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AN INTERNET OF THINGS (IOT)-BASED ATTENDANCE SYSTEM THAT USES RADIO FREQUENCY IDENTIFICATION (RFID) TECHNOLOGY TO RECORD EMPLOYEE ATTENDANCE

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Keywords
System, Attendance, IoT, RFID

Abstract

Development technology has push innovation in various fields, including management presence employees. Research This aiming For develop system absence based on the Internet of Things (IoT) with Radio Frequency Identification (RFID) technology is designed For take notes presence employee in a way more efficient and accurate. Research methods covering analysis needs. design systems, and testing function through approach quantitative. System This integrate RFID device with NodeMCU ESP8266 for manage stored attendance data in a cloud- based database. The results of the study show that system This succeed increase efficiency of the attendance process up to 100% on trial device hardware and devices soft, reduce risk manual errors, as well as provide report presence in real-time via web and mobile applications. Implications from study This covers improvement discipline work, efficiency time, and better management of attendance data. organized, making it relevant solutions For various sector industry.

1 Introduction

Development technology in the digital era has bring change big in various aspect life, including management presence employee. System absence Conventional manual - based ones often cause various constraint like data inaccuracy, non-transparency, and difficult integration processes with system management others. In the context of This, Internet of Things (IoT) technology is becoming solution potential that allows device For each other communicate in a way automatic via the internet. With integrating Radio Frequency Identification (RFID) as an identification medium, the system absence can take notes presence with more fast, efficient and accurate (Rakasiwi et al., 2023).

In various sectors, such as education, companies, and non-profit organizations, the use of IoT with RFID technology has become increasing innovation popular. However, the challenges main is How implement technology This with cost effective and high compatibility. Study by(Ardana, 2024) emphasize that RFID -based IoT implementation requires solid infrastructure and understanding

adequate technical skills, especially in integration device hardware and devices soft.

Improvement efficiency and transparency in system absence become need urgent in the modern era. According to Harahap & Riza, (2024), use system IoT based with RFID no only increase data accuracy but also minimizes possibility cheating. Urgency This the more relevant in situation COVID-19 pandemic, where the non- contact system become very important For guard protocol health .

A number of study previously has to study development system absence based on IoT and RFID. Study byHuda et al, (2022) show that prototype system absence with RFID based technology NodeMCU can give effective results in recording presence . In addition, research by(Dwitama & Bagus Wijaya, 2024) highlight benefit use NodeMCU ESP8266 in integrate system absence with cloud -based database for increase accessibility. Research by Raditya, (2024)also confirms that use RFID technology can increase efficiency time and reduce need manual documentation. However ,Safi'ie et al, (2019) take notes that success system it really depends on the quality device hard and ability integration with other systems.

Although various study has conducted, research This give contribution new with integrating IoT and RFID in One designed system For fulfil need specific modern organization. With utilise technology latest such as cloud computing and web- based platforms, systems This offer superiority in matter scalability and flexibility. Susilo (2022) shows that integration with Google Sheets you can be one of approach innovative in attendance data management in real-time.

Study This aiming For develop system absence IoT based which uses RFID technology for take notes presence employee with more effective and efficient. System This expected can increase data accuracy, reducing time management administration, and provide reports that can accessed in real-time. Research this also aims For give guide implementation that can adopted by various type organization.

With refers to various relevant references, research This will to expose steps design system, analysis need technical, and evaluation performance based on studies cases that have been conducted. Research This contribute to the development system modern absence that is not only effective but also adaptive to change technology in the future.

2 Materials and Method

Study This use approach quantitative and methods descriptive. Descriptive method aiming For describe or describe phenomena that occur. In research This is the observed phenomenon is system application absence RFID- based application used in Indah Photo Studio South Lampung. This done with use card clever or card membership employees. Research methods This is with collecting research data, how to get data, model architecture and analysis need system.

In research this, research data obtained with research data sources. Research This aiming For apply system absence efficient and accurate employees through utilization integrated RFID and IoT technology with web and mobile applications. Research data collection techniques is with quantitative data collected directly by researchers through various technique with the data collection process also involving some people who are made sample in study through activity survey, observation direct, study literature and interviews direct with resource person. All this data source considered as primary data because its accuracy is not in doubt Again.

