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Road Damage Geographic Information System In Sukosari Village

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Abstract

One of the mapping technologies that are widely used today is the geographic information system, geographic information systems are often also called GIS (Geographic Information system) is a mapping technology in the form of a computer-based information system, which is designed to work using data that has special information or spatial references. Roads are land transportation facilities that have an important role in the field of transportation, connecting cities to cities, cities to villages, and villages to villages. Road damage has an impact on the safety and comfort of road users. Until now, there has never been any road damage in Sukosari Village caused by the conflict between Pringsewu and Pesawaran districts. Therefore, it is necessary to collect new information from the community about the current condition of the road so that village officials can immediately repair it because input from the community can make it easier for the village to make further improvements. For the problems mentioned above, a geospatial damage information system was created in the hope that the government can use the clustering method to determine the damage to level roads in Sukosari District. One of the methods used in this system is waterfall or also called waterfall. The information collected for this study came from the Sukosari website. Based on the results of the accuracy method, the waterfall used in this study is 100% accurate in terms of presentation of its suitability. The investigation of this method into the damage to the road geographical information system in Sukosari village clarifies that there are problems in the system that are not addressed in the research so that the system functions as planned.

INTRODUCTION

Sukosari Village is one of the villages located in the border area. more precisely, Sukosari village is divided into two districts, some are in the Pringsewu district area and some are in the Pesawaran district area. According to webstie statistics in Sukoharum, there are about 619 families with a population of 1953 people, which is equivalent to 1000 males and 953 females. Sukosari is one of the few areas where road infrastructure has not developed; Some have been completed, and some are still in the construction stage. Based on the sukosari village website, community data is as follows:

Table 1. Number of Population

Region	CD	LP	L	P
RT 006	61	188	96	92
RT 007	67	205	105	103
RT 008	120	160	178	182
Sum	632	1985	1017	968

Based on Government Regulation Number 34 of 2006, roads are defined as land transportation infrastructure that covers all parts of the road, including additional buildings intended for surface traffic. The problem that occurs is because being on the border is less of a concern for the government, because if repairs are made, it is considered not an area that covers the village. The damage to the road in Sukosari village is also the main cause of accidents, especially in the rainy season, such as in January-March, which also tends to hamper the condition of the road. In addition to the damage, the road is also a vehicle barrier because if you pass through the area, you have to pay more attention to the number of road sections that are blocked and cause vehicles to pass. Based on research, the main cause of traffic in 2013 due to damaged and potholed roads reached 26% [1]. Based on the road data from detikcom, the road graph is as follows:

Figure 1. road data

Research activities, regulations, services, road construction, and monitoring are all necessary in the road repair process. The length, width, class, condition, location, and function of the road are some of the important aspects in the process of repairing a road. Based on previous research, it is proven that the geographic information system (GIS) is an application that is very helpful for the central statistics agency (BPS) and the PUPR office in presenting spatial data. Research conducted by Hendi Suhendi and Fandli Umar Ali (2020) in Cirebon City using a use case methodology resulted in the conclusion that the information system developed can be implemented in accordance with the needs of the Cirebon City PUPR Office. The results of this study show an application of a geospatial information system that will be used by Sukosari. Several more studies have also been conducted related to the performance analysis of road damage thresholds and the use of geospatial information systems.

According to Sura Sembiring and Andiko Edy Eka (2020). Using a geospatial information system, this study examines the level of road damage in the Surakarta area and its surroundings. analyze the damage to level roads in Surakatra and its surroundings based on regional factors. According to Pratama (2019), online research can utilize existing technology to estimate time, cost, and distance and facilitate clandestine data collection. The app overcomes the drawbacks of traditional inspection methods by simulating road damage using only the provided photos without the need to travel slowly to the location and create reports discreetly without the use of intermediaries. Based on the above background, it is necessary to create a service system for the general public by creating a geospatial information system about the road to make it easier for the community to assess the condition of the road.

METHOD

2.1 Data Collection Methods

The purpose of this study is to collect the necessary data and information. Therefore, we use the following data collection methods:

a. Literature Review
   is a type of research that uses data collection techniques from books such as Fundamentals of Dynamic WEB Programming, PHP, Basic Concepts of Geographic Information Systems, and GIS. The magazine is titled "Information Systems.

b. Interview techniques
   In this study, the interview technique discusses the results of the overall road layout, road type, and location. This interview technique explains the head sukosari which was carried out on May 18, 2023 at 09.00 WIB. Based on the results of road interviews compared between districts, this has never been seen before since 2004.

c. Observation
   It is a long-term study of damaged roads in Sucosari Village, based on data that is expected to include, for example, the road coordinate points, the data of the sections, and the drawings on the day of the incident. May 20, 2023. The results of the observation were in the form of information on road damage such as rocky, red soil, and potholes.

