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Development of Village Information System using Waterfall and TAM Method in XYZ Ward

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Abstract

The digital village initiative that is supported by the Indonesian Government is closely related to the development and utilization of digital infrastructure to improve people's welfare. In this study, we present the development and implementation of a village information system to support digital village initiatives in XYZ Ward, Batam. These systems include a civil registration system and a public complaint reporting system aimed to improve service delivery and communication between the government and the public. The Software Development Life Cycle (SDLC) method, specifically waterfall method, was used to develop the system, and using the Technology Acceptance Model (TAM) to evaluate people's acceptance towards the system. The evaluation yielded promising results with a score of 85% strongly agreeing with the usefulness of the systems, 88% strongly agreeing with the systems' ease of use, and 86% accepting the use of the systems overall in their daily lives. The study concludes that digital village community systems can contribute to improving government services and suggest future research to support similar initiatives in other areas.

Keywords: Village Information System; Civil Registration; Public Complaint; SDLC; TAM;

1. INTRODUCTION

Digital villages are closely associated with the development and utilization of digital infrastructure to improve the economy through community empowerment [1]. The Indonesian government has begun to act in fulfilling the needs of the village administrative units to boost digital development. One action that the government took to support this Digital Village Initiative (DVI) is through even and gradual provision of internet access throughout Indonesia [2], [3]. The needs of infrastructure and telecommunication have been prepared and adjusted by the government to the characteristics of the population, and appropriate assistance has been provided for the village communities [4]. Through these efforts of the government to provide adequate digital infrastructure for villages in Indonesia, potential integrations of technology into the daily operational activities of villages are beginning to surface.

Village development has been encouraged to not only develop in the agricultural sector, but also to strengthen their Information and Communication Technology infrastructure [5]. Therefore, it is important for a village, especially for those entering the digitization stage, to have a village information system [6]–[8]. Village information systems are defined as systems that were designed to meet the needs of the village in planning the implementation of technology to improve services throughout the community [9]. The integration with the village information system makes it possible to maintain the integrity of important information such as archives, documents, and other letters [10], [11].

Belakang Padang Sub District is one of the sub districts in Batam City that has been involved in the digital village initiation stage of the DVI. The city government has provided support in the form of internet and telecommunications infrastructure development which has paved the way for Belakang Padang Sub District, especially XYZ Ward, to develop its technological potential [12]. Through the early stages of the village digitization process, Belakang Padang Subdistrict has issued the development of a village information system to support their daily operations.

A possible implementation of a village information system in improving service to the community is a system for conveying community aspirations and complaints. A public complaint reporting system can build a good relationship between the community and the government to provide better service [13]. One major flaw traditional reports face is the lack of a centralized system [14]. This causes all incoming complaints to be separated among different government agents who received it from the people. Ultimately, it results in lengthy processing of the complaints, and risks of being forgotten entirely [15].

Another integral part of a village's operational activity is the administration of civil registration. The way it is done traditionally is to request the letters directly in-person at the government office, or at best, asking via telephone. This method however leads to the same problem, and it only further emphasizes the lack of a centralized system to monitor the progress of each request. In the modern age, it would be a waste to not utilize the existing and ever-advancing technologies to provide ease of service and access from the people to the government [16].

Several researchers have implemented information systems to villages as a way to support the Digital Village Initiative in multiple locations. Research conducted by Juliantoro, et al in Ponorogo Regency assessed the implementation of digital villages through a qualitative approach. The results of the study show that village information systems can facilitate public services and access to information, even though there are obstacles in terms of development budget and digital literacy among the residents [17]. Similar research was also carried out by Fardani et al in Cikole Village, Lembang by assessing the readiness of implementing digital villages and developing village information systems. The study shows that Cikole Village has the basis for becoming a digital village and the researchers have succeeded in designing a village

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information system that displays Cikole Village development activities [18]. The next research was conducted by Madjidu et al in Bone Balango Regency, focusing on the development of a civil administration information system. The results indicate that the system is applicable to both the department and sub district office, and it was able to facilitate residents in their digital administrative applications. Finally, research conducted by Sahfitri et al in Karyasari Village by developing a web-based public complaint information system. The results assessed that the results of the development were able to facilitate and simplify the management, search, and deliver complaint reports [19].

Based on these facts, we will support the digital village initiative in XYZ Ward through village information system development. The system will consist of a civil registration system to support the ongoing registration process, and a community complaint reporting system to support the communication between the community and the government. Software Development Life Cycle (SDLC) method will be used to develop both systems, and the Technology Acceptance Model (TAM) method to evaluate the acceptance of the systems. These systems are developed with the aim of pioneering the growth of a digital village in XYZ Ward in the form of a civil registration system and community complaint reporting system. Through this activity, we hope that the government can improve the quality of its services to the community through the application of information systems.