If you look at it from technique data collection, can done with interviews, observations, and studies library :

Interview

Interview study This used For collect data for researcher For do studies introduction use know problem that must be researched. Knowledge or belief personal, or at least report about self myself, is base from technique this data collection. Interview This done in a way structured and able

done Good through telephone or look at face.

Observation

Participation direct or observation direct are two categories observation in study this. Observation open and closed are two categories. Observations can also be done with technique structured and unstructured structured. Observation done For gather information about behavior informants and conditions others. The purpose of observation is For give description about What will studied in study This. The activities that occur and the people involved in them. This method ensure that researchers who do observation is at in reasonable conditions, not manipulated situation.

Book lesson

The researchers has investigate system attendance using *card Internet of Things* (IoT) *based RFID smart* for monitor existence workers. Here is a number of example study related Topic this : Research First, "System absence lectures based on the Internet of Things for effectiveness recapitulation absence students" discuss problem system absence faced manually at STMIK PPKIA with system absence lectures based on the Internet of Things (IoT) with utilise NodeMCU ESP8266 and Radio Frequency Identification (RFID). Another study, " Designing Employee Attendance System Web Based ," creating application running attendance in real-time.

System Model Architecture

Because of the analyst must understand specification or condition system, design process system only done after need fulfilled. Some things to do done during this process is architecture system, design data flow, and database design.

Architectural Design Model

One of design key in design system information is design architecture system , which provides description general about system. Very important For do design this is for design system information and analysis need study can each other related. Architectural design the system also shows How system system information functioning together and exchange data. System old flowcart using manual attendance, but absence RFID based has updated so that the attendance data employee no mistake. System new and old are illustrated here :

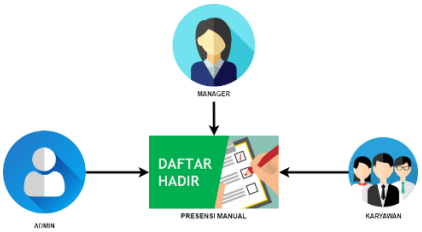


Figure 1. Manual Attendance Framework

Based on design legacy system model architecture, admin or staff provide paper manual attendance then employee fill in absence with enter time entry and time back, no only enter time entry and departure but employees also sign attendance and going home work. After presence employees, managers are also present, but only sign the hand that only For inspect presence employees. After that, admin returns paper attendance and saving manual paper.

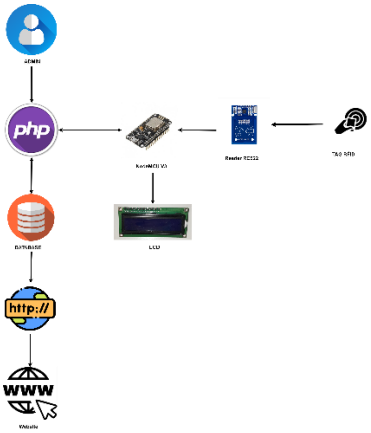


Figure 2. System Model Architecture Web Presence

Based on design web admin system model architecture, RFID tags will read on RC522 and then LCD will read whether RFID cards have registered or not yet, after that PHP program can accept and execute order from the admin website. Next, the PHP command connects the website to the database server. The database server processes PHP commands and perform CRUD queries (create , read, modify, and delete) data on the PhpMyAdmin database above admin request. RFID reader and temperature sensor data sent to the database server via HTTP protocol.

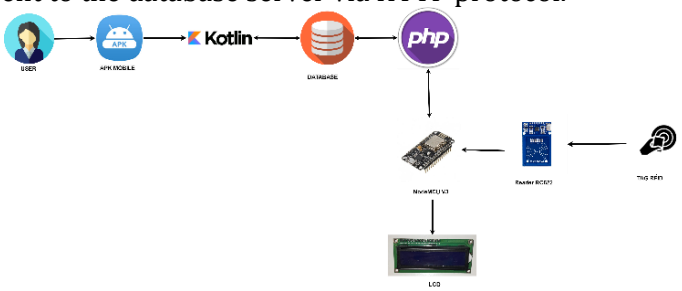


Figure 3. Architecture System Presence Mobile

Based on design system model architecture user mobile, RFID tags will read on RC522 and then LCD will read whether RFID cards have registered or not yet, after that PHP program can accept and execute order from the admin website. Next, the PHP command connects the website to the database server. The database server processes PHP commands and perform CRUD queries (create, read, modify, and delete) data on the PhpMyAdmin database above admin request. NodeMCU RFID reader and sensor data sent to the database server via HTTP protocol. After that, the database will integrate kotlin via API and then will displayed whether employee the present or No.

