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Development of a Website-Based Project Monitoring, Evaluation, and Reporting Information System in Community-Based Infrastructure Programs

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Abstract

In the Community-Based Infrastructure Program (IBM) organized by the Ministry of Public Works and Housing (PUPR), there are several programs such as SANIMAS, Sanitation LPK, TPS 3R, and the PAMSIMAS Program, which are distributed across various villages and neighborhoods in Bali with a substantial budget. Consequently, this demands that the Commitment Officer (PPK) and their team effectively monitor and evaluate the programs. Time and personnel constraints and the community's limited understanding of construction processes and aid management pose significant challenges. In this research, website-based software will be developed that has good functionality and quality, so that it can provide information quickly and accurately to PPK and relevant stakeholders involved in the project. The development of an integrated project monitoring, evaluation, and reporting information system (SIMEPP) for the IBM program was designed and built using the waterfall model development method, on the client side (frontend) built using HTML, CSS, and Javascript, while on the server side (backend) built using the Laravel framework with the PHP programming language, data storage using a relational database management system (RDBMS) namely MySQL database and on the web server side using apache to serve the Laravel application. Testing results indicate that this system meets all established criteria and is reliable for effectively and efficiently supporting project monitoring, evaluation, and reporting. The functionality testing yielded a score of 1 (good), reliability testing achieved a success rate of 99.99%, and portability testing demonstrated that the SIMEPP website functions consistently across various major browsers.

Keywords: Project Management, Information System, Website

Introduction

Commitment Officer (PPK) or in projects can be referred to as project owners are officials who lead every procurement activity of goods or services in a government project, they have the management ability to organize and manage activities effectively and efficiently. PPK duties include planning, managing resources, implementing, supervising, and evaluating activities. PPK is usually responsible for handling various activities from the preparation stage to the final handover (Nugroho, 2012).

One of the government programs through the Ministry of Public Works and Public Housing (PUPR) is the Community-Based Infrastructure Program (IBM). In the IBM program, the PUPR ministry is a government representative as a provider of aid funds. The IBM program is an activity to develop and improve the quality of basic settlement infrastructure both in rural and urban areas carried out by community groups through a participatory approach, in addition to improving the quality of basic settlement infrastructure, the IBM program also aims to

distribute the populist infrastructure budget evenly throughout Indonesia, encourage the community economy, and expand employment opportunities.

According to the Decree of the Minister of PUPR No.532 /KPTS/M/2023, in fiscal year 2023 the Bali Regional Settlement Infrastructure Center, especially the IBM Program in the field of Sanitation, carried out three community-based infrastructure development activities, namely Community-Based Sanitation (SANIMAS), Sanitation of Religious Education Institutions (Sanitation LPK) and Reduce-Reuse-Recycle Waste Processing Sites (TPS 3R), In addition to the Sanitation program, the Regional Economic Social Infrastructure Development Program (PISEW) and the Community-Based Drinking Water and Sanitation Provision Program (PAMSIMAS) are also implemented, where the three programs are in the form of community-based infrastructure development spread across 75 villages in all districts in Bali with a budget of 29 billion, so that PPK and technical staff under it experience limited time and personnel in carrying out their duties to monitor all the implementation of these activities, besides that the communities involved in the IBM program still have a low level of understanding during the physical construction process, management of aid funds, and project reporting so that they need more attention in the monitoring and evaluation process during the implementation of the IBM program.

PPK and his team in overcoming limited personnel and time for direct monitoring in the field carry out online monitoring and evaluation efforts through physical and financial progress update reports through WhatsApp groups created, but the project management information system implemented has not been able to provide database services, online information systems, and project report systems that are integrated and well stored so that PPK and the team have difficulty selecting and accessing the information needed quickly and accurately, this can cause monitoring, coordination, and decision making activities in the project to not run optimally so that it can affect the cost, quality, and time of the project being carried out.

With the rapid advancement of information technology in the world, technology has an important role for the progress of the construction industry. Now, we can design an information system for monitoring, evaluating, and reporting web-based projects using the PHP programming language and the Laravel framework, with a waterfall development approach. This system is expected to provide an integrated, easily accessible, and flexible information database for further development to store all project information required by PPK and related parties, with the support of all components involved. (Hambali and Samsumar, 2022).