2. RESEARCH METHODOLOGY

To support the development of digital village in XYZ, both civil registration system and public complaint report system were developed and implemented using the following research stages:

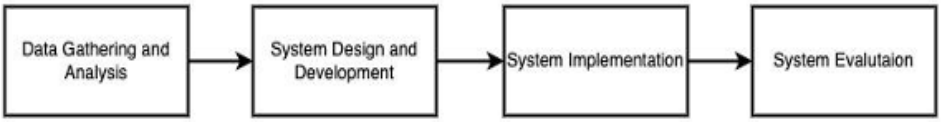

Figure 1. Research Stages

2.1 Data Gathering and Analysis

To learn more about the requirements for the system, observation and interview was conducted during a site-visit to Belakang Padang Subdistrict, specifically to the XYZ Ward. Data that were gathered include but are not limited to the village's general information, existing operational processes, and established infrastructures. Through the analysis phase, a system requirement can be concluded for both the civil registration system and complaint reporting system. This requirement will be used as the foundation in the system design and development stage.

2.2 System Design and Development

The development of the system will follow the Software Development Life Cycle (SDLC) method, specifically waterfall method [20], which consists of the following stages:

a. Requirement Analysis

At this stage, an analysis of required requirements is carried out based on the data gathered previously. These results will be listed and described as the basis for developing the main features. Project requirements such as models and data relations in the form of Entity Relationship Diagram (ERD) will also be created using Unified Modeling Language (UML) at this stage.

b. Design

At this stage, the user interface (UI) will be designed in the form of a prototype. Figma will be used as the main tool to design low-fidelity and high-fidelity prototypes. Responsive design will also be considered during this phase to accommodate devices with different. Digital assets that were required to support the development will also be prepared and gathered during this phase.

c. Development

At this stage, the frontend and backend of the systems will be developed using XAMPP stack and uses Apache as a local web server. There are several tools used to support the development process: Visual Studio Code was used as the main code editor, PHP as the main programming language, and MySQL as the main database management system. Both frontend and backend were integrated using GitHub as the main platform for version control.

d. Testing and Integration

At this stage, the two individual systems were tested using black box testing method to minimize error, bug, and potential security risks. Testing will be done on local and cloud servers to make sure both platforms have similar performance and expected outputs. Integration was done through sub-domain on the chosen cloud hosting platform.

e. Evaluation

At this stage, the system will be hosted on the agreed upon hosting server and made available to the public. It allows users to interact with the system and provides an opportunity to identify any potential issues or areas for

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improvement. The system will be closely monitored throughout the process to catch any significant errors that may arise to ensure a smooth and error-free experience. Evaluation will be done and explained in the system evaluation section.

2.3 System Implementation

As explained on system design and development, both systems will be hosted on the agreed upon hosting server. Implementation will be done through a socialization and training activity for the users to learn how to operate the systems. Guidebooks will be designed and distributed to accommodate all user interactions in the systems, along with a tutorial video about how to operate the system.

2.4 System Evaluation

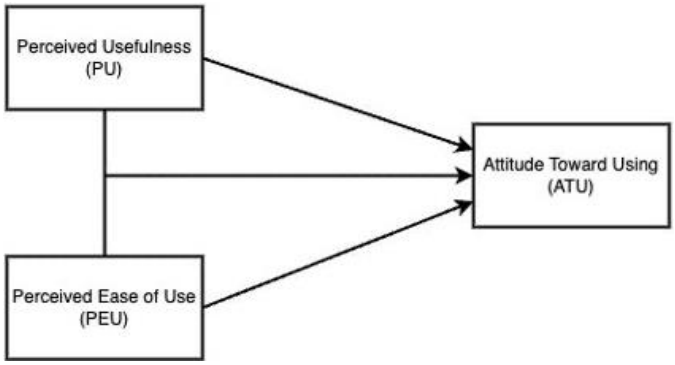

Figure 2. TAM method

The evaluation of the system will be conducted quantitatively using the Technology Acceptance Model (TAM). TAM is a common method used to understand and analyze the factors that affect users' acceptance of a certain computer technology [21]. The TAM method is based on three variables, namely Attitude Toward Using (ATU) that depends on Perceived Usefulness (PU) and Perceived Ease of Use (PEU) [22]. In other words, if a user believes that the system is useful and easy to use, they are more likely to accept and use the system. Data will be gathered using questionnaires that will be distributed through Google Form when implementing the system with instruments shown in Table 1. Each response will be coded using a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree).

