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DESIGN OF A PROTOTYPE MONITORING SYSTEM FOR SCHOOL LIBRARY VISITORS USING RFID AND NODEMCU BASED ON THE INTERNET OF THINGS

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Article Info	ABSTRACT
	Monitoring the identity of library visitors is a very important part. Usually to monitor students who are diligent in visiting the school library by providing books or guest books, the purpose of this study is to record the identity of students who visit the library electronically, in the study describes the monitoring system for library visitors with internet communication lines, database storage media by using descriptive method. The design of this system consists of a library card, RFID, Nodemcu, 2 x 16 LCD, and a web as an application used to process visitor identities or as a place to display information in real time. The web application design uses the programming language HyperText Markup Language (HTML), Cascading Style Forms (CSS), Hypertext Preprocessor (PHP), Content Management System (CMS) using a MySQL database while the test results show that this system can work well, with the The school library visitor monitoring system using internet-based RFID and nodemcu can make it easier for employees to view and process the identity of library visitors
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1. INTRODUCTION

The development of technology is currently growing very rapidly so that it encourages many parties to develop or even create technology that makes human work easier. The field of information technology is one of the triggers for changes in human mindset to be able to obtain information quickly and accurately. Especially the need for a system that can provide the security that humans need at this time and along with technological advances in the field of education, the role of the library is very important to support the current learning process. this can be seen by the large number of visitors in the library, both school libraries and regional libraries and can result in various book collections being lost because the visitor data collection system used is still manual. Monitoring library visitor data is a very important part of the library. Usually, to monitor students who diligently visit the school library, visitors' books or guest books are provided. The visitor's book is a means to record data on visitors who come to the library. This visitor book is very useful to find out how many visitors or students who come to the library every day. It is also useful to find out how many students and students have an interest in reading. The visitor book system uses a large book as a medium for writing [1]. With the current problems, a library visitor monitoring system can be made by implementing NodeMCU and RFID using the PHP framework. Library website design to provide information about libraries that can be accessed via the internet.

2. RESEARCH METHOD

The method used in this research is descriptive method. Descriptive method is a method of researching a group of people, an object, a method that poses a problem by collecting data that is presented to describe the characteristics of a situation or object of research and draw conclusions to be made. In this study, several parts were developed, from the system image consisting of a card that functions as a visitor's identity, RFID to send data

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from a library visitor card which is then read by an RFID reader and then processed by nodemcu. The data that was emitted or sent earlier could contain a variety of information in the form of ID, name and other information. Nodemcu functions to receive and process input data from the RFID used in the system, besides that nodemcu also functions as a liaison between hardware and the internet network, the LCD on this system is used to display information, the internet as a media liaison between hardware and software, the database functions to store many identities such as member numbers, student registration numbers, names, genders, numbers Mobile, Address and Class, and web applications in this design function to display information in the form of data on the number of visitors and the identity of library members who have received member numbers who have registered. The system design can be seen in Figure 1 below: The database serves to store many identities such as student ID number, Name, Gender, Mobile Number, Address and Class, and the web application in this design functions to display information in the form of visitor data and the identity of library members who have received member numbers who have done this. registration. The system design can be seen in Figure 1 below: The database serves to store many identities such as student ID number, Name, Gender, Mobile Number, Address and Class, and the web application in this design functions to display information in the form of visitor data and the identity of library members who have received member numbers who have done this. registration. The system design can be seen in Figure 1 below:
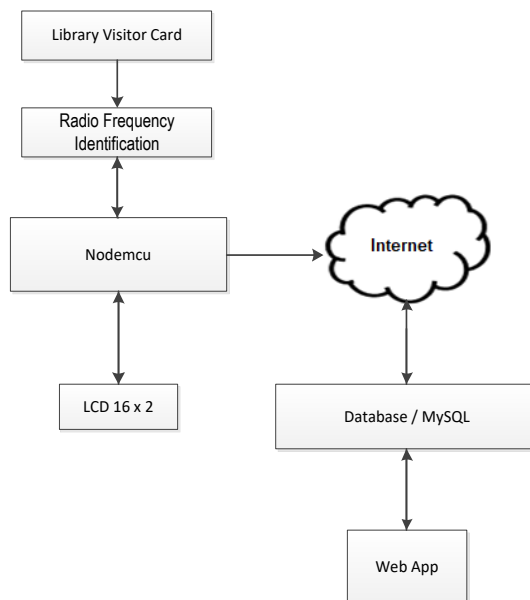

Figure 1. Proposed System Architecture

Based on Figure 2, the Use Case Diagram of the proposed system explains that there are 2 actors, namely students and library staff as follows:

a. Student

Actor: Student.

