

Implementation of Extreme Programming (XP) Method in the Web-Based Information System of the Mutiara Timor Waste Bank

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Keywords: Waste Bank, Information Systems, Agile Software Development, Extreme Programming (XP).

Abstract: The increase in population contributes to the waste growth in Kupang. On this basis, a Waste Bank emerged in the community to help overcome the waste problem. Mutiara Timor is one of the waste banks in Kupang City that processes waste data daily; however, waste management is done manually by writing books. A manual system causes ineffective data management, a myriad of data is not recorded, and data redundancy occurs. With this problem, a computerized system is needed as an information system that can help and facilitate officers' work in waste management. The web-based system is proposed to help manage data, including incoming waste, customers, waste deposit transactions, waste sales and sales of recycled products. Each Waste Bank has different service needs, so a method is needed that can adjust to the customer's needs. By using Extreme Programming (XP), this information system can meet the needs and requests of the Mutiara Timor. All the features in this system are adjusted to the customer's demands. Therefore, the suitable method is Agile with extreme programming (XP) to suit changing customer needs. The output resulting from this research is a web-based application that can conveniently manage waste at the Mutiara Timor Waste Bank.

1 INTRODUCTION

According to the KBBI, waste is goods or objects thrown away because they are no longer used. Improper waste processing can adversely affect an unhealthy environment. The high consumption of people to meet their daily lives impacts the high amount of waste wasted daily. Waste is problematic for the whole community. The increase in population helped contribute to the growth in waste in Kupang city.

Mutiara Timor Kupang is one of the waste banks located in Kupang City. Mutiara Timor processes waste data daily, whereas waste management is still manually done by writing on books. The officer must record all transactions such as customer registration, incoming goods, and customer savings details. A manually done system causes ineffective data management, so much data is not recorded, and data redundancy occurs. With this problem, a computerized system is needed as an information system that can help and facilitate officers' work in waste management.

The web-based Mutiara Timor Waste Bank Information System is an information system proposed to help manage data on waste banks, including data collection of incoming waste, customers, waste deposit transactions, waste sales and sales of recycled products.

2 LITERATURE STUDY

2.1 Past Research

Research on the design and construction of waste bank information systems has been carried out by researchers before and applied in other regions. Many previous researchers have designed and researched web-based waste bank information systems using different development methods. Some of the researchers who use the Agile methodology with Extreme Programming are as follows:

Table 1: Previous Research.

Name (Year)	Heading	Description
Abd. Rahman Kuku (2019)	Development of Waste Bank Management Information System in Gorontalo City	By using the Agile Development method with XP (extreme programming) Coordinating with the Waste Bank in Gorontalo, analyzing problems in the Waste Bank in Gorontalo and adding features to process waste transaction data collection
Hermanto, H. (2021)	E-Waste as a form of Smart Village; Case Study Analysis and Design	By using the Agile Development method with XP (extreme programming), UML (Unified Modeling language), Database with CDM (Conceptual data model) and PDM (Physical Data Model) Analyze and design a system that can be used to help process waste data
Romadhoni, K. (2020)	Implementation of the Extreme Programming (XP) Method in the Application of the Kalirejo Business Development Waste Bank (BUK)	By using the Agile Development method with XP (extreme programming) Make an application that can help the administrative system at Bank Sampag H Kalirejo Business Development

Based on the studies that have been done, it can be distinguished that the research carried out differs in the features displayed and the type of software

used. The data collection information system at the Waste Bank only exists in areas outside NTT, so the **Mutiara Timor Waste Bank Data Collection Information system is the only waste bank information system in Kupang City and even East Nusa Tenggara.**

The following is a research map path that will start from making prototypes, product development and IPR in the following year, namely 2023 and then the application will circulate in the market.

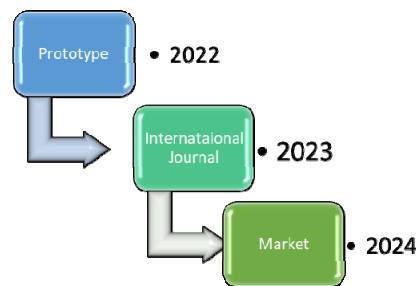


Figure 1: Research path map.