Table 1. TAM Instrument

Variable	Code	Indicator
Perceived Ease of Use (PEU)	PEU1	Ease of learning the system
	PEU2	Ease of controlling the system
	PEU3	Interaction with the system is clear and easy to understand
	PEU4	Interaction flexibility
	PEU5	Easy to skillfully use the system
	PEU6	Easy to use
Perceived Usefulness (PU)	PU1	Faster and completion of work
	PU2	Increase performance
	PU3	Increase productivity
	PU4	Increase work effectiveness
	PU5	Simplify the work
	PU6	Usefulness
Attitude Toward Using (ATU)	ATU1	User acceptance attitude

The resulting data is then analyzed using descriptive analysis to summarize the patterns for all variables [12]. This information will be used to evaluate the acceptance of the systems.

a. Criterion score (SK)

Criterion score is defined as the ideal score to achieve in the study with the formula below:

$$\Sigma SK = Max\ score \times nI \times nR \quad (1)$$

Where:

ΣSK = Criterion score
$Max\ score$ = Maximum point on each indicator
nI = Total indicators
nR = Total respondent

b. Total score (SK)

Total score is defined as the sum of the points from questionnaires, and it is symbolized by ΣSH.

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c. Total percentage (P)

Total percentage is defined as the comparison between total respondents' score and criterion score with the formula below:

$$P = \frac{\Sigma SH \times 100\%}{\Sigma SK} \quad (2)$$

Where:
P = Total percentage
ΣSH = Total score
ΣSK = Criterion score

d. Yield range

After acquiring the calculation of criterion score, total score, and total percentage score, the results can be compared to **table 2** as our descriptive analysis summary.

Table 2. Analysis category yield range

Total percentage	Category
0% - 25%	Strongly disagree
26% - 50%	Disagree
51% - 75%	Agree
76% - 100%	Strongly agree

3. RESULT AND DISCUSSION

3.1 System Design and Implementation

Based on the problem statement and data that were gathered during the on-site interview, there are three different access rights that can be defined as shown in **Table 3**.

Table 3. Capabilities on each access rights

Access Right	User Target	Capabilities	
		Civil Registration System	Complaint Reporting System
User	Residents of XYZ	1. Proposing residential documents 2. Tracking the status of submissions that have been made. 3. Reviewing the history of previous submissions. 4. Changing the account password.	1. Filing complaints. 2. Following up through the chat feature. 3. Reviewing complaints that have been previously filed (archived).
Admin	IT Staff of XYZ	1. Viewing documents from submissions that have been made by users. 2. Changing the submission status and providing a message that can be seen by the user. 3. Viewing and deleting user accounts registered in the system. 4. Reviewing submissions that have been processed. 5. Changing the admin account password.	1. Viewing the summary of the complaint system. 2. Opening and deleting complaints. 3. Establishing the priorities of complaints. 4. Following up through the chat feature.
Supervisor	System Administrator for XYZ	1. All admin capabilities. 2. Managing admin access rights (add, change, and delete).	1. All admin capabilities. 2. Managing admin access rights (add, change, and delete). 3. Changing the supervisor account password.

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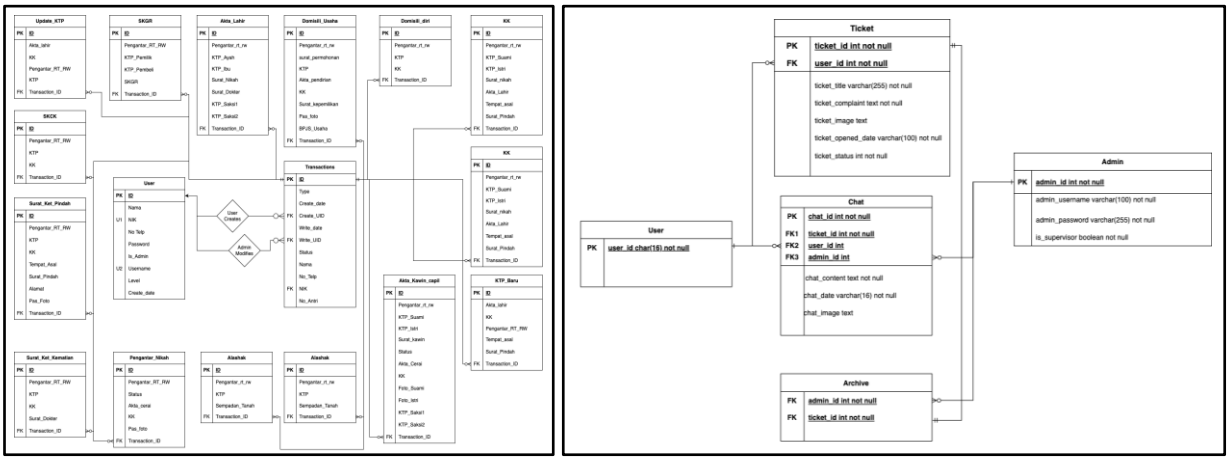

