asistensi	Mode presensi berubah menjadi "Absen Pulang Asistensi" & ID 1545720 (ROYAN) berhasil absen pulang asistensi.

Based on the results of the overall system trial, it can be concluded that this system is able to provide attendance for both picket attendance and laboratory assistant assistance absences. The ID data sent from the valid corresponds to the data displayed on the website from the database. Apart from that, testing the button to change modes works well. And the data displayed for absence from picket, absence from picket, absence from assistance and absence from assistance is very accurate without the slightest error.

C. Performance analysis

From the results of the trials that have been carried out, the system is working according to design. This system can work according to the instructions ordered. When changing the attendance mode by pressing the change attendance mode button, it went well and did not experience any problems or errors in updating information related to changing the attendance mode. Apart from that, the card scanning process carried out by the assistant at the entry and exit picket attendance can be carried out according to instructions. The data stored in the database corresponds to the data sent. In the attendance process the time corresponds to the real time when making an absence and there is no time difference when making a presence.

V. CONCLUSIONS AND RECOMMENDATIONS

- CONCLUSIONS

Based on the results of the system trials that have been carried out, it can be concluded as follows:

- This system was successfully implemented for the attendance of practicum course assistants and carrying out picketing using ID cards.
- Laboratory assistants and coordinators can monitor picketing and assistance activities via the website.
- The assistant's time stored in the database when making a presence corresponds to the real time when making a presence.

- RECOMMENDATIONS

The suggestions for the future so that this system can run more fully are as follows:

- There is a need to upgrade the appearance and menu on the presence website so that it looks better.
- It is necessary to add new features related to laboratories so that they can be integrated with each other

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