Design and Build an Attendance Information System Based on ESP8266

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Abstract - Along with technological developments, attendance management in various institutions is becoming increasingly important to increase efficiency and data accuracy. This research aims to design and build an ESP8266-based attendance information system that can facilitate the process of recording attendance automatically and in real-time. This system utilizes the ESP8266 module as the main component for wireless communication, which is connected to the server via a Wi-Fi network. The attendance process is carried out using RFID (Radio Frequency Identification) which is integrated with the ESP8266, so that attendance data can be directly sent and stored in a database in real-time. The method used in this research is the Research and Development method with 4D development design (Define, Design, Develop and Dessimate). This system is also equipped with a web-based user interface that allows monitoring and managing attendance data easily and accurately and is easy to process. The results of implementing this system show that the ESP8266-based attendance information system can increase the efficiency of attendance management, reduce manual errors, and make it easier to access attendance data quickly and accurately. It is hoped that this system can be implemented in various environments within each institution to improve the overall attendance management system that is good and in accordance with needs.

Keywords—Attendance Information System, RFID, Database, ESP8266, Internet of Things.

I. INTRODUCTION

The change in the way data is delivered from devices to the cloud and from the cloud to end users is represented by the Internet of Things (IoT). In its early evolution, IoT was known as the “Internet of Computers”; later changed to “Internet of People”; and recently, with the rapid development in the ICT field, IoT is known as the “Internet of Things” [1]. Internet of Things (IoT), which is a new era of computing in the digital world, aims at the development of many smart devices that will support various applications and services [2]. IoT, the biggest emerging trend in technology, has launched an unprecedented information revolution (Nord, Koohang, & Paliszkiewicz, 2019) [3]. It integrates elements such as temperature, weight, stickiness, busyness, contamination, object area, and ductile vital signs with a standard or hosted Internet edge structure. Natural checking is a fundamental IoT application that requires monitoring situations and collecting data for practical action in the moment. Electronic gadgets can talk to each other thanks to a technology called the Internet of Things (IoT) [4].

DOI: 10.24036/int.j.emerg.technol.eng.educ..v1i1.5

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Received: 06-08-2024
Revised: 13-08-2024
Accepted: 04-10-2024
Published: 06-10-2024

Currently, the IoT phenomenon is increasing rapidly among academics, industry and the wider community, this is a new phenomenon in the world of information technology [3]. The Internet of Things is a new paradigm shift in the world of IT. The phrase "Internet of Things" which is also known as IoT was created from two words, namely the first word is "Internet" and the second word is "Things" [5]. The Internet of Things is an emerging topic that has technical, social, and economic importance [6]. Internet of Things technology has attracted the attention of a large number of researchers in computer science and other disciplines, both scientific and human, due to its importance in various areas of life, especially education, due to the important services it provides to most educational institutions. Given the importance of the subject, researchers chose to study the Internet of Things, clarify its applications, demonstrate its importance in education, and identify students and professors as the focus of the educational process [7].

IoT = People + Physical Objects (sensors, controllers, devices, storage) + Internet [8]. IoT or “internet of things” connects physical devices, vehicles, and various industrial objects embedded with sensors, software, and connectivity to exchange data with other devices and systems over the internet.

This technology enables devices ranging from simple sensors to complex systems that can control other devices, analyze data and make decisions based on that data. Various industries such as manufacturing, transportation, healthcare, and agriculture use IoT to improve efficiency, safety, and productivity [9].

IoT is a combination of various computing and connectivity trends that have developed over several decades [10]. By using appropriate sensors and communication networks, these devices can provide valuable data and make it possible to

offer a variety of services to society [11]. IoT is not only revolutionizing our social lives, but also has the potential to add another dimension by enabling intelligent learning using intelligent environments to increase self-awareness, skills and knowledge of learners [12].

The industrial revolution 4.0 is marked by technological developments, one example of this technological development is the Internet of Things (IoT) [13]. IoT is a concept where a device is integrated with technology such as sensors and software aimed at communication systems, control systems, connectivity and data exchange through other devices as long as the device is connected to the internet network.

