Web-Based Application for Organic and Inorganic Waste using Laravel

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Article

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Abstract: Waste management is a significant issue that Indonesia must face. The presence of waste will always exist as long as life continues. One of the main challenges in waste management is the proper separation of organic and inorganic waste. As a solution to address this issue, the Ministry of Environment has made efforts to develop Waste Banks. However, it also creates new problems related to manual data collection, lack of monitoring by the community in implementing waste management activities, and a lack of specific reports regarding waste management conducted by officers. We propose the creation of a website using the Agile Development SDLC method. This website involve several steps and incorporate functions for data digitalization and expedited data collection, such as the addition of QR Code functionality, Monthly Reporting Function, and enhanced data security. The method used in this research is Agile Development. The application has been developed with a user-friendly interface and the latest web development technologies to ensure smooth performance. Overall, the web-based application for organic and inorganic waste using Laravel is an important step to promoting sustainable waste management practices.

Keywords: Web-based application; waste management; laravel

1. Introduction

Waste management is a significant issue that Indonesia must face. Waste can be seen as a consequence of human activities that is unavoidable. The presence of waste will always exist as long as life continues. Every year, the volume of waste will undoubtedly increase along with the growing consumerism pattern of society. This is closely related to the suboptimal waste management problem. Insufficient proper waste management has led to environmental pollution and public health issues. One of the main challenges in waste management is the proper separation of organic and inorganic waste.

Law Number 18 of 2008 concerning Waste Management and Government Regulation Number 81 of 2012 require a fundamental paradigm shift in waste management, from the collect-transport-dispose paradigm to a focus on waste reduction and handling [1]. The waste reduction activities aim to encourage all segments o.f society, including the government, business world, and the general public, to implement waste production limitations, recycling, and reuse, commonly known as Reduce, Reuse, Recycle (3R), through smart, efficient, and well-programmed approaches. However, these 3R activities still face a major obstacle, which is the low awareness of the community in waste separation [2]. Especially in large cities, the term NIMBY (Not in My Back Yard) Syndrome has emerged, which implies that people no longer consider waste management their concern once it is outside their homes. This, undoubtedly, leads to a lack of community awareness regarding proper waste management [3].

As a solution to address this issue, the Ministry of Environment has made efforts to develop Waste Banks. This activity is a form of social engineering that teaches the community to separate waste and raises awareness in wise waste management [2]. This solution indeed contributes significantly to waste management by the community. However, it also creates new problems related to manual data

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collection, lack of monitoring by the community in implementing waste management activities, and a lack of specific reports regarding waste management conducted by officers. In this paper, we attempt to resolve these issues.

2. Related Work

This paper proposes a solution to the problem of waste management that still relies on manual data usage by converting it into a digital format accessible by both personnel and management in real-time via a website application.

Of course, the proposed solution has been based on several previous studies. The first study [4], resulted in a web-based application to improve data efficiency for waste management officers. The waterfall model was used in the development process. However, the application created does not have encryption on the data, so it needs to be updated to ensure data security.

The second study [5], resulted in a website for waste processing transactions, where users can sell and buy products from waste processing. This study serves as one of our references in building the website because it uses the RAD method, which is quite simple to implement. However, the method used in this study lacks maintenance, which is essential in application development.

The third study [6], produces a Spreadsheet-based application for processing waste bank data, where users can record waste processing data. This research is one of our references in building a website because it uses a Spreadsheet which is quite simple to implement. However, using Spreadsheets has many risks, so updates are needed for data security.

The fourth study [7], produced an Android-based application for processing waste bank data, using the Kanban method which can record transactions that occur at the Garbage Bank. This research is one of our references in building websites because of its simple implementation. However, by using the Android application, not all mobile phones can access the application. So it is better that the application that is built can run on any device.

The fifth study [8], resulted in a Web-based online waste bank transaction application, using the Waterfall method. An online waste bank transaction system application that can solve problems from customers and BSM officers. This research is one of our references in building websites because of its simple implementation. However, this application does not yet have the feature to create monthly report data.

