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DESIGN OF SMART LIBRARY BASED ON RFID AND ARDUINO FOR BOOK MANAGEMENT

[1] Muhammad Benny Chaniago, [2] Diki Nugraha, [3] Deden Maulana

Abstract— Currently, technological developments are developing rapidly and are starting to replace conventional systems that already exist, one of which is a technological Radio Frequency Identification (RFID) system. One application of the RFID system is applied to the library. The application that is commonly used today for smart libraries is the application of the RFID system. With this RFID system it is expected that library visitors can carry out various activities more quickly, effectively and safely. The research to be conducted by the authors aims to create a smart library system that utilizes RFID technology for the book management process. Therefore, in this research the author will design an RFID-based smart library system using the Arduino Uno Microcontroller for the process of borrowing books, returning books and book security in the library. This system can automate all activities that support book management activities in the library and can ensure the safety of books in the library from someone's irresponsible behavior.

Keywords — RFID, Smart Library, Borrowing Book, Returning Book, Book Security

I. INTRODUCTION

Technology is developing more rapidly, so that many are found today that are sophisticated equipment. The technology certainly provides benefits to the wider community, not least in the library field. With the development of the library, of course it must be accompanied by the application of a library system that can make library visitors more comfortable and more efficient in enjoying the library's facilities, especially in borrowing and returning books.

Widyatama University Library is one library that has implemented information technology. At present the Widyatama University Library has implemented an information technology system for borrowing and returning books with a barcode system, but with the system that has been implemented the Widyatama University Library needs to develop a library system again so that visitors can be more comfortable and practical in enjoying the facilities provided by the library. One part of the development is by developing a book borrowing and returning system that uses RFID system, which in this RFID system visitors can more easily borrow or return books by tapping the system.

Besides that, the part that is being developed by the Widyatama University Library is the book security system where books in the library must be guaranteed its safety from irresponsible parties. Because the book security system at the Widyatama University Library has not yet used the system so that the irresponsible party can easily retrieve or steal books from the library without the knowledge of the library staff.

Seeing these problems, it is necessary to make a book management system design based on Internet of Things (IoT) library. To meet these needs, a Smart Library system was created that would support library facilities and it was hoped that library visitors could be more comfortable in the library, especially in the matter of borrowing or returning and book security at the library.

[1] *Information System Department, Widyatama University*
Jl. Cikutra No. 204A Bandung, West Java, Indonesia. benny.chaniago@widyatama.ac.id
[2,3] *Information System Department, Widyatama University*
Jl. Cikutra No. 204A Bandung, West Java, Indonesia

II. LITERATURE REVIEW

There are many great studies on the use of RFID technology that can be applied both to the library field that can help library staff and in everyday life. In research [1], the RFID technology applied is very helpful for the library in the process of borrowing and returning books [2]. The system of borrowing and returning books uses the RFID system, which in the process of borrowing the book taps student identification cards and tapping books [3]. The application of the RFID system applied to this system is only limited to borrowing and returning control. The RFID reader used is the 122U PCR RFID reader that is connected directly to the PC [4]. The applied RFID technology functions as a medium for borrowing books in the library [5]. The technology used in this research is RFID technology which functions as a book label. Where the book labeling results are ID cards, book codes, titles, authors, publishers, categories and years [6]. RFID technology is applied at the hotel to record hotel room access data, which records the check-in and check-out time for hotel rooms [7]. The system is built using the PN532 reader / writer RFID module [8]. The RFID tag used is in the form of a label attached to the book [9]. Application of RFID technology as tracking vehicle [10]. The application of RFID system is applied to the process of searching books in a library. The application used is based on web applications [11]. The RFID system is applied to the student attendance system, where RFID is accompanied by a telegram so that parents can monitor the attendance of the telegram application.

In reviewing this system, the authors compare the models proposed by many researchers by directly observing the system of borrowing, returning and book security in libraries by implementing an RFID technology system that can help library staff in the process of managing books in a library.