2.2 Theoretical Foundation

2.2.1 Definition of System

The word system comes from Latin(systēma) and Greek(sustēma) which means a whole consisting of components or elements linked together to facilitate the flow of information, matter, or energy to achieve a goal. The system is also a unity of interconnected parts within a region and has driving items.

According to Jacob, 2012 "A system is a network of works of related procedures, gathered together to carry out a certain activity or goal". "A system is a collection of elements that interact to achieve a specific goal. This system describes an event, and real unity is a real object, such as places, objects, and people that exist and happen" (Hartono, 2005).

From the above understanding, it can be concluded that a system is a collection of interconnected elements that are related, interact with each other, and cooperate to achieve the same goal. Furthermore, the procedure is made to facilitate work that is usually done repeatedly; therefore, a system that can run well is needed.

2.2.2 Definition of Information

"Information is an essential part both for individuals and for the industry. Information is invaluable because it can show other resources, such as everything we can see and touch. Information is data processed into a form that is more useful and

meaningful to those who receive it" (Jacob,2012). "Information is data that has been classified, processed, or interpreted for use in decision-making". (Sutabri, 2012).

From the above understanding, it can be concluded that information is a collection of fact data processed into meaningful forms that are useful for anyone in need and used as knowledge or decision makers.

2.2.3 Information System

From the understanding of systems and information described earlier, an information system is an orderly combination of resources, software, hardware and data resources that collect, change, and disseminate information in an organization.

"An Information System (SI) can be defined as a collection of interconnected elements that form a single entity to integrate data, process and store, and distribute information. SI is a unity of elements that interact systematically and regularly to create and form information flows that support decision making and exercise control throughout the company" (Sutedjo, 2002).

"Information systems are components that are interconnected and cooperate in collecting, processing, storing and disseminating information to support decision making, coordination, control, and to provide an overview of activities within the company". (Sungkono et al., 2008)

From the above understanding, it can be concluded that an information system is an orderly combination of resources, software, hardware, and data resources that collect, change, and disseminate information in an organization so that the decisions taken will be more targeted.

3 METHODOLOGY

This information system aims to meet the needs and demands of the Mutiara Timor Waste Bank. All the features in this system are adjusted to the customer's requests of the "Bank Sampah Mutiara Timor" so that Agile software development with extreme programming (XP) is the suitable method for this study.

1. Agile Software Development

The Agile software development method is based on iterative development where collaboration between organized teams is carried out (Pressman, 2010).

2. Extreme Programming (XP)

Kent Beck and Ward Cunningham proposed the XP method. This method comes from customer requests often changing rapidly, resulting in a shorter change loop. In addition, this method is very flexible for users (Widodo, 2008), and because this information system is centred on customer desires, the XP method is a solution for developing this product.

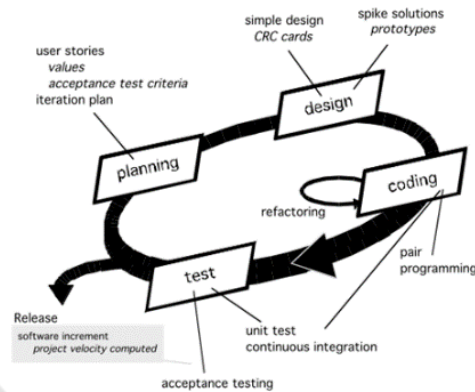


Figure 2: Process of Extreme Programming (XP).

There are four stages in the extreme programming (XP) method, namely:

1. **Planning**
Planning is the initial stage where the team arranges planning, such as problem identification and analysis of customer needs to plan the implementation schedule for building a system.
2. **Design**
The next stage is designed where modelling activities are carried out, starting from system modelling, and architectural modelling to database modelling.
3. **Coding**
This stage is an activity of applying to a model made into the form of a user interface using programming languages.
4. **Testing**
After the coding stage is completed, the system testing stage is carried out to determine what errors arise when the application runs and whether the system is built according to user needs.
Each process will be divided into several iterations, and each iteration has different periods until the system is completed in the program and ready to be *released* to the *customer*.