In managing various projects, effective management of project document databases is essential to provide transparent and quick access to information, which is often required in various situations and conditions. (Nugroho, 2012).

From the above problems, this research will develop website-based software that can provide an easily accessible and integrated online information system to assist project owners and all parties involved in the process of monitoring, evaluating, and reporting on all ongoing IBM programs by adjusting the needs of potential users and the situation and conditions in the project environment. The development of the Monitoring, Evaluation, and Project Reporting Information System (SIMEPP) is very important to overcome the problems of limited personnel, time, and community understanding in the process of physical construction and management of aid funds. With an integrated and easily accessible system, SIMEPP can improve the efficiency of monitoring, coordination, and decision-making, which is expected to improve the overall quality, time, and cost of the project. In addition, SIMEPP allows for faster generation of project reports, low operational costs, and can be accessed easily on simple devices, making it easier for all parties involved.

Methods

For the development of this website-based project monitoring, evaluation, and reporting information system (SIMEPP) using the waterfall model development method where the first step is requirements, at this stage an analysis is carried out of the needs and problems faced by prospective website users using the method of discussions and interviews with PPK and the team, at this stage user needs (User level and User Requirement), information needs in the form of reports, and document management will be obtained.

Furthermore, the design stage is carried out where at this stage the data obtained in the previous process will be compiled into a description of the structure of the software components that will be used in software development, this stage is carried out by designing Data Flow Diagrams (DFD), Entity Relationship Diagrams (ERD), Use Case Diagrams, designing prospective user web page structures, and designing interface layouts using Diagram.net and Figma web applications. The coding process will be carried out after the completion of the system design by translating the design results into programming languages and converting them into physical forms, tables, functions, and procedures. For the design of the main page display (frontend), HTML and CSS are used, while the backend uses PHP, MySQL database, jQuery, and Ajax functions to make the website look more dynamic and interactive. Before uploading to the web host, the system was run on localhost using XAMPP and Visual Studio Code.

After the coding process is complete, testing will be carried out to ensure that the resulting software product meets the predetermined requirements and specifications. The testing stage will be carried out on localhost or on direct web hosting which is widely available on the internet, the tests carried out are Functionality, Reliability, and Portability testing. The last stage is system repair where which stage consists of activities that aim to keep the system functioning properly, fix problems that arise, and make adjustments if needed. The remediation stage starts with the identification of issues/bugs after the testing phase, tracking them down and prioritizing them based on importance, followed by root cause analysis to understand the source of the bugs, followed by solution development and testing again to ensure their effectiveness.

Results and Discussion

Design and Build SIMEPP

To design and build SIMEPP using the waterfall model method where the stages are as follows:

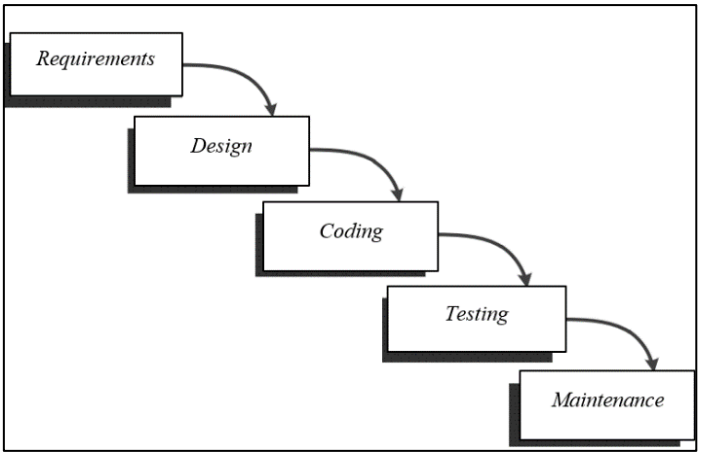


Figure 1. Waterfall Model

Requirements Analysis

Input requirements for this system are in the form of data on the Budget Authority (KPA), PPK, Technical Team, Recipient Villages, physical, and financial progress reports. For user software and hardware requirements, they are: 2GHz processor, 4gb DDR3 memory, VGA Card, 500gb sata hard disk, keyboard, mouse, printer, monitor, and internet, for server software and hardware requirements are slightly different, namely using a 2.8 GHz processor and 500Gb SSD. SIMEPP can be run on Windows /Linux/Mac operating systems, and for web browsers, namely Google Chrome/Firefox/Microsoft Edge. Expected outputs are weekly reports, s-curves, bar charts, supporting document files, and minutes.

