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Presence system using RFID and ESP32 CAM based on Internet of Things

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ABSTRACT

RFID enables fast and accurate user identification via radio waves, while ESP32-CAM, an ESP32 microcontroller-based camera module, adds a layer of security through visual verification. Optimizing the attendance process by reducing the time required for attendance recording, thereby reducing disruption to daily activities. The RFID and ESP32Cam Attendance System Based on the Internet off things "is by attaching the RFID card in front of the RFID reader. The RFID reader will read the unique ID contained in the card. The ESP32-CAM connected to the RFID reader will receive data from the RFID card. The ESP32-CAM will process this information and record the employee's entry or exit time. The ESP32-CAM will use an internet connection (Wi-Fi or cellular) to send employee attendance data to Google Sheet as a storage for attendance data, such as: (employee ID, entry/exit time, and date) This allows overall attendance data management. Based on the results of the tests and discussions carried out, the tool that was made has been successfully tested and works well. From the tests that have been carried out, in order for the card to be read properly, the maximum distance of the card from the sensor is 3cm. The process of sending data to Spreadsheet takes an average of 4 seconds. The speed of sending also depends on the speed of internet access. Esp32 CAM works well in sending photos to Google Drive The author hopes that this tool can be developed further by using the website and adding fingerprint sensors and Face detection.

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1. INTRODUCTION

The development of technology today is very rapid in various fields, especially in the field of electronics. The advancement of technology makes Electrical Engineering practitioners always try to utilize existing technology to continue to innovate to make human life easier [1]. The absence of company workers or employees requires equipment to make it easier to monitor work hour activities as well as to facilitate the recapitulation of employee absences every month to obtain more efficient and accurate data [2]-[4]. This tool offers a solution by monitoring the absence of work hour activities more efficiently and accurately, as well as facilitating the recapitulation of worker or employee data in a company. The integration of Radio Frequency Identification (RFID), ESP32-CAM, and Internet of Things (IoT) technology offers an innovative solution to overcome these problems [5]-[7].

RFID enables fast and accurate user identification via radio waves [8], while ESP32-CAM, an ESP32 microcontroller-based camera module, adds a layer of security through visual verification. Previous research has been conducted on fingerprint-based attendance, but there are still shortcomings in this tool, namely the failure to scan fingerprints, caused by wet or dirty fingers [9]. The next study with an IoT-based RFID attendance system using NodeMCU ESP8266, the results of the test that has been carried out, RFID

reading was successfully carried out at a distance of 3-4 cm [10]. Many types of cards can be read by the RFID Reader, because the card has a frequency of 13.56MHz. The data obtained from reading the RFID in the form of a Tag code is successfully stored in the database. However, there are still shortcomings, namely the vulnerability to fraud, for example by entrusting the card to a friend, because no one knows who actually attached the card.

Nowadays, many people choose to use an attendance system using fingerprints, but there are still shortcomings, namely the many fingers that stick to the attendance process considering the Covid-19 case a few years ago. For this reason, we are advised to reduce physical contact and there is a failure in scanning fingerprints. For this reason, the author prefers an attendance system using RFID (Radio Frequency Identification), because RFID offers several advantages as an attendance system compared to other methods such as fingerprints, facial recognition, or palm scans [11]-[13]. The RFID system is faster and more convenient to use, because employees only need to bring their ID cards close to the scanner, without having to touch the device or wait for a longer scanning process. In addition, RFID is more durable and requires less maintenance than biometric systems that may be affected by physical changes such as wounds or dirt on the fingers, facial changes, or skin conditions. RFID is also more flexible because it can be integrated with building security and access systems, thus providing a more comprehensive solution for employee attendance and security management. In order to anticipate fraudulent attendance using the method of entrusting ID cards to colleagues, the author added an ESP32-CAM module. This module can capture employee facial images in real-time, process the data for facial recognition, and send it to a central server via a Wi-Fi or Bluetooth connection to find out who attached the ID card when checking in..

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2. METHOD

The methods used in this study are hardware preparation, tool making, software program making and tool testing. The components and materials used in this study can generally be seen from the blog diagram in Figure 1.