Based on several studies above, we propose the creation of a website using the Agile Development SDLC method. This website involve several steps and incorporate functions for data digitalization and expedited data collection, such as the addition of QR Code functionality, Monthly Reporting Function, and enhanced data security.

3. Methodology

The method used in this research is Agile Development. Agile Development is a software development life cycle that prioritizes adaptation to change. Focal points of agile methods are simplicity and speed. In development work, the team focuses on delivering essential functions quickly, collecting feedback, and promptly responding to received information [9]. The Agile Development method consists of several stages, Planning, Analysis, Design, Implementation, and Testing. Each of these stages is carried out iteratively and incrementally throughout the project life cycle, enabling fast and flexible fixes and adjustments [10].

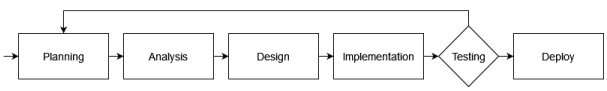

Figure 1. Agile Methodolgy

The stages of Agile Development used in this study are as follows:

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3.0.1. Planning

The planning stage is carried out to understand user requirements, plan goals, and make development plans. At this stage, the developer team works with users to design the features and funcionality needed in the application.

3.0.2. Analysis

The analysis stage are carried out to collect required information and data in application development. At this stage, the development team analyzes the requirement and data that will be used in the application.

3.0.3. Design

The Design stage is carried out to design the appearance and interface of the application. At this stage, the development team designs layouts and displays that are intuitive and easy for users to use.

3.0.4. Implementation

The implementation stage is carried out to develop program code and integrate application features. The development team does the coding and integrates the application features.

3.0.5. Testing

The testing stages are carried out to ensure the application works according to user requirements. At this stage, the development team tests the application and makes improvements if bugs or problems are found.

Each stage is carried out iteratively, allowing for fast and flexible improvements and adjustments. In developing this application, we uses Laravel as the development framework and PostgreSQL as the database.

4. Result and Discussion

4.1. User Requirement

The user requirement outlines the specific needs and expectations of the users for this application, which is designed to help trash collectors report households that did not properly sort their waste. Here are some user requirements for waste management app:

4.1.1. User Login

The app should allow users to login with username and password of their account to use the app.

4.1.2. House Data Input

The app should allow users to input the data of the house that they want to report.

4.1.3. Report History

The app should keep a record of all the reports that have been submitted by user.

4.1.4. QR Code Scanner

The app should have a QR code scanner feature that can be used to scan a QR code on a waste bin or bag. This would automatically fill out the fields in the report form, making it easier and faster for users to submit a report.

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4.2. Technical Requirement

Some of the technical requirements that can be needed in a waste data management application include:

4.2.1. Database Management System (DBMS)

DBMS is needed to manage and store Report data in a structured manner, making it easier to manage and analyze data in the future.

4.2.2. User Interface (UI)

The application must have a user-friendly appearance and be easily understood by the user so that it is easier for the user to access and use the application.

4.2.3. Data Security

Management of report data must be carried out safely and guaranteed confidentiality. Therefore, security systems such as encryption and authentication must be implemented in applications.

4.2.4. Integration with Other Systems

Waste data management applications should be able to be integrated with other systems, such as waste monitoring and collection systems, so as to simplify data management and increase efficiency.

4.2.5. Scalability

Applications must be able to be scaled up and scaled down flexibly, especially if the report data generated is getting bigger from time to time.

4.2.6. Reporting and Analytics

Applications must have reporting and data analysis features, so as to facilitate decision making and strategic planning for managing report data in the future.

4.2.7. Mobile Access

Applications should also be accessible via mobile devices, making it easier for users to access junk data anytime and anywhere.

4.3. Software Requirement

Software requirements are specifications needed from a software. on this website the following specifications are required:

Table 1. Software Requirement

Requirement	Result
DBMS	MySQL
Programming Language	PHP
Framework	Laravel
Operating System	Andorid, Windows, Mac, ios, linux

4.4. User Permission / Access Right

4.4.1. Administrator

Users with Administrator privileges have full rights to access and manage all features in the application, including rights to manage officer data, and generate reports.