System design

Application absence employee RFID based requires integration RFID technology with system information. This will enable management processes presence employee optimized and optimized while ensure data integrity and security. Application absence employee RFID based shows steps systemic For manage the attendance process employees. Send RFID signal to card, data processing by the microcontroller, and saving the data to in an online database that can accessed is all step in this process .

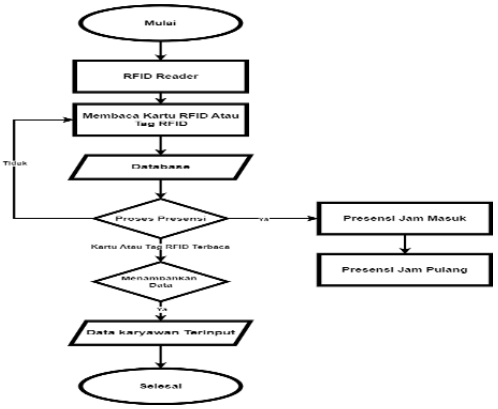


Figure 4. Flowchart System

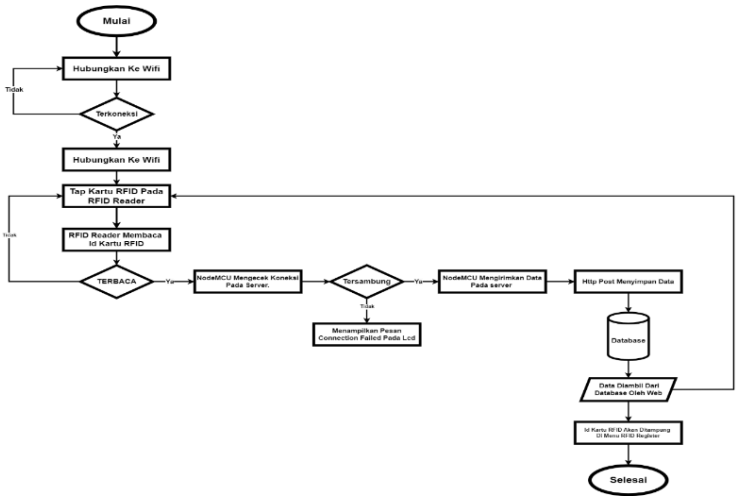


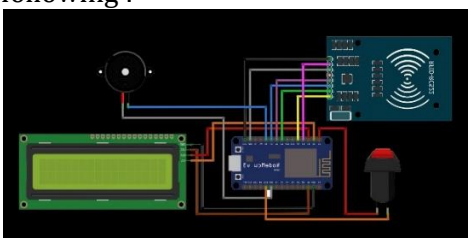
Figure 5. Flowchart or New Card Registration Form

For explain flowchart application absence employee RFID based , you need understand stages systemic and logistics attendance process management employees. Here explanation additionally :

a. Usage : Database data can be used For count presence employees, manage working hours, and optimize attendance processes.
b. Delivery Signal : The Process started with employee use RFID card, which is sent to module connected RFID reader to system.
c. Data Processing : Signals RFID cards are received and processed by the module RFID reader, which then send this data to NodeMCU, which functions as connector between RFID reader and server. If the data right, the database will keep presence employee.
d. Data Storage : Attendance data employee saved in the attendance database that can be accessed online after the server processes it. This is allow monitoring and management presence employees and effective working hours.
e. Usage : The data in this database can used For count presence employees, set working hours, and optimize the attendance process.