Figure 3. Database Data Diagram

Low-fidelity and high-fidelity prototypes were developed based on requirement analysis by dividing them into different access rights. A glimpse of prototypes is shown from figure 4 to figure 9. Throughout the development process, several frameworks such as Bootstrap5 were used to create an interactive and beginner-friendly user experience. After the development, both systems were tested under a series of test scenarios on a local web server (using XAMPP) and temporary cloud hosting. The test results show that both systems passed the test and are ready to be publicly used. After the integration of both systems through the sub-domains (https://keluhan.kelurahantanjungsari.id and https://kependudukan.kelurahantanjungsari.id), a final test was conducted to make sure both systems worked as intended on the same cloud hosting environment. With the system now up and running publicly on the agreed upon hosting server, users are able to interact with the system and provide feedback for improvement.

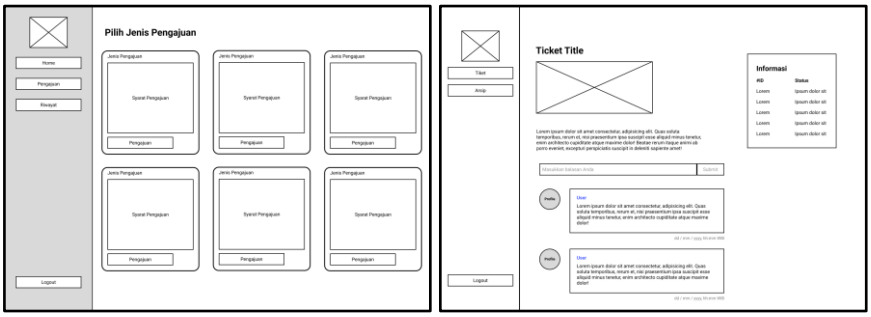

Figure 4. Low-fidelity prototype for user access rights

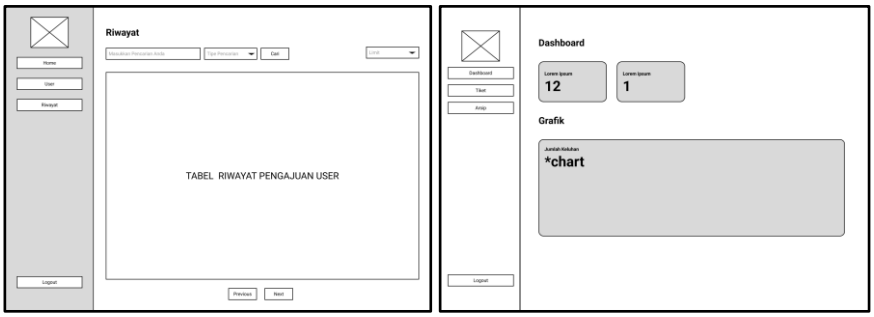

Figure 5. Low-fidelity prototype for admin access rights

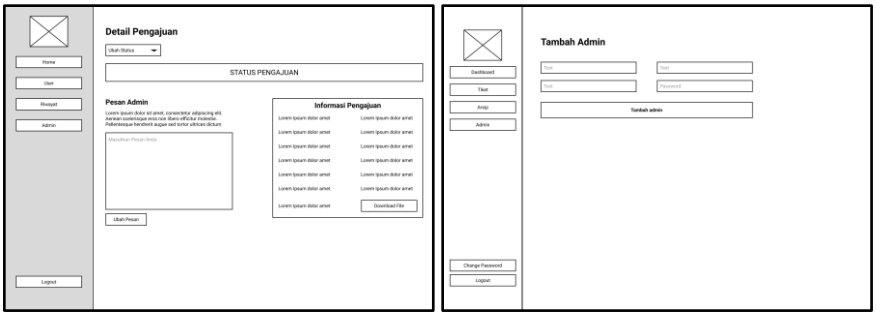

Figure 6. Low-fidelity prototype for supervisor access rights

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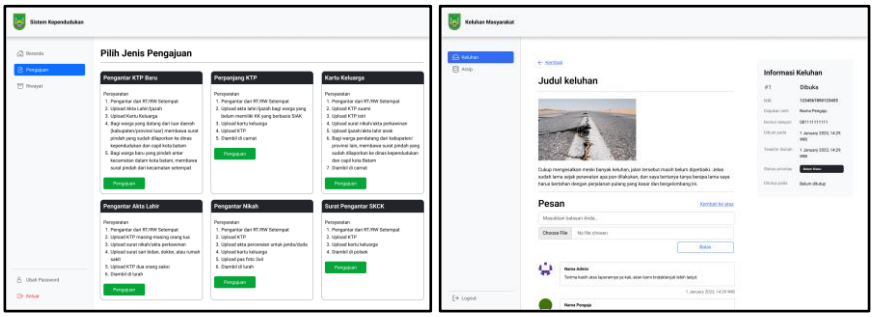

Figure 7. High-fidelity prototype for user access rights

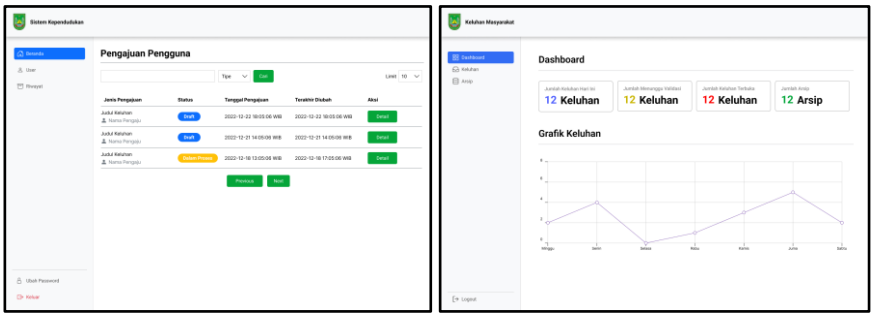

Figure 8. High-fidelity prototype for admin access rights

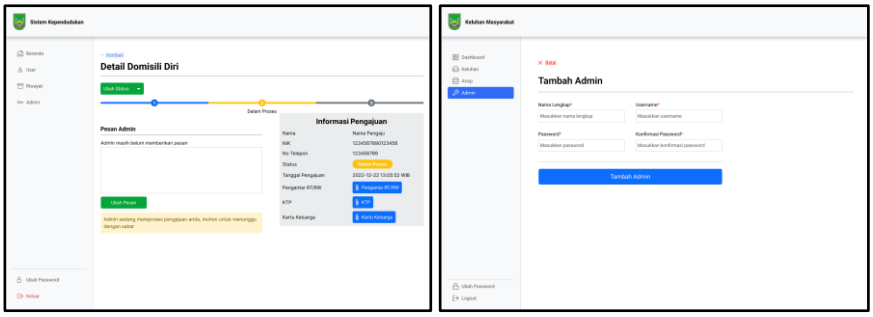

Figure 9. High-fidelity prototype for supervisor access rights

3.2 System Evaluation