Design System

At the system design stage in the Waterfall model, the use of Data Flow Diagrams (DFD), Entity-Relationship Diagrams (ERD), and Use Case Diagrams created on the website https://app.diagrams.net/ is an important tool to ensure a comprehensive and structured system design. By using DFD, ERD, and Use Case Diagrams in an integrated manner, the system design can be organized clearly and in detail, ensuring that all functional aspects, data flows, and data structures are well-defined, and meet the needs of users that have been previously identified.

For the initial stage, a Use Case Diagram will be created, where the Use Case Diagram is a visual tool used in system analysis and design to describe the interaction between users (actors) and the system to be developed. This diagram maps the various usage scenarios or functions that the system must perform to meet user needs. Each use case in the diagram represents one function or service that the system provides, while actors represent outside entities that interact with the system.

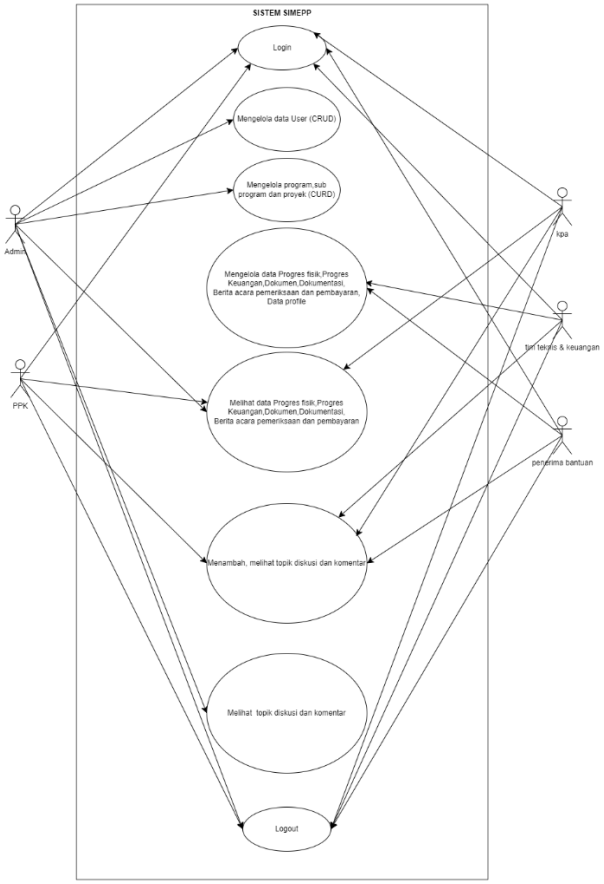


Figure 2. SIMEPP Use Case Diagram

The second stage is to create a DFD, or Data Flow Diagram, which is a system analysis tool used to describe the flow of data through a system or process. DFDs use graphical symbols to represent entities, processes, data storage, and the flow of data between them. Entities are sources or destinations of data in the system, while processes represent activities or transformations performed on the data.

In process 1, the admin registers users according to the access rights made according to the organizational structure, where the access rights are KPA, PPK, Technical Team, Finance, and Village / Family Recipients of Assistance. The input data will be stored in the data store of each user. In this process, each user will get a username and password to log into the system. In process 2, namely login, users who want to enter the system must enter the username and password obtained in the register process. In process 3, namely data processing, users will input the data needed to run the SIMEPP system, the inputted data will be stored in each data store according to predetermined rules. When the user needs information, the data that has entered each data store will come out in the form of information through the data processing process before being received by the user in need.