III. SOLUTION ARCHITECH

An analysis of the borrowing and returning book system in the ongoing Widyatama University Library. The analysis was conducted covering the process of borrowing books, returning books and book security. This process will later be evaluated to define weaknesses in the current system and then also be used to analyse the needs of the system to be developed.

A. Proposed Model

This is the hardware and application required in the Smart Library application. For software we use the c # programming language to build applications. For electronic hardware that uses Arduino Uno as a microcontroller to obtain data provided by the sensor output and other components will be explained as follows:

Arduino

Arduino is an electronic kit or open source electronic circuit board in which there are main components, namely a microcontroller chip with AVR type from Atmel company. The microcontroller itself is a chip or IC (Integrated Circuit) that can be programmed using a computer. The purpose of embedding the program in the microcontroller is so that the electronic circuit can read the input, process the input and then produce the desired output [12].

RFID

RFID (Radio Frequency Identification) is a form of development of wireless technology that is used as a substitute for barcode technology [13].

Buzzer

Buzzer is an electronic component that can convert electrical signals into sound vibrations. Buzzer consists of a coil mounted on the diaphragm and then the coil is flowed so that it becomes an electromagnet, the coil will be pulled in or out, depending on the direction of the current and magnetic polarity, because the coil is mounted on the diaphragm, each coil motion will move the diaphragm alternately turning so that it makes air vibrate which will produce sound [14].

Solenoid

Solenoid is one type of coil made of long cable which is wrapped tightly and it can be assumed that its length is much greater than its diameter [12].

Explanation of the proposed model

This is a smart application that is needed in the Smart Library application. First, in the process of borrowing books, the borrower can do it independently by searching the books on the computer that has been provided. The process of finding books here intends to ensure that books to be borrowed are in the library and the books can be borrowed. After the book is confirmed to be in the library and can be borrowed, the borrower only does the ID Card tapping and book tapping on the system provided for the borrowing book process. Second, in the repayment process, the same as in the borrowing process, namely the borrower only does the ID Card tapping process and book tapping on the system provided. In the repayment process here if the borrower is on time in the repayment process, the system will direct the borrower to open a book box with a way of tapping ID Card to store the borrowed book, however, if the system is late in returning the system will provide a warning that the borrower meets the library clerk to pay a fine in accordance with library policy. Third, in the book security process, if a book comes out of the library area without going through the borrowing book process, the system will give a warning in the form of a buzzer sound, so that the books in the library are guaranteed to be safe.

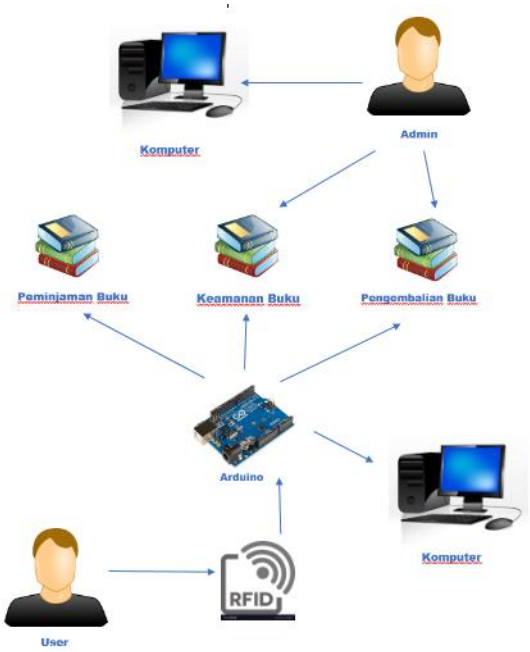

Figure 1. Proposed Model

B. Use Case Diagram

In this section, we will use a use case diagram that shows the functionality of an intelligent library system that is accompanied by a use case scenario to explain in detail what has been illustrated in a use case diagram. The use case diagram shows the interaction between the user, the book borrower and the admin, the library clerk. The following is a use case diagram for smart library systems :