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4.4.2. Officer

Users with officer access rights can input report data. They can also generate management reports.

4.5. System Design

The following is the system design that has been made

4.5.1. ERD

ERD is used to describe how the entities in the database relate to each other. ERD can help in designing databases better, and make it easier to identify and understand relationships between entities.

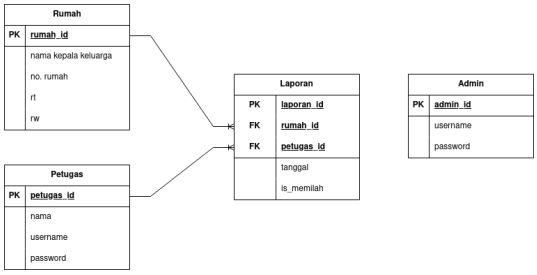

Figure 2. ERD

4.5.2. Usecase

Use case can be used to describe how users (actors) will interact with a system in different situations.

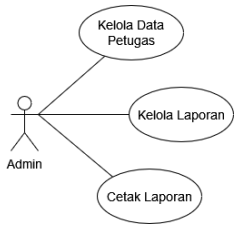

Figure 3. Usecase Admin

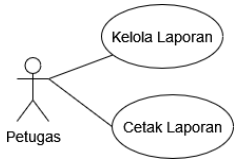

Figure 4. Usecase Officer

In this use case, it can be observed that the Administrator can manage officer data, handle reports, and export reports. Meanwhile, the Officer is only able to manage report data and export report data.

4.6. Product Function

This website has several main views, including:

4.6.1. Login

This view can be accessed by the admin or user to log in to the website by entering a username and password.

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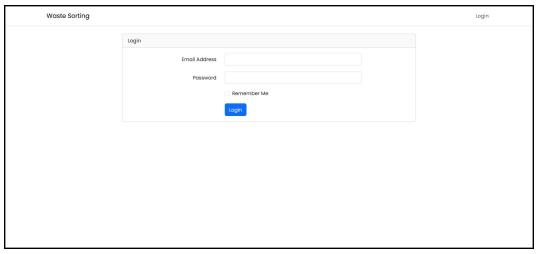

Figure 5. Login Interface

4.6.2. Input Report

This view can be accessed by the admin or user to input reports on waste data management by residents.

Figure 6. Input Data Warga

4.6.3. History Input Data

This view can be accessed by the admin or user to view the history of input data reports.

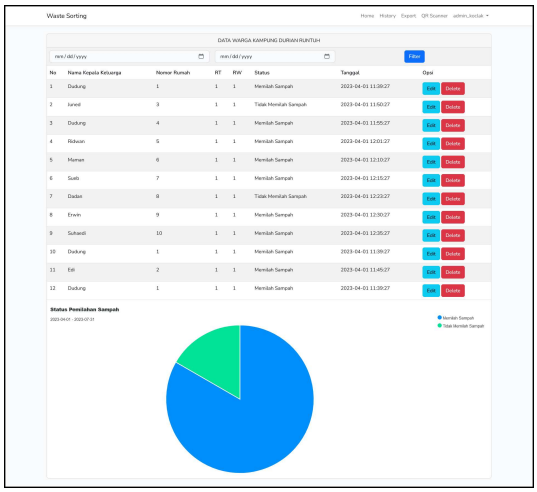

Figure 7. Tabel Input Data

4.6.4. Export Data

This view can be accessed by the admin or user to export management report data.

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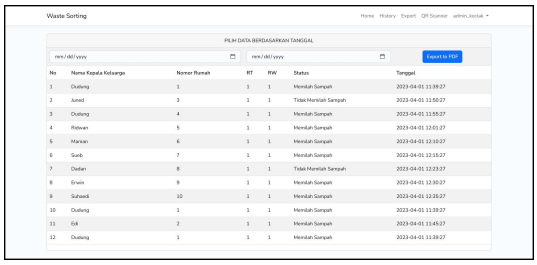

Figure 8. Export Data

4.6.5. QR Scanner

This view can be accessed by the admin or user to input data use QR Code Scanner.