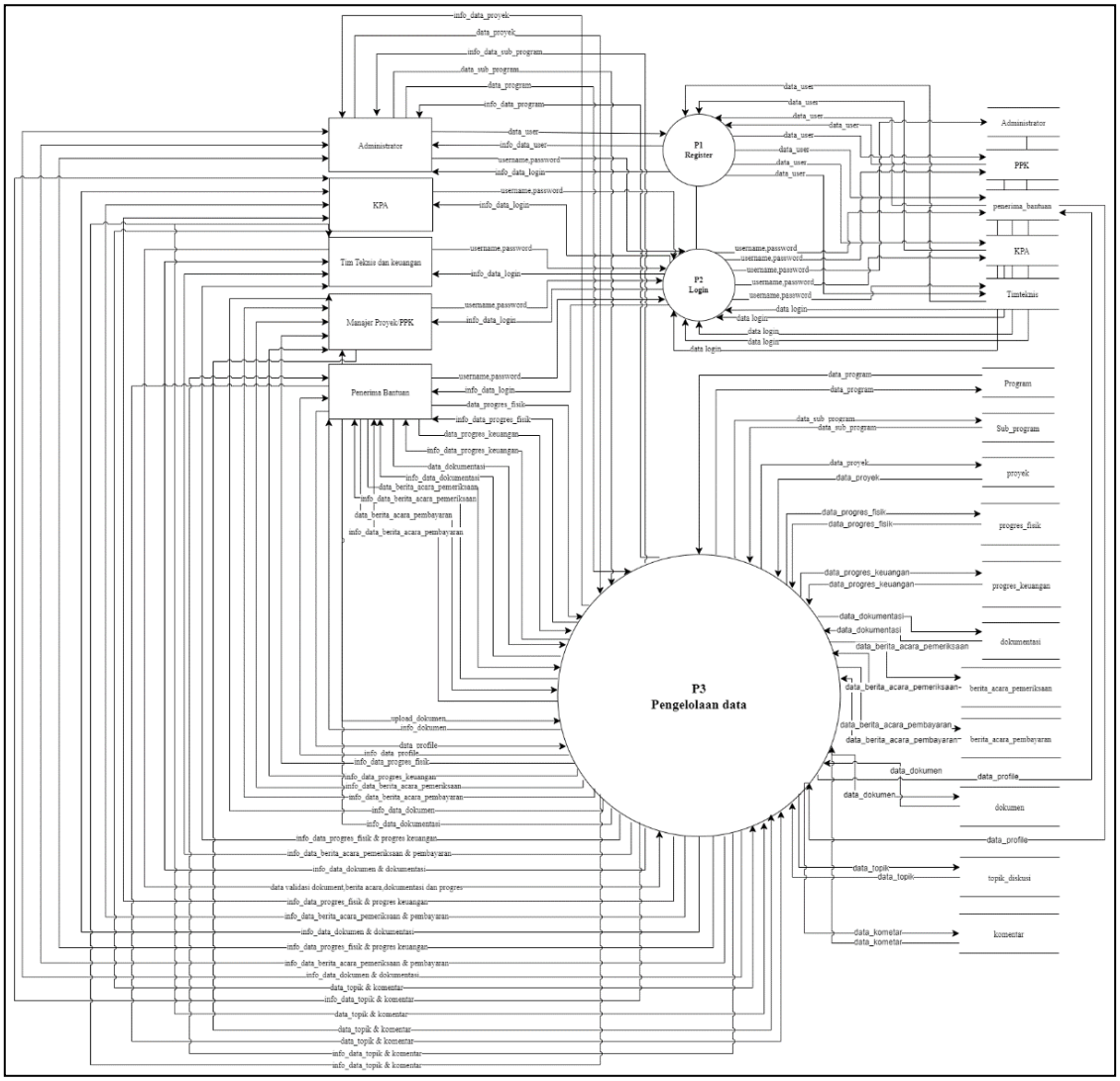


Figure 3. SIMEPP Data Flow Diagram

The final stage is to create an Entity Relationship Diagram that will help represent how data is stored in a database and how these entities relate to each other to provide a better understanding of the structure and relationships of the data before implementation. ERD consists of entities/objects in the database, such as programs where the attributes are id, name, year, status, created at, updated at, and have relationships between other entities.