4 RESULTS AND DISCUSSIONS

4.1 Design System

4.1.1 Planning

Planning is the initial stage where the team compiles planning such as problem identification and analysis of customer needs to plan the implementation schedule for building a system. The process of identical sizing the problem was carried out by a site survey and an interview with the owner of the Timor Pearl Waste Bank.

From the results of this survey, it is known that some of the problems faced by this Waste Bank are data collection of incoming waste, customer data, and customer savings which are still carried out manually by my mother, so it involves data labelling. In addition, data done manually is also vulnerable to human error, which can result in the loss of customer data so that performance measurements cannot be carried out. The next problem is that customers cannot know their savings data, so they have to check manually with the Waste Bank admin.

1. Problem Identification

The problem today is that the absence of a system at the Timor Pearl Waste Bank makes it difficult for Mutiara Timor owners to monitor customers, waste savings and the difficulty of promoting the Waste Bank without help from the website. This situation also causes suboptimal waste and customer data collection due to a large amount of human error and the potential for data labelling.

2. Needs Analysis

- a. Admins can log in waste data
- b. Admins can input consumer data
- c. Admins can input transactions
- d. Admins can print reports
- e. Customers can see savings
- f. Customers can view transactions

4.1.2 Design

Based on the interview results, the next stage is designed where modelling activities are carried out at this stage, starting with system modelling and

database modelling. Modelling is done with UML (Unified Modeling Language) by designing use cases and activity diagrams. Two actors play a role in this system, namely System Modeling.

Actor	Definition
Admin	Have the authority to have an account that is used to input junk data
Customer	Have the authority to view savings and information on the website

Figure 3: Actor role.

Use Case Diagram Customer

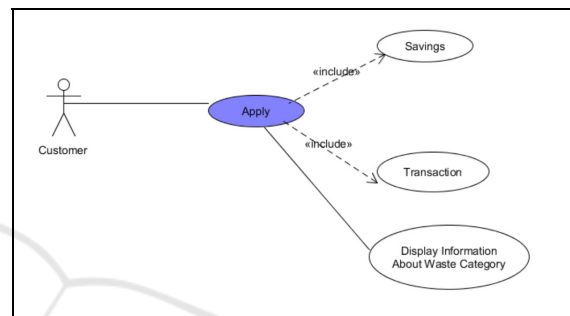


Figure 4: Use Case Diagram Customer.

The diagram above illustrates the function of the waste bank website for customers. Customers can use this website to see important information about the grouping of types of waste and see transaction history and savings data.

Use Case Diagram Admin

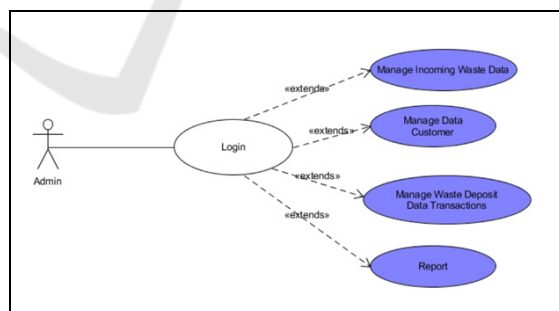


Figure 5: Use Case Diagram admin.

The diagram above illustrates the functions and services of admins to manage. To be able to manage data, admins are required to log in. If successful, they will enter the administrator page. On the administrator's page, the Admin manages data such as incoming waste, customers, waste deposit transactions and reports.