Brief Description: Register to the library section, in this case the library staff, to get a member number by using the student's library card.

Main Flow: Visiting the school library, scanning the library card to the visitor identification device that has been provided.

b. Librarian

Actor: Librarian

Brief Description: Open the website, login then check the identity of library visitors, see the identity of the member, register, check the member number and logout.

Main Flow: Open the website, then check the identity of library visitors, see the identity of library members, register if there are students who want to register as library members, process member identities, check member numbers, then logout.

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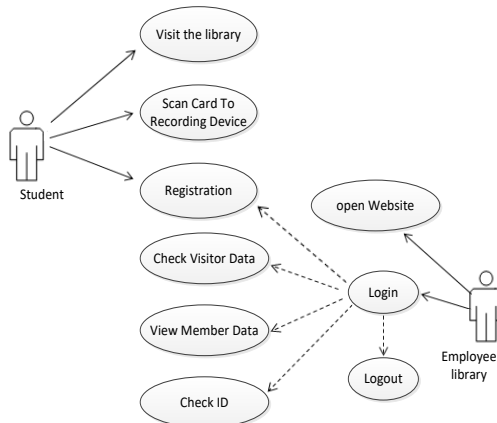

Figure 2. Use Case System Diagram

Overall, this tool is composed of important parts that are interconnected with each other, namely hardware and software These two parts must be in sync with each other so that the intent and purpose of making this tool is achieved and as expected. The hardware and software parts in this study consist of the following components:

1. **Library**. Libraries have an important role as a source of information, both printed and non-printed for users. Libraries exist in every government and non-government institution, both basic education, universities, institutions, and agencies. Talking about libraries, of course, we cannot separate from the function of print and online media as sources of information and learning for students and the general public that are valuable for decision making[2].

2. Internet of Things. According to the coordinator and support for global RFID-related activities and standardized Internet of Things (IoT) actions as a global network connection infrastructure, which connects physical and virtual objects through the exploitation of data capture and communication technology. The IoT infrastructure consists of the existing network and the internet and its development. It offers object identification, sensor identification and connection capabilities which form the basis for the development of independent cooperative services and applications, also characterized by a high degree of autonomy for data capture, event transfer, network connectivity and interoperability. According to the IEEE (Institute of Electrical and Electronics Engineers) Internet of things (IoT) is defined as a network with each object embedded with sensors connected to the internet network. IoT is all electronic devices that can be controlled remotely through internet communication. According to Yasha, IoT is a concept where certain objects are able to exchange data over a network without the help of communication between humans or humans with computer devices[3].
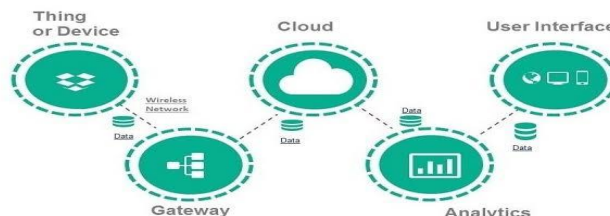

Figure 3. the concept of internet of things

The internet of things concept includes 3 main elements, namely: physical or tangible objects that have been integrated into sensor modules, internet connections, and data centers on servers to store data or information from applications. The use of objects that are connected to the internet will collect data which is then collected into "big data" to be processed, analyzed by government agencies, related companies, and other agencies and then used for their respective interests.[4].

3. NodeMCU. NodeMCU is an electronic board based on the ESP8266 chip with the ability to run microcontroller functions and also an internet connection (WiFi). There are several I/O pins so that they can be developed into a monitoring and controlling application for IOT projects. The NodeMCU ESP8266 can be programmed with the Arduino compiler, using the Arduino IDE. The physical form of the NodeMCU ESP8266, there is a USB port

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(mini-USB) so that it will make programming easier. NodeMCU ESP8266 is a development derivative module of the ESP8266 type ESP-12 IoT (Internet of Things) platform module. Functionally, this module is almost similar to the Arduino module platform, but what makes it different is that it is devoted to "Connected to Internet"[5].