The questionnaire was shared among the people in XYZ Ward. With the total of 10 respondents that consists of both the ward's governing body and the community, and the descriptive analysis was done after gathering the data. Based on table 4, the Perceived Usefulness (PU) variable is classified under the “strongly agree” category with the percentage of 85%, the Perceived Ease of Use (PEU) is also classified in the “strongly agree” category with the percentage of 88%, and the Attitude Toward Using (ATU) variable is classified in the “strongly agreed” category with the percentage of 86%. The results of the descriptive analysis show that the community of XYZ Ward accepted this system and perceived it as both useful and easy to use.

Table 4. Descriptive analysis results

Variables	nI	nR	ΣSK	ΣSH	P	Results
PU	6	10	300	254	85%	Strongly agree
PEU	6	10	300	265	88%	Strongly agree
ATU	1	10	50	43	86%	Strongly agree

4. CONCLUSION

The result of this study shows that the village information systems were successfully developed using SDLC method in XYZ Ward. Through the TAM method, the result shows that both the civil registration system and complaints reporting system were accepted well by the government and the community. Based on the analysis of the results, it shows that the people very much agree with the perceived usefulness of the system by 85%. It also shows that the people feel very much in agreement with the perceived ease of use of the system by 88%. Moreover, it shows that the people very much agree with their attitude towards using it by 86%. Lastly, it shows that the people accept and perceive the system as both useful and easy to use. To furthermore contribute to this activity, future researchers can support in pioneering more digital village

initiatives around the country. Through this activity, it is hoped to beneficially support the government's work efficiency in providing integrated services to the community.

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