Customer Registration Activity Diagram

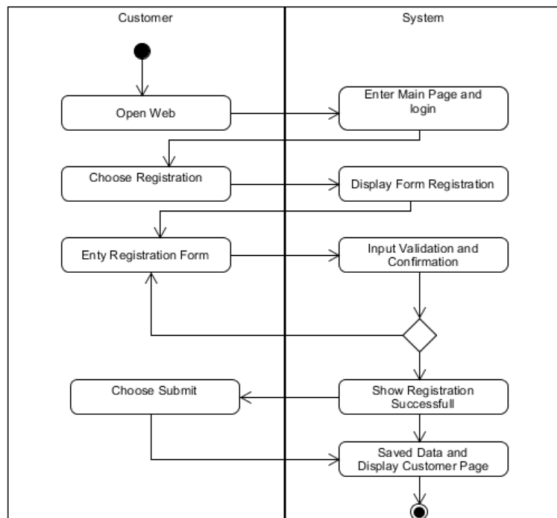


Figure 6: Activity Diagram of Customer Registration.

Before candidate customers save waste at the Mutiara Timor waste bank, candidate customers must register by opening the registration menu and then the system will display the registration page. Candidate participants then fill in the complete data according to the requested data elements, then validate and confirm by pressing the submit button. Furthermore, if successful, the customer will enter the customer's main page.

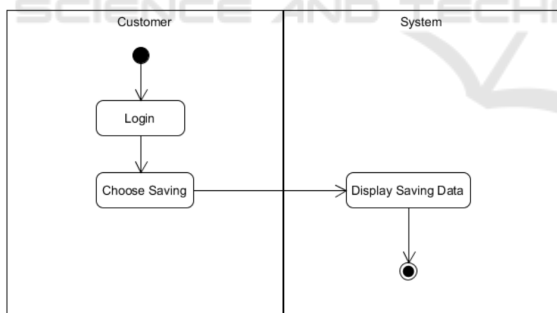


Figure 7: Activity Diagram of Customer Saving Page.

After the customer logs in, the customer can see savings data, transaction history, and information/knowledge about how to group household waste.

Customer Savings Input Activity Diagram

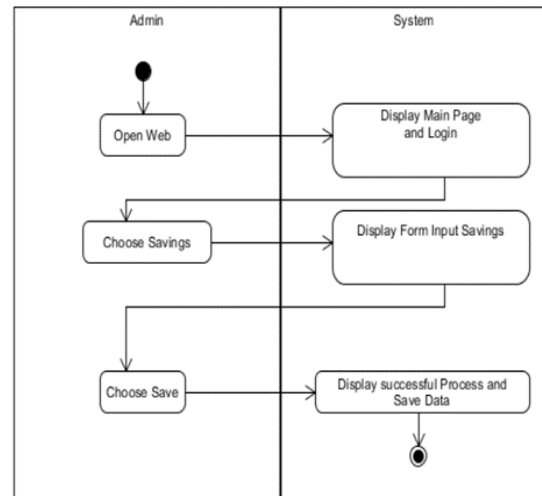


Figure 8: Activity Diagram of Customer Saving Input Page.

When managing savings data, the Admin must log in to the system. After that, the Admin will go to the main page of the administrator and fill in the savings data element. After filling in the data, the Admin then saves the data, and then a confirmation appears that the data has been successfully kept.

Activity Diagram Input Data Transaction

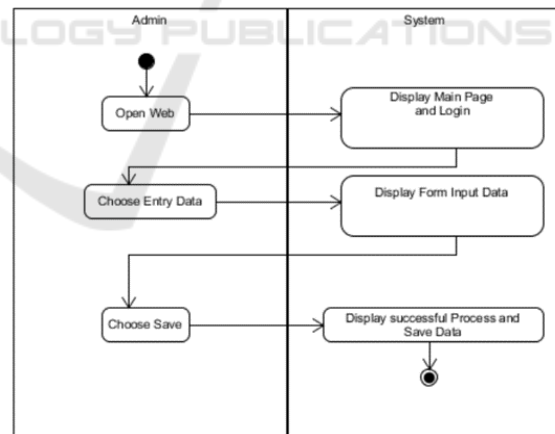


Figure 9: Activity Diagram of Input Transaction Data.

Every data processing carried out by the administrator must begin with Login when accessing the website's main page. After logging in, the Admin will enter the admin page, fill in, and save the waste sales transaction data. A message will appear if all the data has been kept and if the data is successfully submitted.