After design systems and design For register taq or card new finished . Then distance test conducted reading RFID taq and data transmission test. System design device RFID hard consists of from green LCD 16x2 character, Microcontroller NodeMCU V3 or ESP32, MifareReader RC522, USB

cable, 5v active speaker buzzer, 5v micro USB adapter, box electronics, Jumper cables, RFID cards . Schematic design RFID circuit is as following :



Network Schematic

The circuit schematic connects several devices to the NodeMCU including an RFID, 16x2 I2C LCD, Pazio Speaker, and Push Button.

3 Results and Discussions

For know whether system absence IoT based RFID employee function or No functioning with good and also successful applie. Not only test about tool but test to Application. System This aiming For make it easier management absence employees. Use RFID and IoT technology in system capable reduce error recording and time required for the attendance process.

1. *Network RFID Components*

Result of device set implementation hard. Writer using ESP8266 device hard NodeMCU For control all device hardware and devices software connected to mobile web application This. Here This is implementation a series of device components hard :

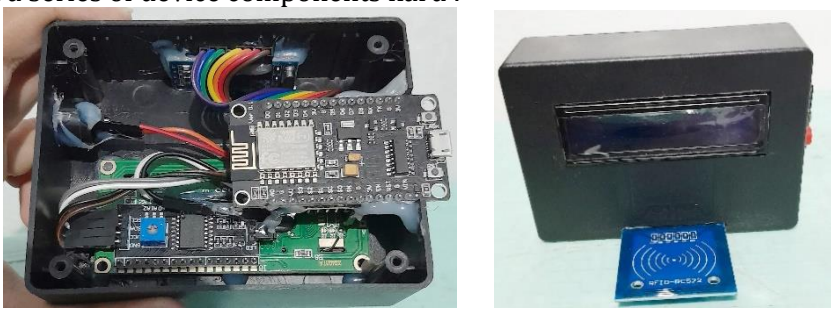


Figure 7. Hardware Component Network

2. *Implementation Software*

Implementation device soft in study This is integrated web application with IoT based mobile employee presence application with RFID technology. Web research application This intended for admins who can monitor presence employee whereas mobile application is intended For users, namely employee. Employee can monitor the progress whether absence that has been done has stored and read in the web application.

3. *Appearance Web Application*

Ways of working system this web application is when a employee to stick RFID card to readers, data in automatic read and saved in the database. Then, the data is can accessed through controlled web application directly by the shop admin. The web application has objective like make report presence employees. Implementation appearance web application has some menus are reserved from user interface (UI) and user experience (UX) designs that have been created as following :