One of the microcontrollers that is equipped with IoT is NodeMCU. NodeMCU is an open-source firmware and development kit that helps in developing IoT-based application systems. NodeMCU was created to make it easier to use advanced application programming interfaces (APIs) for IO hardware. APIs can help reduce the amount of time spent configuring and manipulating hardware. NodeMCU has the advantage of being programmable in various programming languages and with an open source IDE [14]. NodeMCU is an open source LUA based firmware developed for the Espressif ESP8266 wifi chip. NodeMCU firmware comes with ESP8266 Development board/kit. A large number of studies were conducted using NodeMCU, some of which are listed below [15].

The extensive development of IoT itself has resulted in various products that can be combined with each other, such as the combination of NodeMCU and RFID. RFID technology, which stands for Radio Frequency Identification, can be a powerful tool in helping manage attendance. A powerful tool in helping manage attendance. RFID technology has been applied to solve the problem. RFID is an automatic identification technology used to retrieve from or store data onto RFID tags without physical contact [16].RFID is a technology that is used to collect information automatically by radio frequency data communication between a mobile object and an RFID reader, to identify, categorize and track them. They are most commonly referred to as tag and reader respectively [17].

RFID tags, also known as transponders, are small devices that can be attached to an object so that the object can be identified and tracked. The tag consists of a microchip, an antenna, and a substrate or encapsulation material. The microchip stores data while the antenna transmits and receives data. Microchips and antennas attached to the substrate are referred to as inlays [18].

The problems that occur include how the effectiveness of the attendance information system can increase the efficiency of recording attendance, and how to integrate this information system with existing systems, so that from the problems currently being faced, various solutions can be understood to be able to solve them, so that they can be resolved properly. .

The emergence of various new technologies is a solution in this case, namely by utilizing technology combined with several pre-existing systems so that it becomes a more complex innovation in solving every existing problem. This extraordinary development is of course used as a form of effort to create better conditions, apart from that it can be used as a form of innovation from the development of more advanced and better technology, so that it can create a system that can help human needs and simplify the process.

Many efforts have been made to increase comfort and security when taking attendance, especially the current use of RFID which is equipped with cards as input which will automatically be read by the radar so that it can create a novelty that is more interesting and more advanced, so that this can become a Several advantages of a system design are currently being pursued. Apart from that, with this utilization it is hoped that the latest things and errors that generally occur can be resolved and can run well..

II. METHOD

This development method uses a 4-D development model as its methodology [19]. This research refers to the 4-D (Four-D) development model developed by Thiagarajan, Semmel, and Semmel (1974). The steps for the 4-D development model according to Thiagarajan, et al (in Trianto, 2012: 232) contain four stages of the 4D model, namely, Define, Design, Develop, and Disseminate [20]. The general aim of this research is to develop innovative learning strategies.

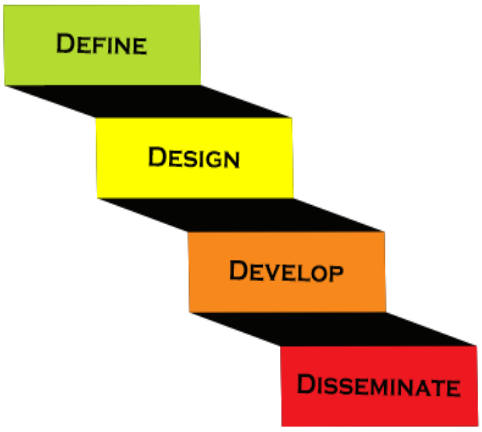

Fig. 1 4D Development Method

Based on the design image above, this research process has 4 stages. The first stage is define, namely determining and defining student needs to support the learning process. The second stage, design, is designing the learning tools that will be created. The third stage, develop, is producing and developing products that have been declared valid and practical [21].

A. Blok Diagram Sistem

System design and creation begins with creating a block diagram to clarify the overall system concept. The block diagram is shown in Figure 2 below.