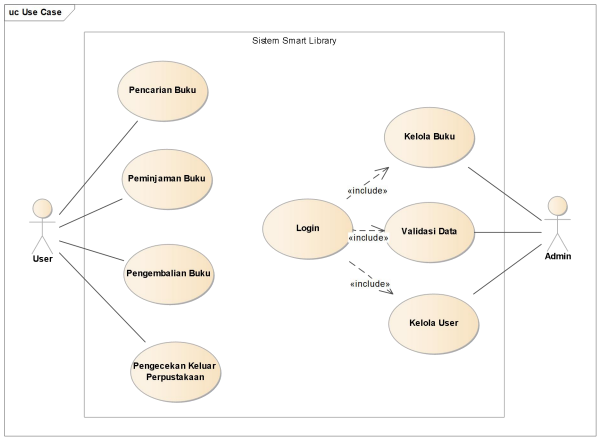

Figure 3. Use Case Diagram

The actor's explanation in the use case is as follows:

1. User
   User can use the system on the side of book search, borrowing books, returning books and checking out the library (book security).

2. Admin
   Admin can use the system at the side of logging in, managing books, validating data and managing user.

IV. IMPLEMENTATION

1. User

Home

The user home page is the home page for user in borrowing and returning books applications at the Widyatama University Library.

Figure 5. User Home

Book Search

Book search page is a page for users to search for books to be borrowed at the Widyatama University Library.

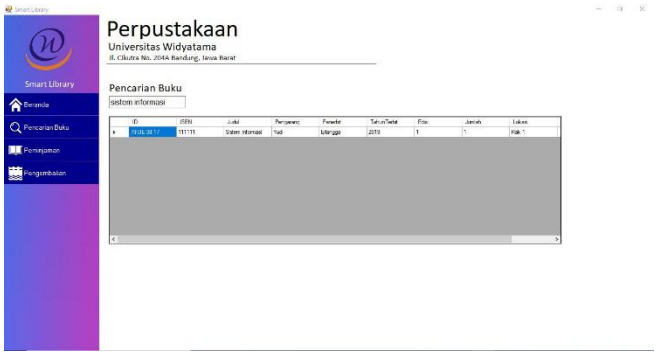

Figure 6. User Book Search

Borrowing the User ID Card Tapping

The id card tapping book loan page is the main page for the user in the process of borrowing books at the Widyatama University Library. On this page there is a command for tapping the user's id card.

Figure 7. Borrowing the User ID Card Tapping

Borrowing the User Book Tapping

The user home page is the home page for user in borrowing and returning books applications at the Widyatama University Library.

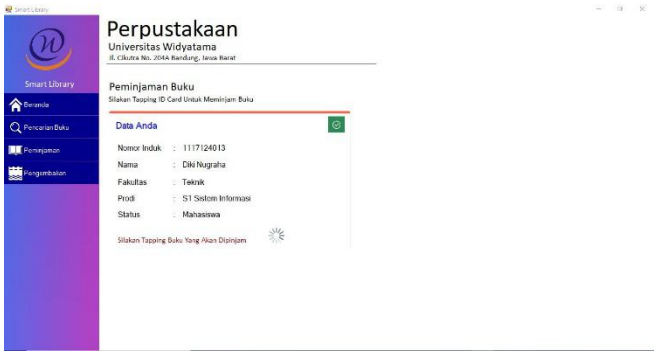

Figure 8. Borrowing the User Book Tapping

Successful Book Borrowing

Successful book lending page is a page to find out the results of borrowing books at Widyatama University Library has been successful.

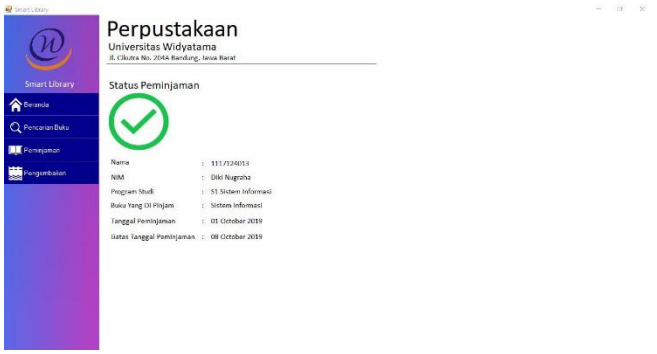

Figure 9. Successful Book Borrowing

Return the User ID Card Tapping

The return page of the id card tapping book is the main page for the user in returning the book to the Widyatama University Library. On this page there is a command for tapping the user's id card.