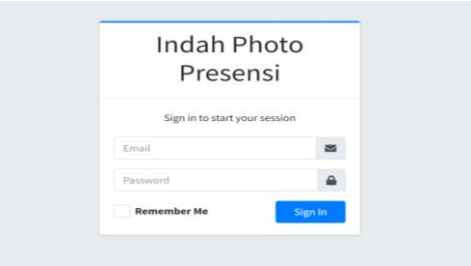


Figure 8. Main Menu Web

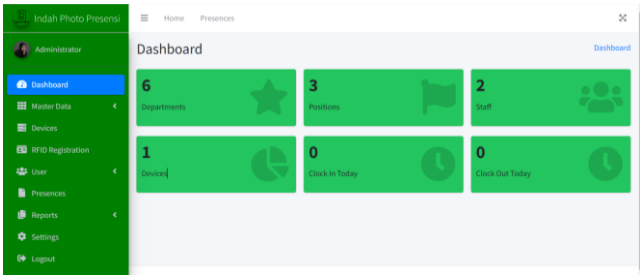


Figure 9. Dashboard Web Menu

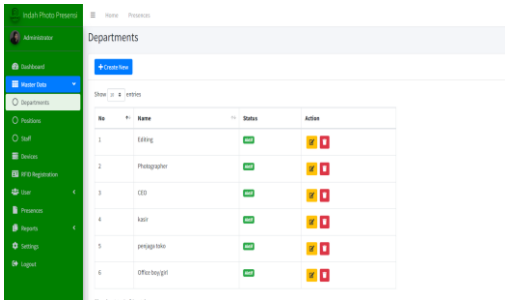


Figure 10. Department Web Sub Menu

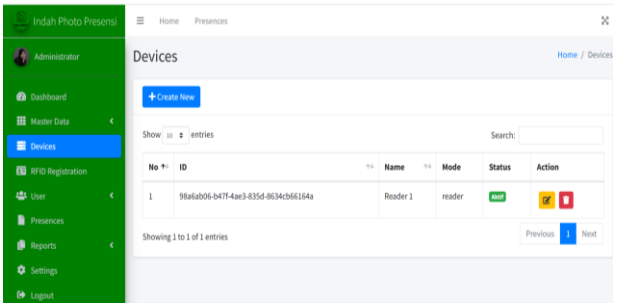


Figure 11. Device Web Menu

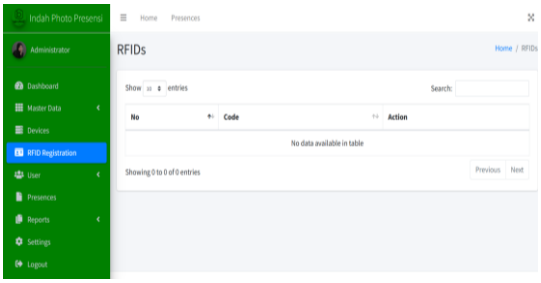


Figure 12. RFID web menu

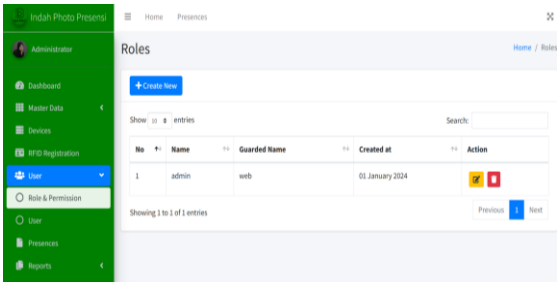


Figure 13. Role & Permission Sub Menu

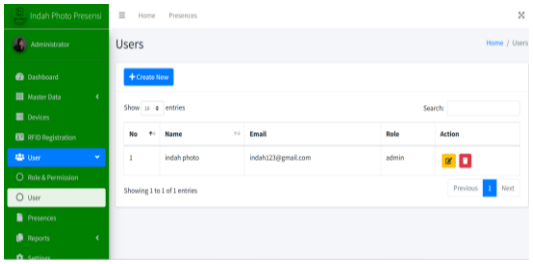


Figure 14. Sub Menu Users

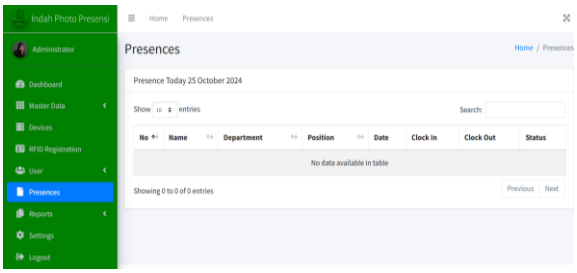


Figure 15. Menu Presence

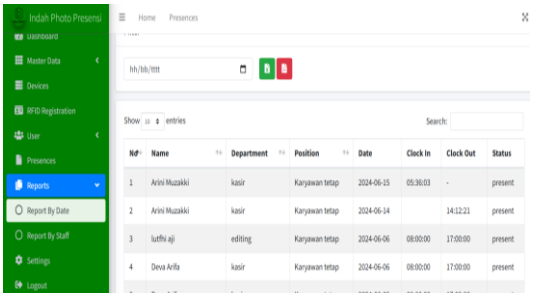


Figure 16. Sub Menu Report Based on Date

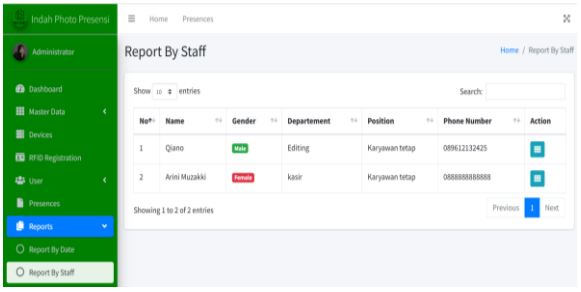


Figure 17. Sub Menu Report Based on Staff

On the login page there is a special email that has been provided registered in the database for the admin in charge answer For control presence employee. Login page does not only entering email, but also entering password that has been registered in the database. In the database can register more from one email or one admin registered.