Coding

The coding stage starts with client-side (frontend) development using HTML, CSS, and JavaScript. HTML builds the structure of the web page, CSS defines the layout and visual style, while JavaScript adds interactivity. This process involves writing code, testing, and refining repeatedly to ensure an optimal user experience. Next, the server-side (backend) development uses the Laravel framework and the PHP programming language. PHP scripts start with <?PHP or <? and end with ?>, between these marks is PHP code that is executed by the web server before being sent to the client's browser. Laravel makes it easy to handle routing, authentication, and database management where data is stored in MySQL. The Apache web server serves the application to ensure efficient processing of user requests. The SIMEPP program code can be seen on the following Google Drive link : https://drive.google.com/drive/folders/1b6UmuJEK7lqa9WAOm5BTCkPX7vRyWlJB?usp=sharing.

Software System Functions

To find out the function of the software that has been made, testing will be carried out, in addition to using localhost as a server, testing the running of the website on the internet using a web server hosting service whose address is https://www.dewaweb.com, to go to the website in this thesis can access via https://simepp.my.id. The use of web hosting is because it has an affordable cost and good performance for testing.

The tests carried out are Functionality, Reliability, and Portability tests according to the ISO 25010 standard. The initial stage for testing is to upload website files to the web server. After the website file is uploaded to the web server, then there are adjustments to the MySQL database login access on the web server. Changes in MySQL hostname, username, password, and database name are adjusted as stated in the C-panel information.

Functionality Testing

In this test, the author simulates various user scenarios to evaluate whether the SIMEPP application developed can meet the needs and expectations of users by conducting Black Box Testing which covers various aspects of application functionality, including input validation, system responses to various user actions, and verification of outputs produced. Here is one of the inputs and outputs tested in black box testing:

Table 1. Black Box Testing

Input Data	Expected Results	Testing Results	Conclusion
The user enters the username and password given correctly.	Users log in to the dashboard page according to their respective access rights.	Users successfully log in to the dashboard page according to their respective access rights.	Retrieved

After conducting Black box testing on 33 input and output processes, calculations will then be made to determine the level of functionality of the web system created using the data analysis formula set out (ISO / IEC, 2002) below:

$$X = 1 - \frac{A}{B}$$

Where:

X = Functionality

A = Number of functions that are not working at the time of evaluation

B = Number of evaluated functions

In the functionality aspect test, the software is said to be good if it is close to 1 ($0 < X \leq 1$). So that:

$$X = 1 - \frac{0}{33} = 1$$

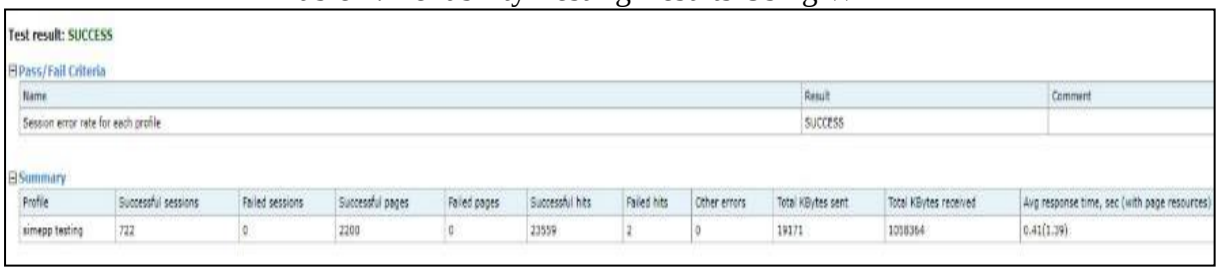
The Functionality calculation above gets a value of 1 so that the software created can be said to have good Functionality because all the features tested are successfully implemented properly.

Reliability Testing

Using Web Application Testing (WAPT), the authors simulated various user scenarios involving varying traffic loads, including high usage peaks and continuous usage with moderate loads. These tests help in identifying potential weak points in application performance such as memory leaks, server performance degradation, and system failures that may occur over time.