Figure 10. Return the User ID Card Tapping

Return the Book Tapping

The book return book tapping page is the next page for the user in returning the book to the Widyatama University Library. On this page there is a command for tapping books.

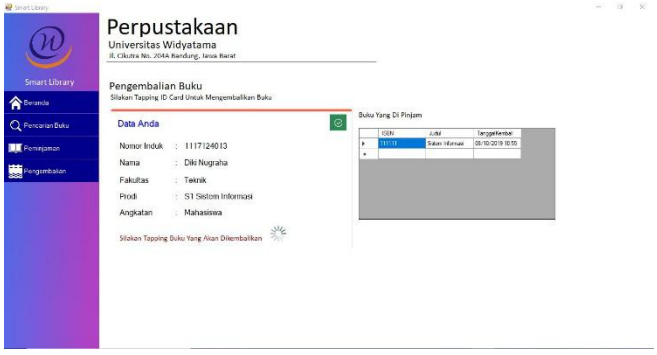

Figure 11. Return the Book Tapping

Successful Book Return

Successful book return page is a page to find out the results of returning books at Widyatama University Library has been successful

Figure 12. Successful Book Return

Unsuccessful Book Return

Book returns page book tapping failed is a page to find out the results of the tapping id card. On this page there is borrowed book data and the return time data is not timely, so there is a warning to see the library staff

Figure 13. Unsuccessful Book Return

2. Admin

Borrowing and Return Activities

The activity page is a page for admins to see user activity. On the activity page there are two menus in accordance with user activity, namely the borrowing and returning menu

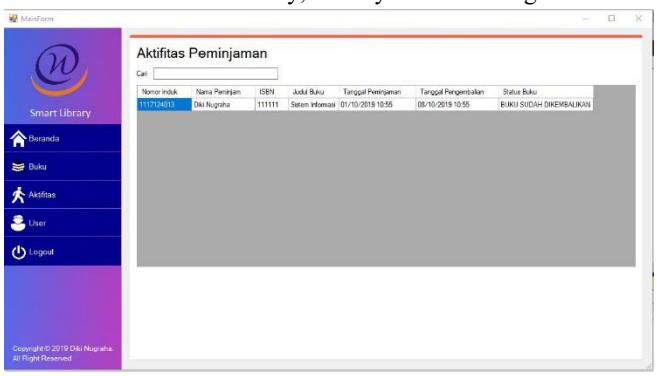

Figure 14. Borrowing and Return Activities

Validation of Late Return of Books

The data validation page is a page for the admin to validate users who are late in the book return process.

Figure 15. Validation of Late Return of Books

Book Security

Book security page is a page for admins to ensure books in the library are guaranteed security. When the book comes out of the library area before the borrowing book process will be lit and the library clerk can immediately follow up on the library's visitors.

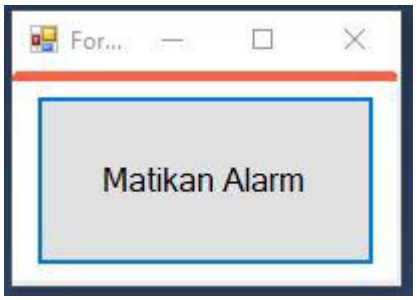

Figure 16. Book Security

V. CONCLUSION

The Smart Library Prototype designed in the system of borrowing and returning books are user friendly, where the application is very easy to use by users so that users will not find difficulties in using this application even though it does not involve library staff. The system that has been integrated between RFID and applications can facilitate the process of borrowing and returning book transactions and when there is a delay in returning books, the system will provide notification to resolve the problem of delay in returning books to library staff.

Smart Library prototype book security system at Widyatama University Library using RFID sensors can help library officers in protecting books from the actions of irresponsible parties.

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