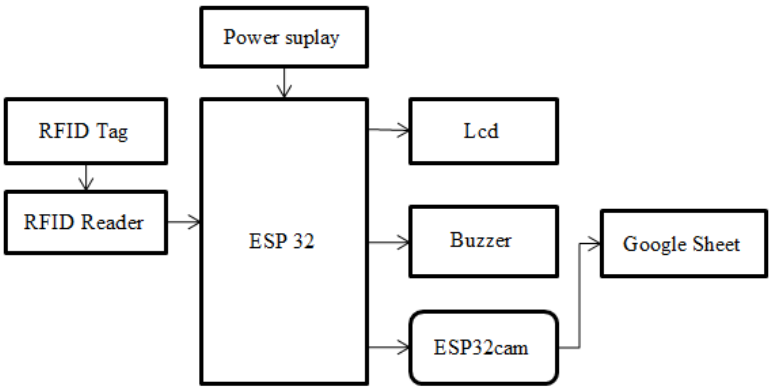

Figure 1. Block Diagram

The block diagram above illustrates the composition of the material structure used in this study. This device utilizes the Esp32 Microcontroller as a controller of all connected components, the ESP32 also receives data from the RFID Reader which will be sent to the Web Server, this component also gives commands to other components according to the commands from the program created on the Arduino IDE. The Power Supply functions as a power source for the microcontroller and modules in the blog diagram because the output voltage of the power supply is 12 volts, it must be reduced to 5 volts using a stepdown module.

The ESP32-CAM here functions to take pictures of the faces that are taking attendance, then send the image data in jpeg format to the Web Server. The ESP32-CAM is a development board that combines the ESP32 microcontroller, camera, and WiFi/Bluetooth module. The ability to take pictures with facial recognition and detection is one of the open source features of this microcontroller. To take advantage of the built-in libraries and features of the Arduino platform, a microcontroller can be installed in it. The ESP32-CAM is one of the microcontrollers that has additional features, such as a microSD slot. The ESP32CAM module has two sides: a removable camera module that sits on top of the device, and a rechargeable microSD and flash for use in low-light conditions. The ESP32S chip, male I/O pins, the module's internal antenna, and an external antenna connector.

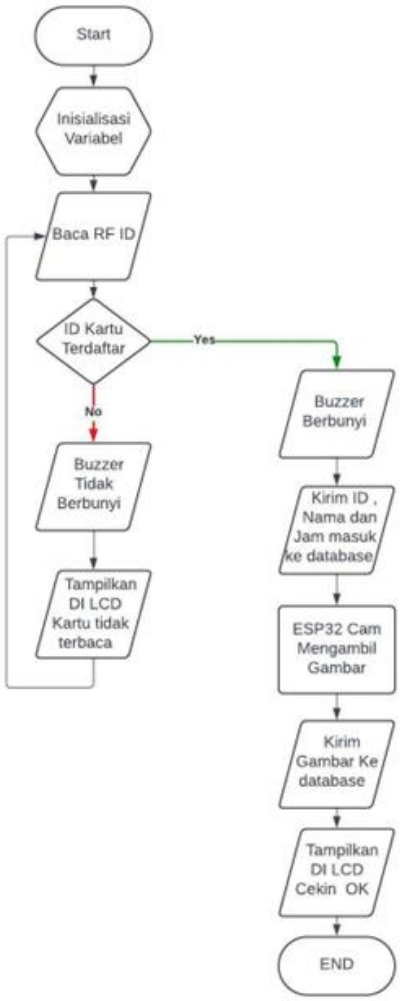

Figure 2. System flowchart

Figure 2 provides a detailed explanation of the system workflow with a Flowchart as a visual representation. The initial step is variable initiation, namely all components are activated and prepared so that they are able to run system operations. Figure 3 shows the circuit between components used in this study. Where in the wiring can be seen the components connected according to the data sheet on the component. The components in the circuit diagram above are in accordance with the blog diagram of the tool design.