2.2 System Development Methods

a. Waterfall Method

The waterfall method is a type of system development where one phase transitions smoothly to another phase (B Fachri et al., 2019). The waterfall method is a technique that facilitates the development and maintenance of the system development process (Pancabudi, Riskysurbakti, 2021).

The first SDLC method used to develop software was called "waterfall". This method allows for management and departmentalization.

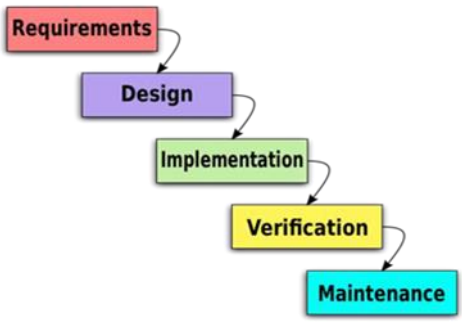

Figure 2. Phases of the waterfall method

The following are the stages of development using the waterfall method in the image above:

1. Reqiutmen
   At this stage, an analysis is carried out to understand the needs of road geography in order to develop the road geography information system. This includes identifying user needs, such as user authentication, user profiles, road damage detection, notifications, dashboards, officer dashboards, searches and filters, and statistical reports.
2. Design
   The design of the Geographic Information System was carried out after a thorough needs analysis. This aims to improve the website design (menu/display), user interface to calculate the state of dashboards and reports, and the data models used by the company. The ER (Entity-Relationship) diagram is used to illustrate the necessary tables, such as report tables and report statuses, integrate with existing geographic information systems (update systems), and illustrate online geographic data.
3. Implementation

At this point, software design is connected as a program or program unit. Testing verifies that each device meets the specifications. This stage includes the development and implementation of the website according to the design made. The development team will describe the code using HTML as a programming language, creating a web page by integrating it with a data system and connecting it to it.

4. Verification
   It is done to ensure that the system built meets all the needs that have been set such as, verification of functional needs is carried out to test every desired feature, user authentication is also tested by trying to log in using valid and invalid accounts, road damage complaints are tested by filling out forms and ensuring that complaints are stored in the database and users receive notifications that complaints have been received, The user and officer dashboards are also tested to ensure all information received is accurate and the search and filter features are tested to find specific complaints with appropriate results.
5. Maintenance
   The maintenance of the road damage complaint information system is an important step after implementation to ensure that the system functions properly and meets the needs of users. The review covers several aspects, from bug fixes to feature development. The development team must consistently maintain the system to detect and fix any bugs or technical issues that may arise. This includes conducting thorough research to ensure that each feature is working properly and that there are no issues that could hinder the user experience. Maintenance also includes evaluating system performance in terms of security and performance; The system should be updated regularly to increase productivity and align with emerging technology trends. The development team must also provide complete and clear documentation to facilitate the learning process so that new participants can quickly understand the existing system. By conducting effective and thorough research, the maintenance road damage information system can continue to operate as well as possible, provide maximum benefits to users, and provide a quick response to maintenance road damage.

2.3 Data Analysis

To understand the characteristics of patterns, trains, and damage that have been described by the general public, it is necessary to analyze data in the geographic information system (GIS) for road damage complained. The information provided includes details of the location, type, and duration of damage as well as the status of its handling. Using GIS mapping tools, the location of the damage can be displayed in the form of a map, thus allowing spatial analysis to identify areas with a high frequency of damage. Similar to heatmaps, this mapping can assist authorities in determining improvement priorities. Additionally, time-based analysis can be used to identify seasonal patterns in complaints, such as an increase in complaints during seasonal rainfall, which can help with research maintenance. Classifying the type of damage is also very important because it can more effectively determine resources and budgets, especially if there are many pothole-related incidents in the road. In addition, time-response analysis and complaint handling can be used to assess system efficiency, identify areas that need improvement, and measure user satisfaction with the services offered. Integrating data from other sources, such as weather and cross-data, can help provide more information about factors that indicate road damage. The results of this analysis can be discussed in a single paragraph that prioritizes attention and recommendations to interested parties for improvement priorities and more effective maintenance strategies. Therefore, data analysis in GIS for road damage can help interested parties make better decisions, improve response to complaints, and ultimately improve the quality of road infrastructure.