Figure 4. NodeMCU ESP8266

4. RFID (*Radio Frequency Identification*). RFID is an identification method or technology based on radio waves (radio frequency). This technology is able to identify various objects simultaneously without the need for direct contact. Simultaneous means that the various objects are identified not one by one as is done in the identification of the barcode system. This RFID belongs to the category of Auto-ID (Automatic Identification) technology which includes barcode techniques, optical character readers, and biometric technology. But the other AutoID group still requires human intervention, although it is limited to capture the identity data, but this is not the case with RFID. RFID was developed as a replacement or successor to barcode technology[6].
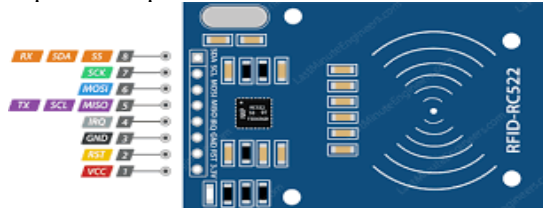

Figure 5. Radio Frequency Identification

5. LCD *(Liquid Crystal Display)*. LCD is an electronic component that functions as a display of data, whether characters, letters or graphics. In the market, LCD displays are available in the form of modules, namely LCD displays and their supporting circuits including ROM and so on. LCD has data pins, power supply control, and display contrast control[7].

Figure 6. LCD *(Liquid Crystal Display)*

6. Arduino Software. Arduino was created for beginners even those who do not have a basic programming language at all because it uses the C++ language which has been simplified through the library. Arduino uses Software Processing which is used to write programs into Arduino. Processing itself is a combination of C++ and Java. This Arduino software can accommodate various operating systems (OS) such as: LINUX, Mac OS, Windows. Arduino is not just a development tool, but a combination of sophisticated hardware, programming language and Integrated Development Environment (IDE). IDE is a software that plays a very important role in writing programs, compiling them into binary code and uploading them to the memory of the microcontroller. Arduino IDE software consists of 3 (three) parts:

a) Program editor, for writing and editing programs in processing languages. Listing programs on Arduino are called sketches.

b) Compiler, a module that functions to change the processing language (program code) into binary code because binary code is the only programming language understood by the microcontroller.

c) Uploader, a module that functions to enter binary code into the microcontroller memory[8].

7. PHP (*Hypertext Pre-processor*). PHP is a script that integrates with HTML and resides on the server (server-side HTML embedded scripting). With this PHP you can create a variety of web-based applications, ranging from simple web pages to complex applications that require a connection to a database. PHP is designed to be able to

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work with database servers and is made in such a way that the creation of HTML documents that can access the database becomes so easy. The purpose of this scripting language is to create applications where the application built by PHP will generally produce results in a web browser, but the entire process is run on the server[9].

8. **MYSQL** *(My Structured Query Language).* is a basic data relationship system or relational database management system (RDBMS) that is able to work quickly and is easy to use MySQL is also a networked database access program, so it can be used for multi-user applications (many users). MySQL is distributed free under the GPL (General Public License). Where every program is free to use MySQL but cannot be used as a derivative product that is closed source or commercial[10].

9. **HTML** *(HyperText Markup Language).* HTML is a markup language used to create a web page, display various information in an Internet web browser and simple hypertext formatting written into ASCII format files in order to produce an integrated display. In other words, a file that is created in word processing software and saved in the normal ASCII format so that it becomes a home page with HTML commands. Starting from a language that was previously widely used in the publishing and printing world called SGML (Standard Generalized Markup Language), HTML is a widely used standard for displaying web pages. HTML is currently an Internet standard defined and controlled for use by the World Wide Web Consortium[11].

10. **CSS** *(Cascading Style Sheets).* CSS stands for cascading style sheets, which are scripts used to manage website designs. Although HTML has the ability to customize the appearance of a website, its capabilities are very limited. The function of CSS is to provide more complete settings so that the website structure made with HTML looks neater and more beautiful[12].

11. **CMS** *(Content Management System).* CMS is software that was built specifically to create a store in the virtual world or what is often called eCommerce (MADCOMS, 2011:2) an application that is useful for managing the contents of a website. With a content management application, website administrators can manage all the content on their website. Website content can be in the form of various file types, such as text, photos, audio, video, documents, and all types of files that can be displayed on the website[13].