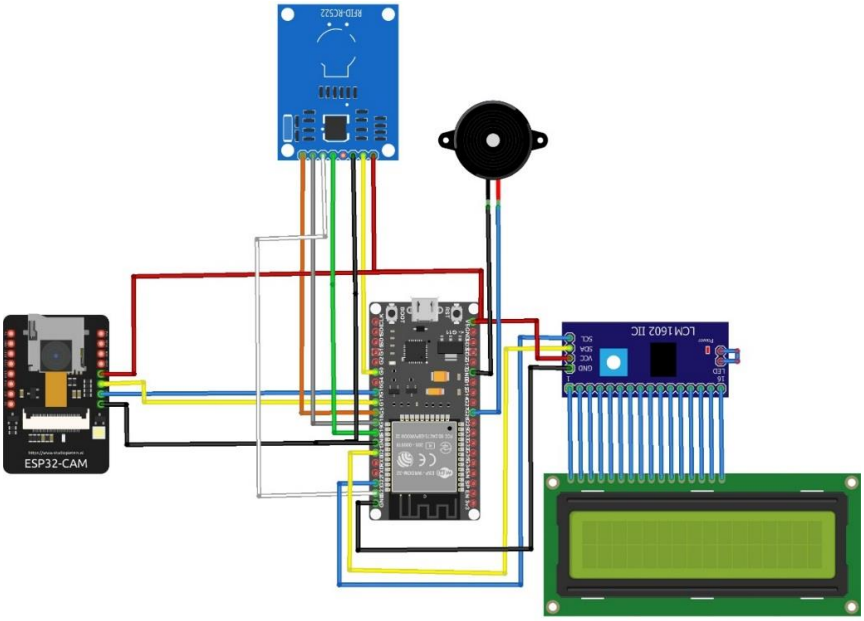

Figure 3. Circuit Schematic

3. RESULTS AND DISCUSSION

The testing was started with testing on the RFID sensor. The RFID sensor module is a module used to read the ID on the RFID card. RFID cards have unique IDs so that each employee has a card with a different ID. The tests carried out are as shown in Figure 4.

Figure 4. RFID Card Reading Test

Based on the tests carried out as in Figure 4 above, it can be ascertained that the module works well in reading RFID cards. Testing is done by reading the ID on 3 cards owned by the user. The results of reading the card ID can be seen in Table 1.

Table 1. RFID reading

Distance	Card 1	Card 2	Card 3
6 cm	Can not be read	Can not be read	Can not be read
5 cm	Read	Can not be read	Can not be read
4 cm	Read	Read	Can not be read
3 cm	Read	Read	Read
2 cm	Read	Read	Read
1 cm	Read	Read	Read
0 cm	Read	Read	Read

From the test results in table 1 that have been carried out from the three cards that have been tested, it can be seen that each card has a different read distance, this is due to the quality of the Radio Frequency embedded in the card. From the tests carried out, it can be concluded that the card can be detected properly, it is better if the card is attached a maximum of 3 cm from the device. The next test is the Esp32 Cam Camera Test. The ESP32 CAM camera functions to take employee photos when doing attendance. The photos taken are then sent to Google Drive storage. To ensure that the camera is functioning normally and properly, testing is carried out by viewing the display results from the ESP32CAM camera. The results of the ESP32 CAM camera can be seen in Figure 5. From the test shown in Figure 5, it can be concluded that the camera is functioning normally so that it can be used to take pictures of employees when taking attendance.

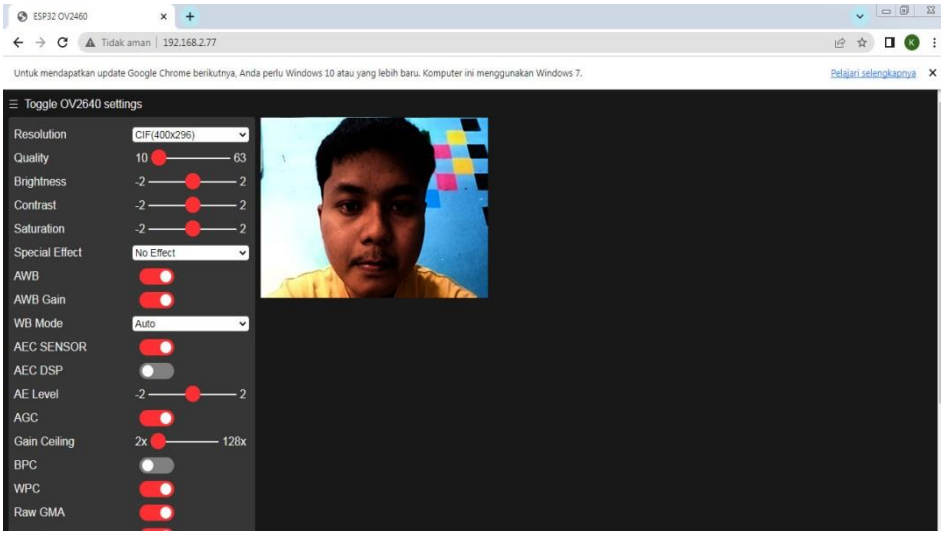

Figure 5. ESP32 CAM Camera Testing

4. CONCLUSION

After designing and testing, several conclusions can be drawn, namely: the tool that was made has been successfully tested and works well. The card can be read properly, so the maximum distance of the card from the sensor is 3 cm. The process of sending data to Spreadsheet takes an average of 4 seconds. The speed of sending also depends on the speed of internet access. Esp32 CAM works well in sending photos to Google Drive.

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