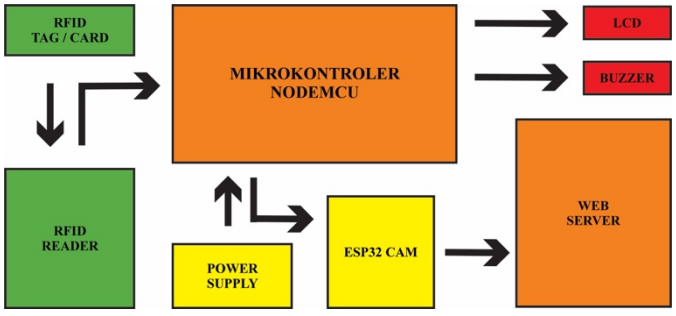

Fig. 2 Blok Diagram Sistem

Based on the block diagram that has been presented, it can be explained that there are several parts which are divided into input, process and output. Rfid tag/card: is a device that stores identification information and can be read by an RFID reader. These tags usually contain a unique number associated with a particular object or individual. RFID readers are devices that read information from RFID tags. This tool uses radio waves to communicate with the tag and retrieve the data stored in it. This microcontroller acts as the brain of the system. Nodemcu is an esp8266 based module that has wifi capabilities. This microcontroller manages communication with the RFID reader, controls the LCD display, activates the buzzer, and communicates with the web server. The power supply provides power to the system. Microcontrollers and other components require a stable power supply. The LCD screen displays information such as the identification number on the RFID tag. Users can view this data visually. The buzzer provides audio feedback, for example when an RFID tag is detected or when there is a problem in the system. The web server allows remote access. Users can access data from the system via a web interface. The system can also send data to a web server, such as attendance records. The esp32-cam adds camera capabilities to the system. With esp32-cam, you can take pictures or videos and send them to the server..

B. Flowchart Sistem

The design and creation of the system is continued with a flow diagram to clarify the overall system concept. The flow diagram is shown in Figure 3 below. The flow of the system being designed will be displayed in the form of a flow chat or flow diagram. A flowchart is the flow of a program or system procedure being built which will be displayed in chart form [22].

In system design, it will be explained how the system works. In the design, it is explained how the NoceMCU ESP8266 can process data from the input of the working system to the output that appears in the database. To design a system, a flow diagram will first be created to describe the processes that occur in the system.

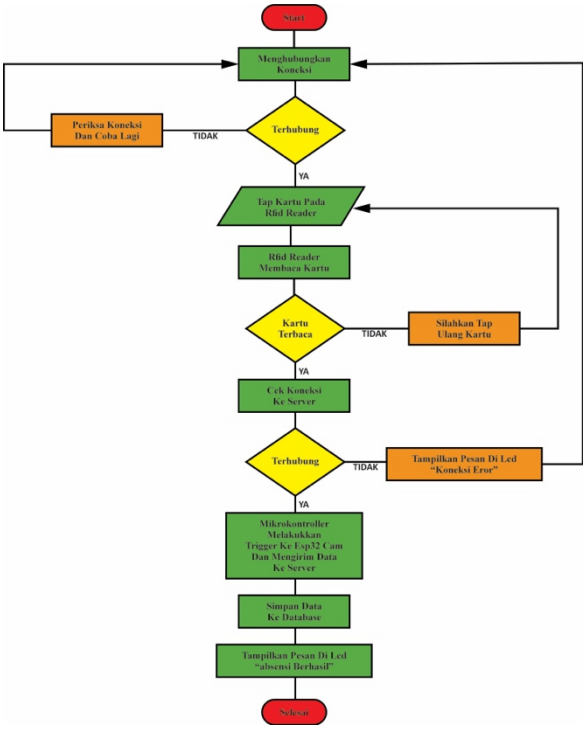

Fig. 3 Flowchart Sistem

C. Hardware Casing Design

The Hardware Casing Design functions as a place to install and place other components as shown in Figure 4 below.

Fig. 4 Hardware Case

The casing is the outer part that protects the internal components and provides structural support. The casing functions to protect internal components from dust, moisture and physical damage. The casings that are often used are acrylic and aluminum as the main materials to protect computer components, this is because many users pay more attention to visuals than the use of the material itself [23].

D. Circuit Schematic

Circuit schematic designs are used to illustrate how all components are interconnected and interact in a system as shown in Figure 5 below.