RESULTS AND DISCUSSION

3.1 System Analysis

Systems analysis is a problem-solving technique that involves ensuring that the system is aligned with its components to understand how those components work together and interact to achieve the system's goals.

Because it is located along Jalan Sukosari, the information system is currently an obstacle in the Sukosari area. The lack of attention of government officials to sukosari residents is a bit difficult because residents are only biased to do it through the Facebook application. Based on the problems mentioned above, information on complaints about road damage in this village should be more accessible to the government and facilitate complaints. With the advancement of information technology, it is hoped that the presence of web-based road damage GIS will make it easier for the general public to conduct research and government agencies to find out geographically about an area. Therefore, Sukosari residents may be more vigilant.

3.2 Design

a. Use case

Usecases are interactions between users (or actors) and systems to achieve a specific goal. In the context of system analysis and design, use cases serve to explain how the system will be used in real-world situations, thus helping to understand the needs of users as well as the functionality that must be present in the system. Each use case typically includes several important elements, such as the actors interacting with the system, the desired outcome the actor wants to achieve, and a precise description of the issues that arise during the interaction. In addition, the use case describes the preconditions that must be set before the process begins, the postconditions that must be achieved after the process is completed, the primary flow that describes the successful interaction, and the secondary flow that describes the situation that may arise outside. from the main flow, such as a problem or misunderstanding. Therefore, use cases are helpful in software development because they provide clear examples of how the system will be used, help the development team understand the needs of users, and serve as a foundation for system testing. The following is a use case diagram of the Road Damage Geographic Information System in Sukosari:

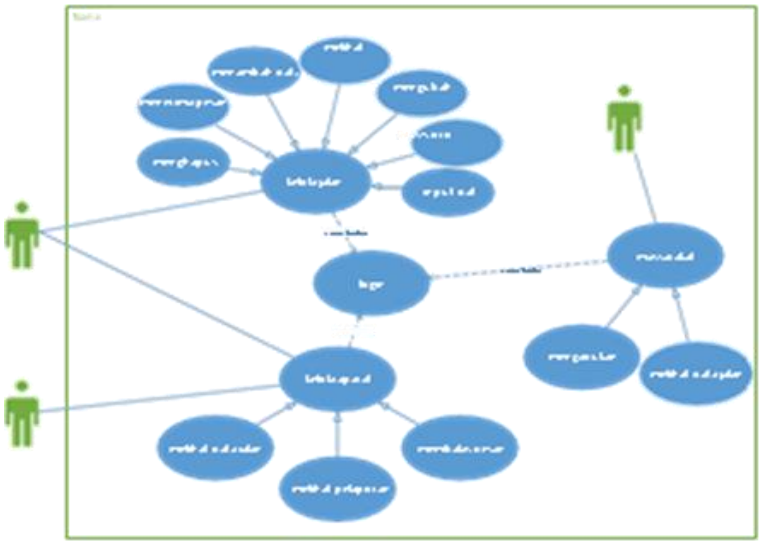

Figure 4 Use case

The definition of an actor is as follows:

1. An administrator is a person who has the ability to enter data into a system.
2. who have the ability to observe, balance, and listen to others.
3. A community is any person or organization that is located near a geographical road and has

the ability to access and carry out geographical road activities.

The definition of the use case, which is as follows:

1. Login is the first step in using a system.
2. Manage data path This process allows administrators to perform editing, deletion, searching, entering, viewing, and replying.
3. The key component of account security is passwords.
4. Admin Sarana Kelola has the ability to reply to or delete Suggestions.
5. Manage users refers to the procedure for creating passwords.
6. Checking map data and road conditions This is the process by which one can observe road conditions.
7. Print reports Illustrate how village officials print reports.
8. Examining Predetermined Suggestions Researching Suggestions or Reports received from the public.

b. Squence diagram

Sequence diagrams are a type of diagram that is used to clearly explain and describe the various components of a system in detail. In addition, the sequence diagram depicts the messages and commands that are outlined. The squance diagram in Figure 3.2 describes the sequence in which the actor performs the login process.

Figure 5 Sequence diagram

Figure 5 Sequence diagram describes the sequence performed by the login admin on the GIS road breakdown.