Activity Diagram Report

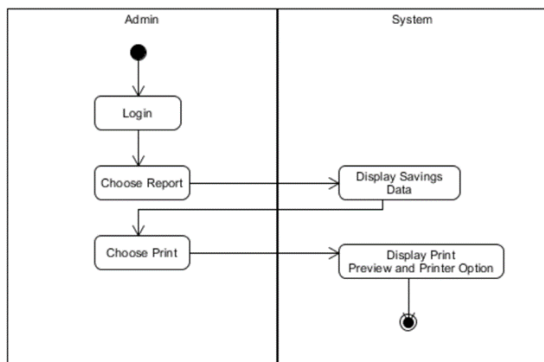


Figure 10: Activity Diagram of Report.

In addition to admins inputting customer, transaction, and incoming waste data, admins can also print transaction reports. This transaction report can be used for information materials and transaction reports for the Mutiara Timor waste bank.

4.2 Coding

4.2.1 Home Page

The Home view displays the home, about us menu. Login contains information about the timor pearl waste bank, photos, and the Login menu.

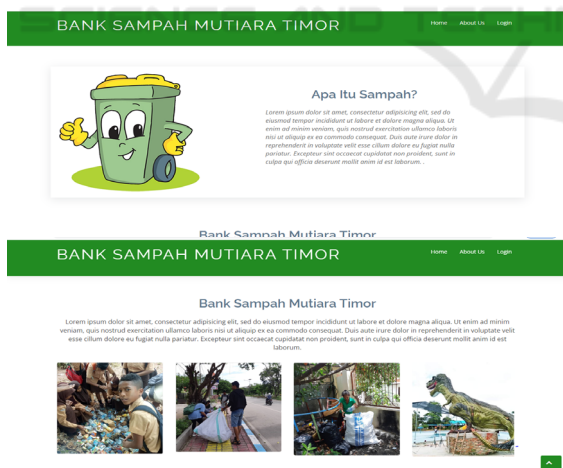


Figure 11: Home Page.

4.2.2 Login Page

The login page contains access for admins and customers. Admins have access to manage data such as incoming waste data, customer, and waste sales transactions. Meanwhile, every customer who makes

transactions at Bank Sampah Mutiara Timor must register and log in to see transaction history, savings and essential information about groupings rubbish.

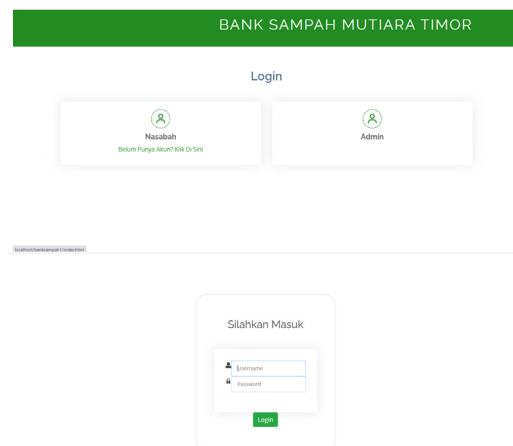


Figure 12: Login Page.

4.2.3 Customer View

The customer menu contains customer data in the form of customer personal data, as well as the amount of savings, type of transaction, transaction date, and information.

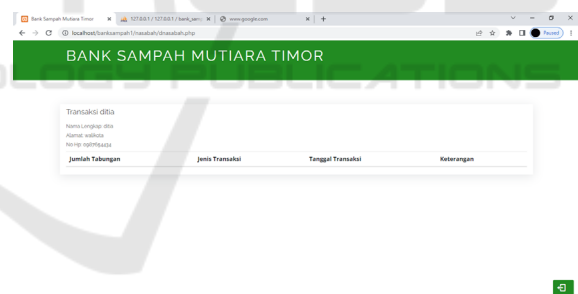


Figure 13: Customer Page.

4.2.4 Admin Page

This page has several features, including customers, transactions, and reports.

