Sales Information System Utilizing 13.56 MHz RFID Member Cards for Enhanced Efficiency in Cooperative Stores

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1. Introduction

RFID is currently widely used by companies for employee, member, and asset identification purposes. It is also extensively used in supermarkets for identifying items during shopping. Life nowadays is becoming increasingly advanced with technology always present around you wherever you are. The identification process in a company for asset, employee, and other purposes also utilizes a technology called RFID. Apart from companies, RFID is also widely used for identification in supermarkets and hospitals. RFID stands for Radio Frequency Identification. It is a technology used for identification and data retrieval using barcodes or magnetic cards.

Koperasi Ubhara Jakarta Raya is one of the cooperatives in the city of Bekasi that engages in activities such as savings and loans as well as selling goods to its members. Sales recording at Koperasi Ubhara Jakarta Raya for its approximately 600 members is still done manually, leading to several challenges. Firstly, it takes a long time to create periodic sales reports. Secondly, there is a possibility of input errors, whether it's regarding product names, purchase prices, or selling prices of items.

Based on the issues mentioned above, Koperasi Ubhara Jakarta Raya requires an application that can process store sales transactions for its members. The cooperative membership card, which contains a 15.56 MHz RFID chip, can be used to validate cooperative member data when shopping at the cooperative store. With this application,
it is hoped that it can simplify sales transactions for members and minimize input errors by store personnel.

This application is developed using PHP 7 Native programming language with its database stored using MySQL DBMS. The system development method employs the prototype method with the following stages: Requirements gathering and analysis, Quick design, build prototype, User evaluation, and the final stage is Implement product and maintain. System design notation uses UML (Unified Modeling Language) as a visual modeling method.

Using a mobile RFID reader, the proposed scheme achieves essential security requirements, which prevent several kinds of attack between RFID tag and reader, also satisfy mutual authentication and conforming to EPC C1G2 standards. (C.-L. Chen et al., 2013)

The membership holders can also use the accumulated digital coupons to redeem prizes with the server. (C. Chen & Chien, 2012)

2. Research Method

a) RFID

RFID stands for Radio Frequency Identification. It is a technology used for identification and data retrieval using barcodes or magnetic cards. The identification method involves using a device called an RFID tag that is used to store and retrieve data remotely. In practice, RFID tags can be embedded in a product, animal, or even a human being. The identification process in RFID occurs using electromagnetic waves. Therefore, the RFID identification process requires two devices: the tag and the reader, to function properly.

An RFID tag is a device attached to an object that will be identified by an RFID reader. RFID tags come in two types: active and passive. Passive tags can be used without batteries, while active tags require a battery to operate. RFID tags contain a unique identifier that distinguishes them from one another. Additionally, the information stored on an object or item connected to the tag is only available in the system or database linked to the RFID reader.

An RFID reader, on the other hand, is a device capable of reading RFID tags. RFID readers also come in passive and active variants. Passive RFID readers can reach up to 600 meters. However, passive readers can only receive radio signals from active tags. Active readers, on the other hand, can emit interrogator signals to tags and receive authentication responses from tags. Moreover, the interrogator signal can also serve as power for passive tags.

One of the commonly used RFID cards is the MIFARE Card, which is an access card containing a chip. This card is typically used for attendance systems, access control, parking cards, ID cards, and others due to its data storage memory. The frequency used is 13.56 MHz.

b) Information Systems Development

The development of a system is defined as the process of organizing, designing, and implementing a system or developing information systems through investigation, analysis, design, implementation, testing, integration, and maintenance.
There are six steps in the development of information systems as described in Figure 1, the Information System Development Cycle. (C. Chen & Chien, 2012; Mahyuzir, 1998; Pressman, 2002; Setiawan, 2005; Sommerville, 2011; Sukamto & Shalahuddin, 2018; Yusuf, 2022)

c) **Metode Prototype**

A prototype is an initial sample, model, or release of a product built to test a concept or process to convert various abstract characteristics of an idea into a more tangible or resembling the actual results. The purpose of prototyping a system is to gather information from users so that they can interact with the developed prototype model because the prototype represents the initial version of the system, giving users a clear picture of the system that the development team will build. Prototypes are built much faster than finished implementations, allowing us to evaluate them more quickly and receive feedback sooner about the strengths and weaknesses of a design. Here are the stages of prototyping in system development:

a. **Requirements gathering and analysis**

The initial stage of prototyping begins with requirements analysis. In this stage, system requirements are defined in detail. During this process, the client and the development team will meet to discuss what kind of system is needed by the user. Analysis is conducted to identify the components of the current system, which can include hardware, software, network, and system users as the end-user level. The next step is to gather the necessary information from end-users, including the cost and benefits of the system being built or developed. System requirements analysis defines the system's requirements, such as system inputs, system outputs, processes running within the system, and the database used.

b. **Quick design**

The second stage is the creation of a simple design that will provide a brief overview of the system to be developed. A new design can only be created once the user's requirements are known. After that, the design creation can be based on the requirement gathering and analysis done in the first stage.

c. **Build prototype**

After the quick design is approved by the user, the next stage is the actual prototype development, which will serve as a reference for the programming team to create the program or application.

d. **Customer evaluation**
After the prototype is created, the next stage is user evaluation. In this stage, the system that has been created in the form of a prototype is presented to the client for evaluation. Subsequently, the user will provide comments and suggestions on the prototype that has been created. Prototypes are built much faster than finished system implementations, allowing users to evaluate them more quickly and provide faster feedback on both good and bad design aspects.