4. *Appearance Application Mobile*

Mobile attendance application employee designed For facilitate the recording process presence employee in a way automatic and accurate. Employee mobile application integrated with database in web application that has been implemented. Implementation the mobile application aims for employees can control whether absence that has been affixed Already entered or Not yet.

The mobile application own several menus, namely login menu function for enter to application If Already registered. Registration menu functioning For register email and password for enter to the login menu. On the main menu, there are two menus, namely the attendance menu and the settings menu application. Sub menu attendance functioning For control whether employee enter or no, on the attendance submenu There are 2 menus, namely the attendance menu login and attendance menu Home. Settings menu functioning For set and change Name user application mobile employee.

Application This make it easier For do absence employee in a way accurate and efficient use RFID technology. Attendance data employee will recorded and saved in a way automatic in system. Sub-menu entry used For take notes time arrival employees on site work and sub-menu exit used For take notes time return employee from jobs. Here This is appearance mobile attendance application employee as following :

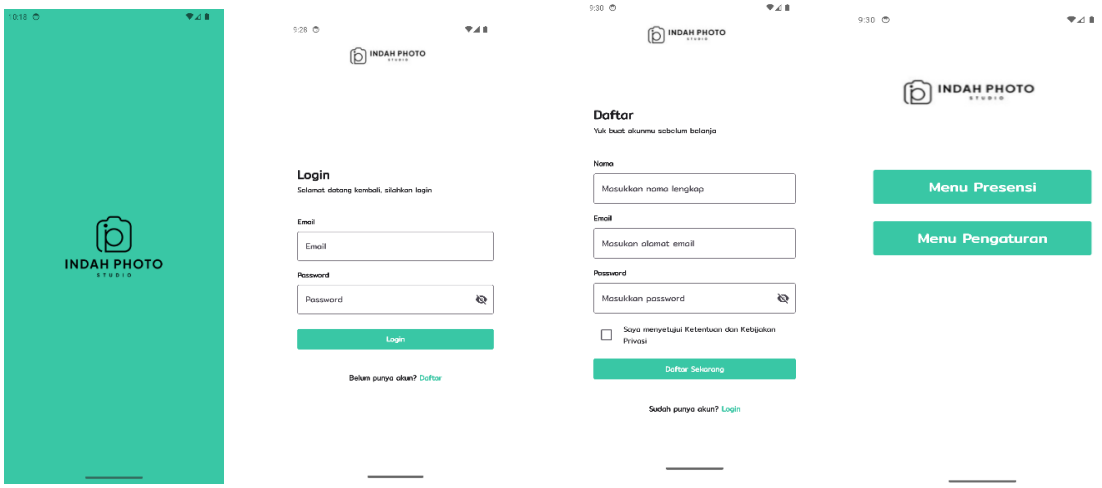


Figure 18. Spark, Figure 19. Menu, Figure 20. Menu, Figure 21. Main Menu Login Screen