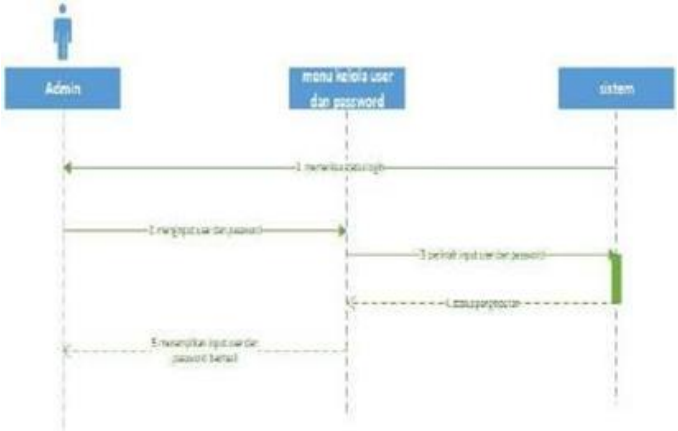

Figure 6 User and password input diagram

Figure 6 Sequence diagram describes the sequence in which the admin enters the username and password process.

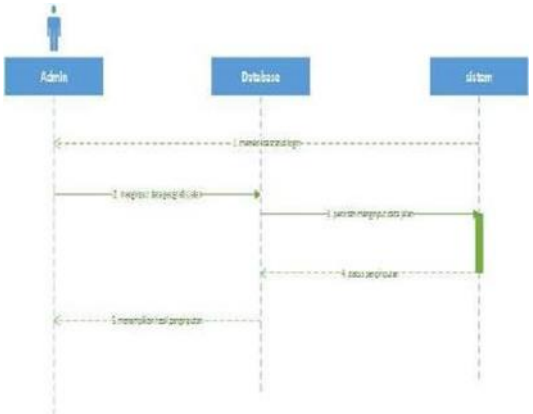

Figure 6 User input and path diagram

Figure 7 sequence diagram explains the calculations that the admin makes in the process of entering road data.

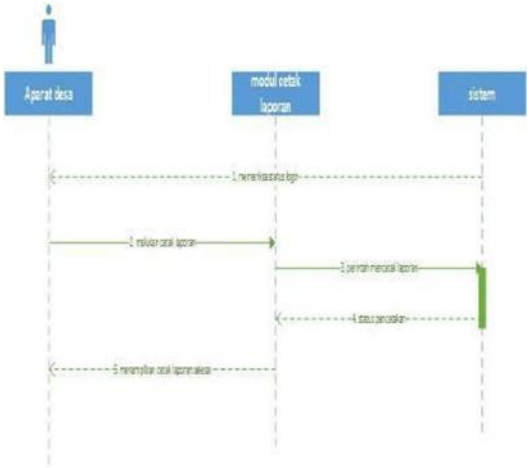

Figure 8 View suggestions

Figure 8 sequence diagram explains the sequence in which village officials look at suggestions.

c. Diagram Class

The main UML diagram used to describe a class or object in a system is called a class diagram. Classroom diagram analysis is the first step in any program development.

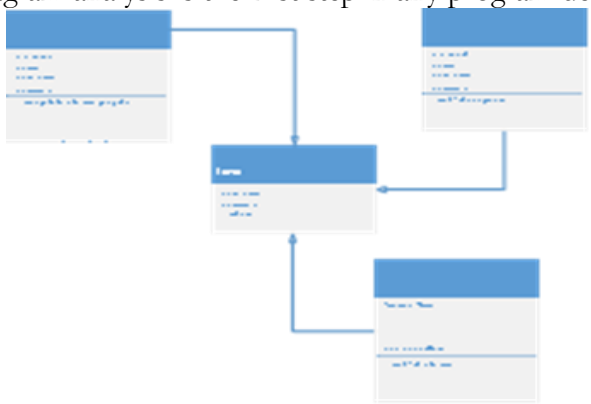

Figure 9 Class diagram

d. Interface design

The most striking representations of shapes, warnings, and typefaces are provided by the interface design. This includes designing the system interface used for the damage to the Sukosari road.

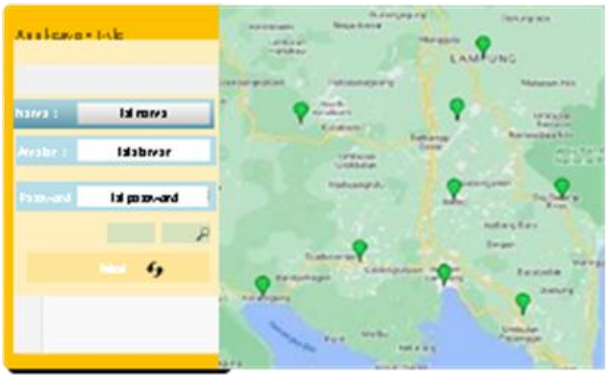

Figure 10 Website interface design

The image above is a design of the public login interface used to see the state and geographical location of Jalan Sukosari.