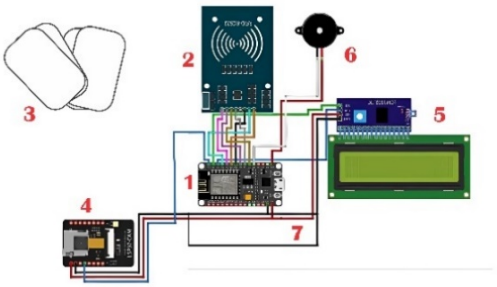

Fig. 5 Circuit Schematic

This circuit schematic was created to be able to see how this circuit system can be interconnected and interconnected, so that it can determine what kind of program will be integrated so that these components can run well and normally. In this case, efforts are made so that this circuit can run as expected, because a system will not all run smoothly, there will definitely be some errors, by determining this circuit scheme it will help a little in overcoming errors..

III. Result And Discussion

After the tool is completed, the designed tool is tested both in terms of software and hardware to determine the success of the tool being designed and compare it with the desired specifications. During the process of making electronic circuits, all the hardware used needs to be tested first before it can be connected to form a complete system.

Hardware testing is performed to ensure the hardware is functioning properly, RFID Sensors are tested, ESP8266 NodeMCU Connections are tested as part of this testing. Overall in terms of performance and results. The tool is made according to the system design. The design of the tool is arranged in such a way that errors do not occur when taking measurements.

This test was carried out to prove the correctness of the MFRC522 specification which states that it can take readings with a maximum distance of 50mm (NXP Semiconductors, 2007). Apart from that, this test also aims to determine the effect of obstacles on the maximum RFID reading distance.

A. Result

Figure 6 shows the form of a tool that has been designed and made, there are various components that have been integrated and are ready to be used, there are several components that look like a camera feature on one of the components and a screen as an information display.

Fig. 6 Box

The position of the components determines the appearance, because components that are well arranged and neat can add a better and more attractive appearance, this is also part of the result of thorough and orderly preparation. The correct position of components can minimize space, so that components can be arranged in an orderly manner and not messy.

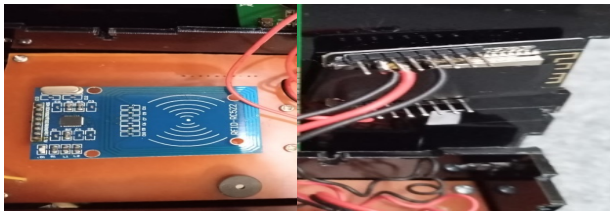

Fig. 7 Position of rfid reader,lcd and buzzer

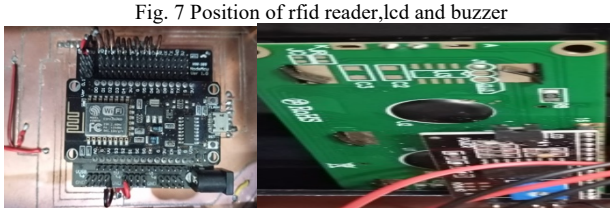

Fig. 8 Hardware

These components are placed according to positions that have been measured and determined previously so that they can be organized according to the capacity of the casing being made, so that everything can be closed neatly and attractively and is not messy which makes the components not well organized.

The results above were obtained from installing components directly into the casing and equipped with connectors that allow the components to function immediately when the device is used. This directly connected system allows users to more easily apply a system that is ready to use.

B. Discussion

Tool testing is carried out to see the results of several tests carried out to ensure the components and materials used work well, after which adjustments are made according to the needs of the tool to be used.

This aims to test whether the device used is in accordance with what is needed to operate the tool. Apart from that, this test also aims to ensure that the device is working properly and that no damage or errors will occur when the device is used later.

ESP32-CAM testing aims to ensure that the module functions properly and can meet the planned application needs. This testing process covers various aspects, including verification of network connectivity, resulting image quality, camera responsiveness to commands, as well as performance stability under different operating conditions.

Alat dilakukan untuk melihat hasil dari beberapa pengujian

Fig. 9 Trial

Testing rfid readers, rfid cards, rfid tags and lcd. The purpose of testing the rfid-rc522 sensor is to assess the overall card reading performance. This test will ensure that the rfid-

rc522 sensor can read and identify various types of rfid cards accurately and quickly.