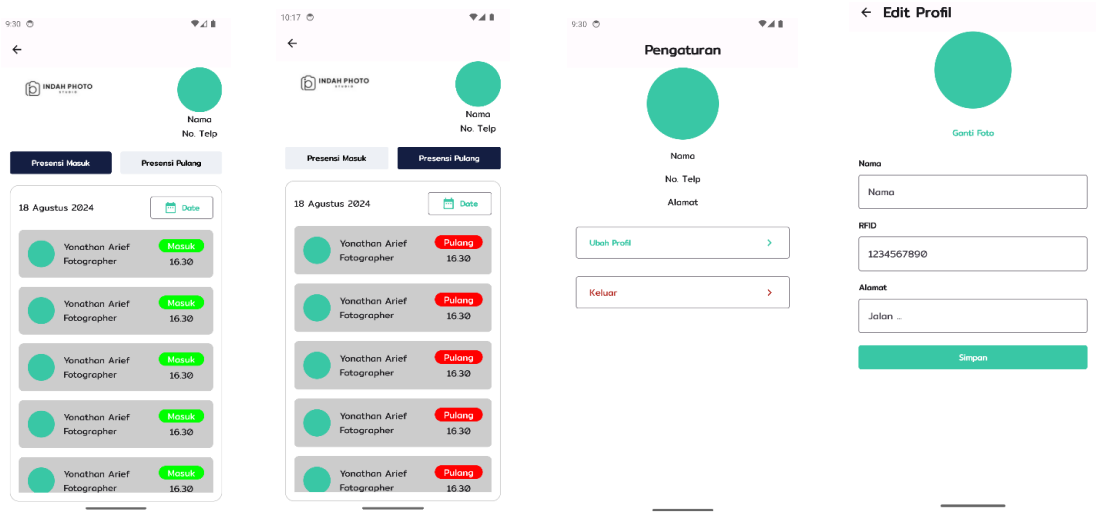


Figure 22. Menu, Figure 23. Menu, Figure 24. Menu, Figure 25 Menu Login Attendance Settings Home Profile Editing

5. Test Results Devices

In the application test results absence employee RFID based, will there are 2 results test, namely device test results hardware and device test results soft. Here This is explanation Application test results :

a. Test results device hard

Functional test results device hard show that every test always successful and unsuccessful There is problem. With Thus, the device hard used in condition Good Because writer has finish steps like driver installation, libraries, and wiring diagrams in accordance with reference related.

Table 1. Testing Devices Hard

No	Testing	Expected results	Condition
1	NodeMCU ESP8266 connected to wifi	NodeMCU ESP8266 can connected to the internet via WiFi.	Succeed
2	Embedded http client program in ESP8266 NodeMCU.	NodeMCU ESP8266 can connected to the web server.	Succeed
3	According to the wiring diagram, the RC522 RFID sensor is connected to microcontroller.	Microcontroller can connecting the RC522 RFID sensor.	Succeed
4	Integrated RFID tags or affixed with sensors.	The RC522 RFID sensor has ability For reading RFID tags.	Succeed
5	How the I6×2 LCD is connected to microcontroller.	With the embedded program , the I6×2 LCD can connect and display character.	Succeed
6	the RFID tag and card to the RFID Reader with distance not enough from 5 cm.	Data can read by the database.	Succeed

b. Test results device soft

Testing functionality device soft done For know whether system has fulfil hope and can walk with good. Test results show that system walk Enough good and just own a number of error technical in operation, but the problem can quick completed with start appropriate operation. Here This is table results testing device soft :

Table 2. Test Results Software

No	Testing	Desired result	Amount experiment	Condition		Percent
				Yes	No	
1	Log in using the username and password you have provided entered to in the database.	you can access page dashboard.	2	2	0	100%
2	Login with username and password that is not registered in the database	Login failed message appear	4	3	1	95%
3	People attach RFID tags or RFID cards that are not registered to RFID reader.	Show message notification on dashboard, identification that is not registered	4	4	0	100%
4	Administrator accesses employee data via the website.	Employee data registered in the system displayed on the Dashboard	4	4	0	100%
5	Admin presses knob For change employee data.	Showing form For change employee data, and when the admin presses knob send, data will be updated to the database.	4	4	0	100%
6	"Delete employee data " button is pressed by the admin.	Selected worker data will deleted.	4	4	0	100%
7	With using the time mode that has been set, user can No present (enter and leave).	Presence entering database and attendance in time mode displayed on the dashboard.	4	4	0	100%
8	Admin sees results presence via the web.	Featured in the recap menu presence	4	4	0	100%
9	Press the " Export " button presence " in excel and pdf.	Attendance data will exported to Excel and PDF formats.	2	2	0	100%

4 Conclusion

System absence based on the Internet of Things (IoT) which uses Radio Frequency Identification (RFID) technology has proven as effective solution For increase efficiency and accuracy recording presence employees. Based on implementation carried out, system This capable minimize

error human, improve transparency, and saving time in the administrative process. With IoT integration, system absence This No only take notes presence in real-time but also provides convenience access through mobile devices and web. Research results show that use technology This can become a reliable alternative For replace method manual attendance, at the same time give mark plus for organization in manage presence employee in a way more professional.

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