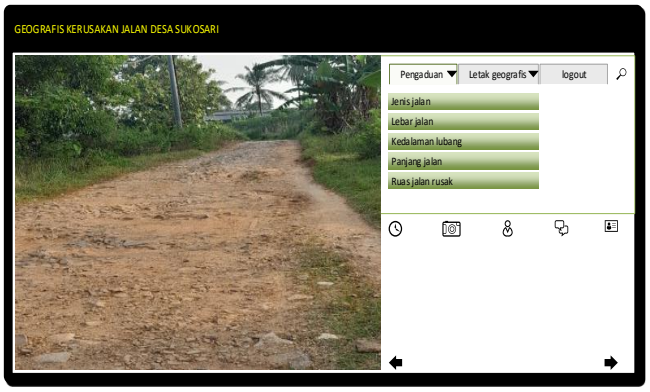

Figure 11 road website interface design

The image above is an interface design based on public awareness of Jalan Sukosari. People who have logged in to the system are biased in observing the road, while people who have not logged in can observe the road and other people's comments.

The purpose of black box testing in Geographic Information Systems (GIS) is to assess the functionality of the system from the user's point of view without changing its internal structure. The purpose of this trial is to identify problems with the functionality of the system, ensure that the system meets the needs of users, and provide recommendations for improvement based on the findings of the study. The methodology used covers several topics, starting with test planning that discusses the objectives and criteria for success, such as data accuracy, response time, and ease of use of the interface. Finally, test scenarios are developed based on system specifications, including new complaints, complaint status, and search complaints. Verification testing involves users representing a variety of roles, such as the general public and maintenance personnel, to ensure that the system is functioning in accordance with the law. Once the test is successful, the results are analyzed to identify issues and areas that need improvement. The research findings show that while most of the system's functions function well, there are some issues that need to be addressed, such as data loss that results in the loss of important information, user interfaces that hinder communication, and slow response times when interacting with business locations. It provides useful information about the user experience and helps the development team focus on the necessary improvements. Therefore, black box testing has successfully identified several functional issues that need to be fixed, and recommendations have been made to improve user interface, data analysis, and response time. The study highlights the importance of thorough testing of the system to ensure that it meets the needs and functions of the user as intended, which will increase the effectiveness of the system in managing traffic and improving user satisfaction.

3.4 Discussion

Based on the results of the system evaluation above, it can be concluded that the system is effective for the improvement of a road. Questionnaires made by Sukosari community respondents consistently highlight problems in the community. The findings of this study make it easier for the community and the government to manage it [@5 VC-LX0/tau the geographical condition of the road. In addition to accidents, road damage is also an obstacle to the speed of vehicles because if you are passing through this area, you must pay attention to the number of road sections that are hampered and cause vehicles. [8]. This complaint strategy aims to clarify policies related to complaints. The determination of the complaint design model and the two selection of complaint handling facilities must be the first performance of the system.

application analysis and information system design through UML. Based on the results of the system evaluation above, it can be concluded that the system is effective in determining road damage in 2024 [6]. Questionnaires made by Sukosari community respondents consistently highlight problems in the community. The results of this research make it easier for the community and the government to maintain the geographical condition of the road. In addition to the damage, the road is also a vehicle barrier because if you pass through the area, you have to pay more attention to the number of road sections that are blocked and cause vehicles to pass. This complaint strategy aims to explain policies related to complaints. First and foremost, the performance system should include a complaint determination model thanks to two complaint selection facilities.

Based on the results of its implementation, this article discusses the Geographic Information Market. The research shows, among other things, that complaint information systems can help increase system productivity and innovation by utilizing information technology, online, social media, and geography, as well as influencing complaint work and geographical points. In this study, the methodology of SDLC (Software Development Life Cycle) system development was used combined with the waterfall analysis method. The system uses WordPress as its CMS along with Microsoft Xampp. The result of this study is the geographical information system of Road Damage in Sukosari.

CONCLUSION

Based on the results of the discussion above, it can be concluded that this study identifies the area as a geographical road damage website. This system assists the community in conducting geospatial studies on road damage in Sukosari Village and provides convenience for district officials in assessing road damage. To understand how the system and menus work thoroughly, the system is tested with Black Box. Based on the process mentioned above, the existing functions can be carried out according to needs and desires. With the help of this technology, the apparatus can easily maintain the flow of the road. In addition, residents of Sukosari Village can also easily see the condition of the road. Based on the results and analysis of the research, this research can provide valuable information to the residents of Sukosari Village, improve community efficiency, and improve geographic data.

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