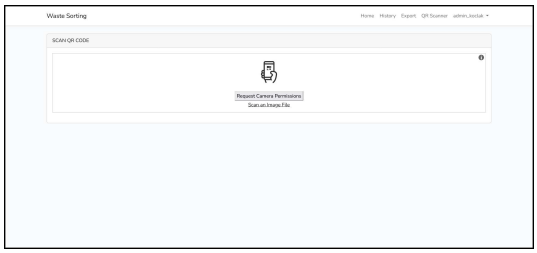

Figure 9. QR Scanner

4.7. Implementation

4.7.1. Implementation of Login Page

Figure 10

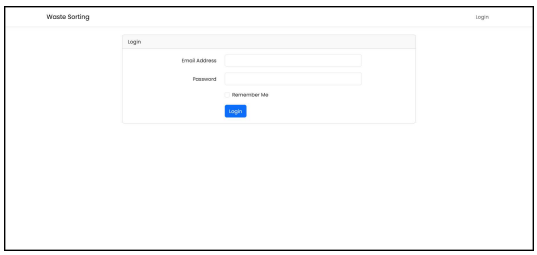

Figure 10. Login Implementation

4.7.2. Implementation of Input Data Page

Figure 11

Figure 11. Input Data Impleemntation

4.7.3. Implementation of History Data Page

Figure 12

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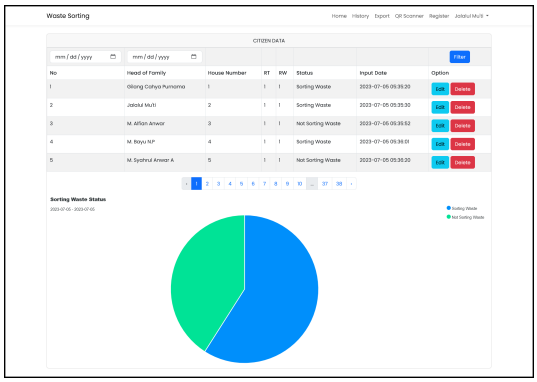

Figure 12. History Data Implementation

4.7.4. Implementation of Export Data Page

Figure 13

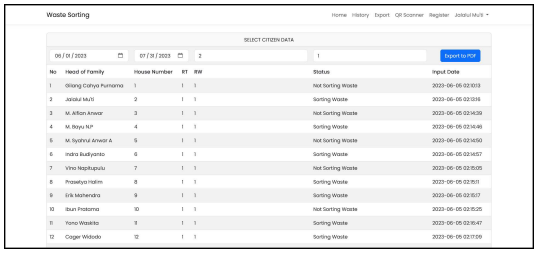

Figure 13. Input Data Implementation

4.7.5. Implementation of QR Code Scanner

Figure 14

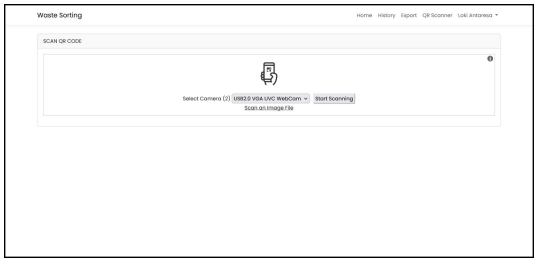

Figure 14. QR Code Scanner

4.8. Testing Application

In this section, we conducted application testing using black box methodology. Black box testing focuses solely on the application's functionality, assessing whether it operates smoothly or encounters any issues.