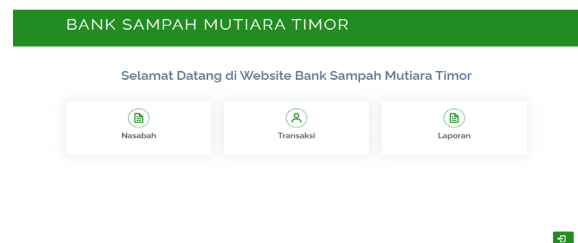


Figure 14: Admin Page.

4.2.5 Customer Data Page in Admin

The Customer Menu displays the identity of customers who register independently through the registration menu, and this menu also has a menu to change and delete customer data.

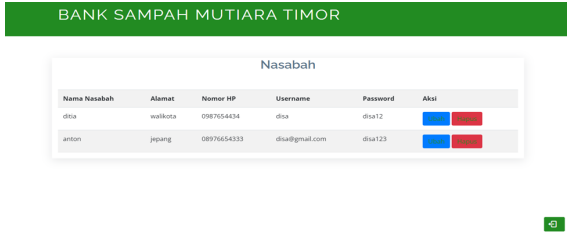


Figure 15: Customer Data in Admin Page.

4.2.6 Customer Deposit Page

This menu serves to add customer transactions, and this page contains the customer's name, type of waste, the weight of waste, price of waste, total cost, date of commerce, and availability.



Figure 16: Customer Deposit Page.

4.2.7 Report Page

This page displays reports per semester or six months. The data displayed includes customer name, type of waste, weight, amount of savings, transaction date, and information.

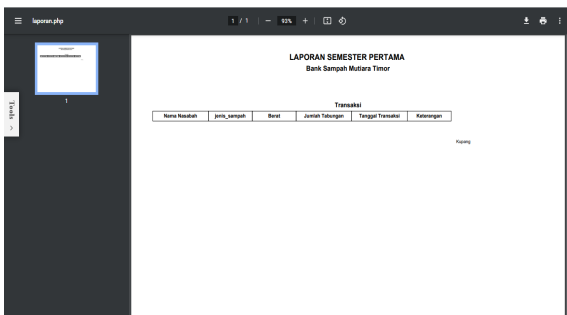


Figure 17: Report Page.

4.3 Testing

Testing list pages

The test carried out on this page is by testing each textbox contained in the registration form, namely the full name, address, email, telephone number, and password used at the time of Login.

Table 2: Registration page blackbox testing.

No	Process Design	Expected Results	Result	Information
1	Fill in the data entirely and according to the type	The appropriate prospective customer data is stored	Appropriate	If all textboxes are equipped
2	Fill in incomplete data	The system will give an incomplete data message	Appropriate	

Testing on admin and customer login pages

The testing on this page is carried out on the username and password validation function, whether it runs according to its function. Here are the test results of the participant login page:

Table 3: Blackbox testing of admin and customer login pages.

No	Process Design	Expected Results	Result	Information
1	Enter your Username and Password completely, then click Login.	Go to the main page admin/customer	Appropriate	
2	If the username and password are entered incorrectly, then click Login.	The system gives the message, "Your Username or Password is Wrong. Please Repeat It!"	Appropriate	
3	The username or password is emptied, and then click sign in.	The system gives the message "Enter your Username and Password!"	Appropriate	

Testing input waste deposit transaction

The tests on this page are carried out by testing each textbox contained in the waste deposit form of transaction data such as customer name, type of waste, the weight of waste, price, total, transaction date and description.

Table 4: Testing input waste deposit transaction.

No.	Process Design	Expected Results	Result	Information
1	Fill in the data entirely and according to the type	The appropriate prospective customer data is stored	Appropriate	
2	One or more textboxes are not filled in, and then click save.	The system will give an incomplete data message	Appropriate	
3	All textboxes are emptied, and then click save data	The system will provide a message to complete the data first	Appropriate	

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5 CONCLUSIONS

Based on the results of research, it was found that the Mutiara Timor Waste Bank Information System can provide convenience to the owners and customers to get information and knowledge related to waste, making it easier to register and carry out waste sales transactions. In addition, the Extreme Programming (XP) method can be used to build or develop software that matches customer demands.

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