This test, was simulated with 20 active users accessing the system simultaneously for 1 hour. During the test, the author monitored several key metrics such as success sessions (interactions made by users), success pages (pages successfully loaded), and success hits (HTTP requests successfully answered by the server), for the WAPT test results can be seen in the table below:

Table 2. Reliability Testing Results Using WAPT



Test result: SUCCESS

Pass/Fail Criteria

Name	Result	Comment
Session error rate for each profile	SUCCESS	

Summary

Profile	Successful sessions	Failed sessions	Successful pages	Failed pages	Successful hits	Failed hits	Other errors	Total KBytes sent	Total KBytes received	Avg response time, sec (with page resources)
simepp testing	722	0	2200	0	23559	2	0	19171	1018364	0.41(1.39)

Matrix	Success	Failed
Sessions	722	0
Page	2.200	0
Hits	23.559	2
Total	26.481	2

From the above results, the percentage of success will be calculated using the formula below:

Total score: 26.481 + 2 = 26.483

$$\text{Success percentage}(\%) = \frac{Total\ number\ of\ successes}{Total\ number\ of\ scores} x100\%$$

$$\text{Success percentage}\ (\%) = \frac{26.481}{26.483} x100\%$$

$$\text{Success percentage}\ (\%) = 0{,}99992x100\%$$

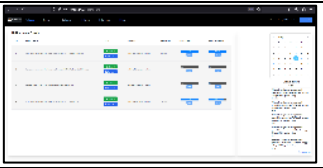
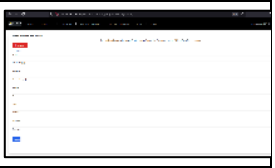
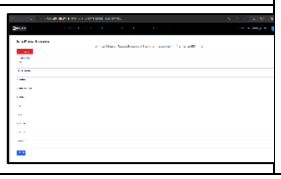
$$\text{Success percentage}\ (\%) = 99{,}99\%$$

With a success percentage result of 99.99%, it shows that web SIMEPP can handle the user's operating load, maintain optimal response time, and exhibit high stability without any significant degradation in performance, even after a long testing period. This provides confidence that the application can be reliably deployed in a real operational environment, ensuring continuity of service for end users.

Portability Testing

Portability testing ensures that the application can run well in various environments and browsers users use. In SIMEPP web testing, three main browsers are used, which are Google Chrome, Microsoft Edge, and Mozilla Firefox.

Table 3. Portability Testing Results

Browser	Screen Capture	Description	Browser	Screen Capture	Description
Google Chrome		Landing Page	Google Chrome		Login Page
Mozilla Firefox			Mozilla Firefox		
Microsoft Edge			Microsoft Edge		
Google Chrome		Dashboard	Google Chrome		Finance Progress Form
Mozilla Firefox			Mozilla Firefox		
Microsoft Edge			Microsoft Edge		

The testing process included a series of user scenarios covering various core operations such as login, navigation between pages, form filling, document uploading, and downloading. Each browser is tested to ensure that all features and functions of the application run smoothly without experiencing compatibility issues.

Based on the test results, SIMEPP web has met the ISO/IEC 25010 requirements. Testing shows that SIMEPP can function well in various environments without requiring significant code changes. This is proven through several key indicators, including: (1) Consistency of Functionality across Browsers: SIMEPP shows consistent functionality across the three browsers tested; (2) Response Time and Page Rendering: There were no significant differences in response time, page rendering, or overall performance across the tested browsers; (3) Display of User Interface Elements: The user interface elements were successfully displayed correctly in all tested environments; (4) Error-free Script Execution: The script executed without any errors in all tested environments; (5) Uniform User Experience: SIMEPP provides a uniform user experience, which includes consistent performance and appearance across different environments. Thus, the SIMEPP web has demonstrated high portability by the ISO/IEC 25010 standard.

Conclusion

The development of an integrated project monitoring, evaluation, and reporting information system for the Community-Based Infrastructure program has been successfully designed and built using the waterfall model development method, on the client side (frontend) built using HTML, CSS, and Javascript, while on the server side (backend) built using the Laravel framework with the PHP programming language, data storage using a relational database management system (RDBMS) namely MySQL database and on the web server side using apache to serve Laravel applications. This website-based software system is designed to be accessed online and can translate and provide information needed by the Commitment Officer (PPK) and related parties. The test results show that this system functions well according to user needs and has met all the criteria set and can be relied upon to support project monitoring, evaluation, and reporting effectively and efficiently with the results of functionality testing using the black box testing method getting a score of 1 (good), indicating that all the main functions of the system work as expected. Reliability testing using WAPT resulted in a success percentage of 99.99%, indicating that the system is very reliable and stable. In addition, portability testing shows that the SIMEPP website functions consistently across major browsers, including Chrome, Firefox, and Microsoft Edge.

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