4.8.1. Login

login page works normally

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Table 2. Login Test

ID	T01		
Test Name	Login Test		
Objective	Login into Web Application		
Scenario	User login using email and password on the form. if finished then click login. If true then access is accepted, if false then access is denied		
Evaluation	Result accepted if Input data Form Displayed		
Test Result (Data Normal)			
Input	Expected	Analysis	Conclusion
Email, Password	Access Accepted, The system displays a data input interface.	Access Accepted, The system displays a data input interface.	Valid
Test Result (Data Error)			
Input	Expected	Analysis	Conclusion
Email, Password	Access Denied, The system displays warning popup.	Access Denied, The system displays warning popup.	Valid

4.8.2. Input Data

Input Data Works Normally

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Table 3. Input Data Test

ID	T02		
Test Name	Input Data Test		
Objective	Input Data Sorting		
Scenario	User input data the citizen data (Name of Head of Household, House Number, RT, RW) and Select sorting		
Evaluation	Result accepted if history data page Displayed		
	Test Result (Data Normal)		
Input	Expected	Analysis	Conclusion
Name of Head of Household, House Number, RT, RW, Sorting	Data Accepted, The system displays History Input Data Page.	Data Accepted, The system displays History Input Data Page.	Valid
	Test Result (Data Error)		
Input	Expected	Analysis	Conclusion
Part of form is filled (ex RT is Null)	Data Rejected, The system displays Error Pop up.	Data Rejected, The system displays Error Pop up.	Valid

4.8.3. History Data

History data page work normally. In this page, data can be edited or deleted

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Table 4. Edit Data History Test

ID	T03		
Test Name	Edit Data History Test		
Objective	Edit Data Sorting History		
Scenario	User edit the citizen data by id		
Evaluation	Result accepted if data from history data page changed		
	Test Result (Data Normal)		
Input	Expected	Analysis	Conclusion
ID	Result Accepted, The system displays History Data Page that was changed.	Result Accepted, The system displays History Data Page that was changed.	Valid
ID	Data Accepted, The system displays Edit Data Page and then Displayed History Data Page that was changed.	Data Accepted, The system displays Edit Data Page and then Displayed History Data Page that was changed.	Valid

4.8.4. Export Report

Export data page work normally. In this page, data can be exported by date or by RT.

Table 5. Export Data Test

ID	T04		
Test Name	Export Data Test		
Objective	Export Data Sorting		
Scenario	Users can export report data by date or RT		
Evaluation	Result accepted if data report downloaded		
	Test Result (Data Normal)		
Input	Expected	Analysis	Conclusion
Date	Result Accepted, The system displays data sorting results by date.	Result Accepted, The system displays data sorting results by date.	Valid
RT and RW	Result Accepted, The system displays data sorting results by RT.	Result Accepted, The system displays data sorting results by RT.	Valid

4.8.5. QR Scan

QR Code Scanner work normally.

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Table 6. QR Code Scanner Test

ID	T03		
Test Name	QR Code Scanner Test		
Objective	Scan QR Code		
Scenario	User scan QR Code for input data		
Evaluation	Result accepted if data from QR Code inputted to Input data form		
Test Result (Data Normal)			
Input	Expected	Analysis	Conclusion
QR Code	Result Accepted, The system displays Inputted data from QR Code to Input Data Form.	Result Accepted, The system displays Inputted data from QR Code to Input Data Form.	Valid
Test Result (Data Error)			
Input	Expected	Analysis	Conclusion
QR Code Error	Result Accepted, The system displays nothing and reloads the qr scan.	Result Accepted, The system displays nothing and reloads the qr scan.	Valid

5. Conclusion

The development of the web-based application for organic and inorganic waste using Laravel has provided an effective solution for the waste management system. The app is specifically designed for trash collector to report incidents of improper waste disposal and monitor the progress of waste sortation in their area.

The application has been developed with a user-friendly interface and the latest web development technologies to ensure smooth performance. With this application, trash collector can easily identify households that do not separate their waste and take appropriate actions to promote proper waste sortation.

Overall, the web-based application for organic and inorganic waste using Laravel is an important step to promoting sustainable waste management practices. It is expected that this app will help waste management personnel to carry out their duties more effectively, resulting in a cleaner and healthier environment for the community. Future research can explore ways to improve the application's effectiveness and optimize its performance to better serve the needs of waste management personnel.

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