This test aims to carry out optimal readings, such as displays, where the sensor can still function properly. Apart from that, the aim of testing the i2c 16x2 LCD is to ensure that this LCD display functions well and can be used optimally in various applications. This test aims to assess the quality of the character display on the screen, ensuring that each character is displayed clearly and without distortion.

TABLE I
RFID READOUT RESULT

No	*ID*	*LCD Status*	
		In	*Out*
1	WGHRWRH	Read	Read
2	C33A6211	Read	Read
3	F345A812	Read	Read
4	4334A8F7	Read	Read
5	33D33D36	Read	Read
6	53C7030	Read	Read
7	A3C8B111	Read	Read
8	E3D94736	Read a	Read

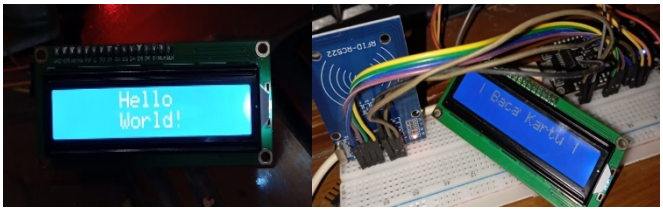

Fig. 10 16x2 lcd and rfid reader test results

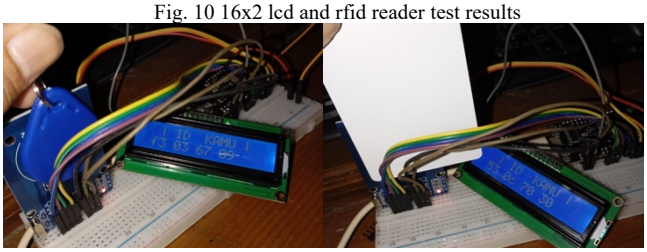
Fig. 11 trial rfid

Testing of the attendance database is carried out to ensure that this system can store, manage and access attendance data accurately and efficiently. This test aims to assess data integrity, ensuring that each attendance data entry is stored correctly and is not damaged. Attendance database testing is to ensure that this system can store, manage and access attendance data accurately and efficiently. This test aims to assess data integrity, ensuring that each attendance data entry is stored correctly and is not damaged.


Fig. 12 tes twebsite

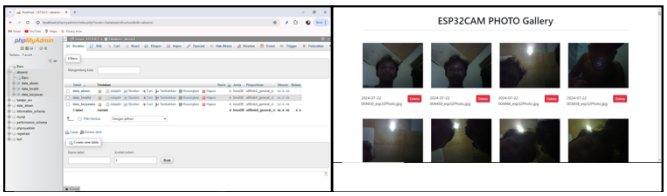

Fig. 13camera

All tests are carried out to obtain optimal results from each system that has been designed, this is part of the completeness of the system whether it is suitable for continued use or not.

The ESP8266 was chosen because of its ability to manage wireless connectivity which is an important element in this attendance system. Apart from the ESP8266, an RFID reader is also used to read identification cards used by users [24]. The main focus of software development is to ensure that each main function, such as reading RFID data, sending data to the server, and managing wireless connections, can run well. The system is designed to connect to a designated WiFi network, allowing the ESP8266 to send collected attendance data to the server via the HTTP POST protocol. Every time an RFID card is attached to the reader, the card ID data will be immediately read and stored temporarily before being sent to the server [25]

IV. CONCLUSIONS

Based on the results of tests carried out on the tool design in the ESP8266-based Attendance Information System Design and Construction project, several important conclusions can be drawn. 1. The ESP8266 module used together with the RFID sensor plays an important role in detecting presence in real-time. The Esp32 Cam used in this system serves as an additional identification feature that is very important to increase the security and validity of the data collected. The developed attendance web is used to manage attendance data efficiently and effectively, as well as display attendance reports in a comprehensive and easy to access manner. The Web Camera integrated in this system functions to display photos captured by the Esp32 Cam, thereby providing a more complete and accurate visualization. The server in this system acts as the main body responsible for storing and processing attendance data sent from the ESP8266 module, so that the data can be accessed and analyzed easily by system users.

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