3. RESULTS AND ANALYSIS

Based on the design of the library visitor monitoring system for interface design, the results are in line, following the results of the display of interface pages from web applications and devices built:

3.1. Admin Login Page and Main Menu

in Figure 7 is the login page and the main menu display for library employees, this login page is the homepage on the website application display, while the main menu display of this page serves to see the number of daily visitors who are visiting, the number of members and the total visitors in real time.
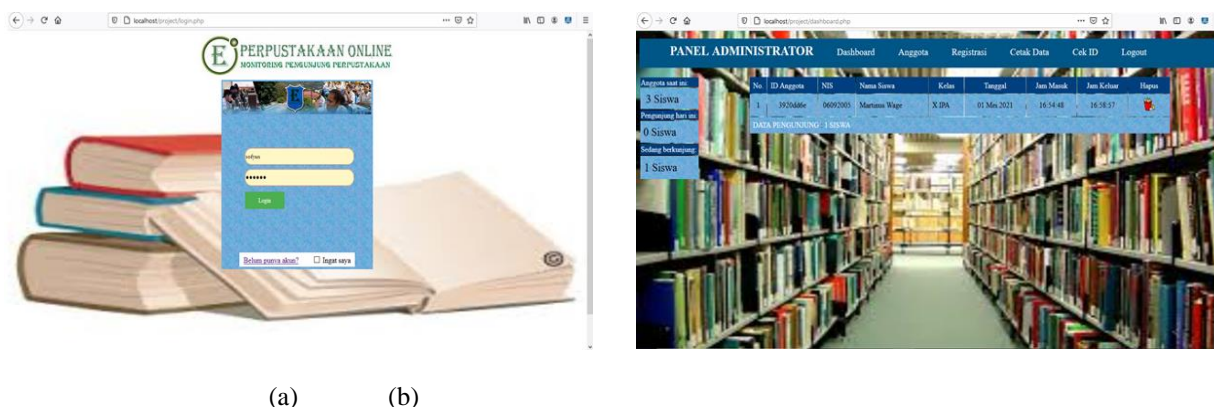

(a)   (b)

Figure 7 Admin Login Page and Main Menu
(a) Admin Login Page, (b) Main Menu

3.2. Display Recording Device

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In Figure 8 in the analysis of this system, when the recording device is given an electric voltage, the LED lights on the RFID and Nodemcu will light up as information that this device automatically gets an internet signal because it has been set to use a wifi username and password on the device, after the system is connected to the internet. then the RFID will work according to the instructions given, when the RFID detects the registered member card, the visitor's identity will automatically be sent to the server and displayed on the library website as information.
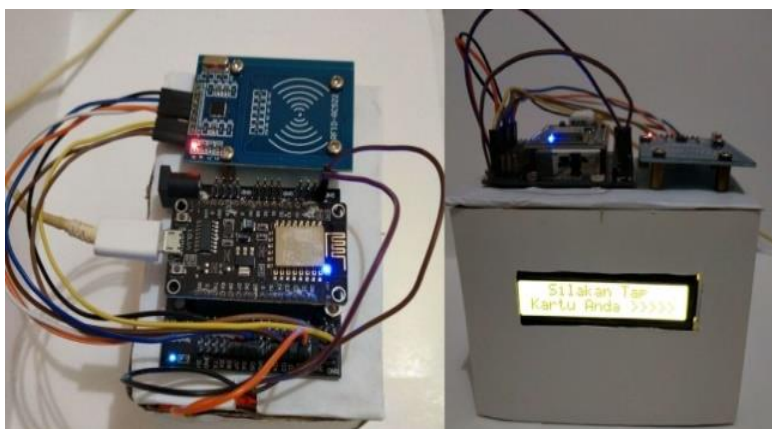

Figure 8 Display Recording Device

4. CONCLUSION

Based on the results of observations and descriptions of the results and analysis that have been described, the following conclusions can be drawn:

1. In the internet of things-based monitoring system for high school library visitors, there is hardware and software.

2. System This system has software in the form of a web application that can provide information on library visitors

3. With this recording device, it is easier for library employees to get the identity of library visitors.

4. Further research can use the android application to display information and apply a barcode scanner to the application to make it easier to get the identity of library visitors.

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