e. Refining prototype
The refining stage involves refining the prototype based on the client's feedback from stage four. If the user does not have revision notes for the created prototype, the team can proceed to stage six for product implementation. However, if the client has notes for system improvement, phases four and five will continue to iterate until the client approves the system to be developed.

f. Engineer Product
After the improvements in stage 5 are approved by the client, the next step is implementation and maintenance. In this final phase, the product will be developed by programmers based on the final prototype. Subsequently, the system will be tested and delivered to the client, and maintenance will ensure that the system runs smoothly without any issues. (Indrajit, 2001; O’Brien, 2019; Pressman, 2010; Sabarudin, 2020; Seoling & Tolle, 2022)

3. Results and Analysis

The system development method used in this research is the prototype method.
3.1 System Analysis

Before proceeding to the information system development phase, the researcher conducted a needs analysis process through interviews with several Computer Science Faculty staff members. In addition to conducting interviews, the researcher also searched for relevant theories related to the existing problems. The researcher obtained references from the internet, books, journals, articles, or other research reports. Based on the results of the interviews and literature study, the software and hardware requirements for designing a periodic maintenance system on machines were identified effectively. The software and hardware requirements can be seen in the following section.

3.2 Software Requirements

The software needed for this research is as follows: Windows 10, Notepad++ versi 8.5.5, Xampp 8.1.1, MySQL Workbench 8, and Enterprise Architech 7.5.

3.3 Hardware Requirements

The Hardware Needed For This Research Is As Follows: Laptop Lenovo Y380, Processor I7, Ram 8gb, Monitor 14 Inch, and Hardisk Ssd 256gm.

3.4 System Architecture

The sales information system of the cooperative to its members using RFID cards can be accessed through a browser by present employees, secretaries, and administrators. Below is an overview of the architecture of the cooperative's sales information system for its members.

Source: Research’s Result (2023)
Figure 4. Cooperative Sales IS Architecture
3.5 System Planning

The researcher utilizes Use Cases to demonstrate the relationship between system users and the system itself using Enterprise Architect 7.5 software and Enhance Relation Diagram (EER) using MySQL Workbench 8.0 software to explain the database relations.

a. Use Case Diagram

Here is an example of a Use Case diagram for developing a cooperative sales system for its members.

![Use Case Diagram](image)

Source: Research’s Result (2023)

Figure 5. Usecase Diagram

b. Database Design

Database Design is the process of determining the content and organization of data needed to support various system designs. The goal of Database Design is to meet the specific information needs of users and their applications. It facilitates the understanding of information structures and supports processing requirements and various presentation objects (such as response time, processing time, and storage space).

![Database Design](image)

Source: Research’s Result (2023)

Figure 6 Database Design
3.6 System Implementation

The implementation is based on the results of the previous design phase. The implementation phase begins with coding using the PHP programming language and employing native programming styles. The database implementation utilizes MySQL. The interface implementation involves HTML, CSS, and Javascript with the Bootstrap framework. (Yusuf, 2019)

a. Module Login

To be able to use the cooperative store sales system using the 13.56 MHz RFID card, users must first log in. The implementation of the login Module is as shown in the image below. However, as a text-based AI, I don't have the capability to display images. If you have specific instructions or details related to the login Module that you would like to discuss or clarify, please feel free to provide them, and I'll be happy to assist you further.

Source: Research's Result (2023)

![Figure 7 Page Login](image)

b. Module Main Page

If the user successfully logs in, they can access the main page with menus that can be accessed according to the user's level. The implementation of the main page Module is as shown in the image below. However, since I can't view or display images as a text-based AI, I recommend describing the contents or functionalities of the main page Module that you want to implement, and I can provide guidance or assistance based on your description.
c. Module Product

Administrators can add, change and delete product master data in the system. The product module implementation is as shown in the picture below.
d. Module Member

The administrator can add, modify, and delete member data that exists in the system. The implementation of the member Module is as seen in the picture below.

![Module Member](image1)

Source: Research's Result (2023)

Figure 10. Page Member

e. Module Sales

The administrator can add, modify, and delete sales data that exists in the system. The implementation of the sales Module is as seen in the picture below.

![Module Sales](image2)

Source: Research's Result (2023)

Figure 11. Page Sales
To perform a new sales transaction, click the 'Add New' button, then on the page displayed below, swipe the member card as shown in the picture below.

Source: Research’s Result (2023)  
Figure 12. Add Sales

The next step is to enter data on the goods to be sold (you can use a barcode scanner to search for goods based on the item code as shown in the picture below.

Source: Research’s Result (2023)  
Figure 13. Add Product Item

Next, when you have finished entering the items to be sold, the next step is to print the sales receipt as seen in the picture below.
4. Conclusion

The result of this research is a web-based information system designed to manage sales transactions using RFID cards with a frequency of 13.56 MHz. This system has two user levels: Administrator and Member. By creating this application, it will facilitate the Cooperative in managing sales transactions for its members. The sales information system for cooperative members has been successfully tested and has helped facilitate Ubhara Jakarta Raya Cooperative in conducting sales transactions with its members. This application system was created according to their input and needs and has been used effectively. Based on the explanations provided in the previous section, the author can draw the following conclusions: The development of this cooperative sales system can facilitate store personnel in conducting sales transactions. This application system can be further developed, such as adding integration features with financial departments so that payments can be deducted directly from the salaries of cooperative member employees.

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Author Contributions

Dani proposed the topic and designing. Deni conducted testing and implementation.

Conflicts of Interest

The authors declare no conflict of interest.

References

