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Webgis-Based Flood Disaster Inventory System in Karawang Regency

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Abstract

One of the natural disasters that often occurs in Karawang Regency is flooding. This is caused by high rainfall and the topography of Karawang Regency which tends to be low so that some areas can be submerged. However, along with the rapid development of information technology and Geographic Information System (GIS) in Indonesia, information technology plays an important role in the process of disaster management. The available spatial information can be in the form of facts resulting from events, raw data taken from measurement results, or derived data obtained from conclusions drawn from these facts and data. Therefore, the purpose of this research is to develop a WebGIS-based Karawang District Flood Disaster Inventory System. In its development, the Waterfall Software Development Life Cycle (SDLC) method is used starting from the analysis, design, coding, to testing stages. The results of the system testing are then identified using BlackBox. With this disaster inventory system, it is hoped that the flood disaster management process in Karawang Regency can be carried out more effectively and efficiently.

Keywords: *Karawang Regency, Flood Disaster, Geographic Information System (GIS).*

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INTRODUCTION

Karawang Regency has an area of 1,753.27 km^2 or 175,327 Ha, which is 3.73% of the area of West Java province. Karawang Regency is a relatively low land area. Natural disasters that often occur in Karawang Regency are floods. The main factor for flooding is high rainfall which submerged several areas, such as the flood that occurred in the Bumi Mutiara Indah 1 housing complex in Dawuan Tengah Village, Cikampek, and the flooding in the Bumi Mutiara Indah 2 housing complex in West Dawuan Village, Cikampek. Based on interviews with local residents, the two residential areas often experience flooding every year with heights ranging from 50 – 100 cm.

Based on the flooding disaster that occurred in Karawang Regency, there are 3 spatial information needs in natural disaster management, namely when it happened, where it happened, and how intense it happened. Geographic Information Systems (GIS) have an important role to record and map natural disaster data that has been spatialized. Spatial information can be in the form of facts resulting from events, rawa data taken from measurements, data derived from knowledge (conclusion) from these facts and data (Suharto & Suhrujo, 2016).

The research entitled "Web-Based Geographical Information System for Mapping Natural Disaster Locations in North Sumatra", examines the purpose of reducing and overcoming the aftermath of a disaster. This research produced a

geographic information system for mapping natural disasters which has a function to display and find information on disaster points in the North Sumatra region, with a WebGIS system that contains a statistics menu, a map menu, and a login menu (Yustria Handika S, 2018).

The research entitled "Web-Based Geographic Information System with Case Studies of Natural Disaster-Prone Areas in the City of Tasikmalaya", with the aim of managing spatial data in order to identify and avoid the location points of natural disaster-prone areas. The results is the creation of a geographic information system for natural disaster areas in Tasikmalaya City. The designed WebGIS system has 2 users, namely the admin and the public. The admin has the task of processing and defining data on disaster-prone areas so that it becomes information, and the public can find out the distribution of disaster-prone areas in Tasikmalaya City (Wildan Nugraha, 2018).

Based on the Regulation of the Head of the National Disaster Management Agency No. 1 of 2011, inventory is an activity of collecting data, recording and reporting physical conditions as material for analyzing equipment needs. Inventory of disaster management equipment is the activity of collecting, recording, and reporting data as material for analyzing the need for disaster prevention equipment.

In this research, the development of a WebGIS flood inventory in Karawang Regency will be carried out. The purpose of this research is to develop and identify the results of WebGIS testing of the flood disaster inventory, so that it can be used as a source of information in the future. This research can provide knowledge benefits for the people of Karawang Regency to find out the location points of flood-prone areas, and can also find out the amount of damage and the extent of the natural disaster that occurred, so that the government can re-arrange spatial planning after a disaster occurs.

RESEARCH METHOD

In this study, the WebGIS-based flood inventory system in Karawang Regency was developed using the Waterfall Model, namely the Software Development Live Cycle (SDLC). The waterfall model has several processes or stages in designing a system. Each process has inputs required to advance to the next stage. The following is the processes or stages of the waterfall method used in this study.

1. System analysis
2. System design
3. System coding
4. System testing

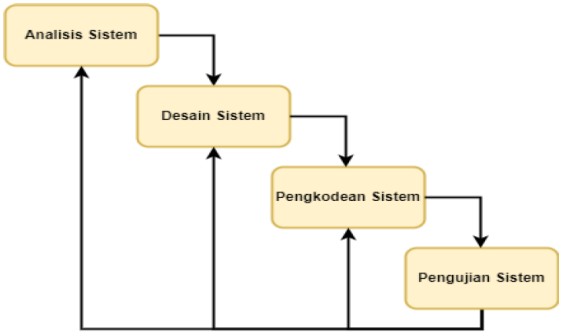

Figure1. System Development Illustration

RESEARCH RESULTS AND DISCUSSION

The result of developing this system is a geographic information platform that was developed to carry out an inventory of flood disasters in Karawang Regency. This is the first system created to help manage flood disasters in Karawang Regency. The test and evaluation results show that this system is capable of meeting the development objectives of providing geographic information regarding the location, type, and scale of flood disasters, as well as facilitating monitoring, analysis and decision making regarding flood disasters.

Overall the results and discussion of the development of a WebGIS-based flood inventory system in Karawang Regency focus on efforts to meet development goals and increase effectiveness and efficiency in flood disaster management.

System Analysis

The needs analysis process is divided into functional and non functional requirements.

1. Functional Requirements Analysis
   Describing the feature services, or functions required by the user so that the built system can function properly. There are 2 users in this system, namely user or community and admin. Access rights for each user are different.
2. Non-Functional Requirements Analysis
   Functional requirements are not directly related to certain elements in the system. Non-functional requirements in this study are hardware requirements such as processor, RAM, storage, mouse, and keyboard. Meanwhile, software requirements are such as the Windows 10 operating system, visual studio code, XAMPP, geogle chrome, figma, php framework codeigniter, and js leaflets.

System Design

1. Use Case Diagram

Overall, the interaction between the system and the environment in this study, especially what the user and admin can do, is as illustrated in the use case diagram below.

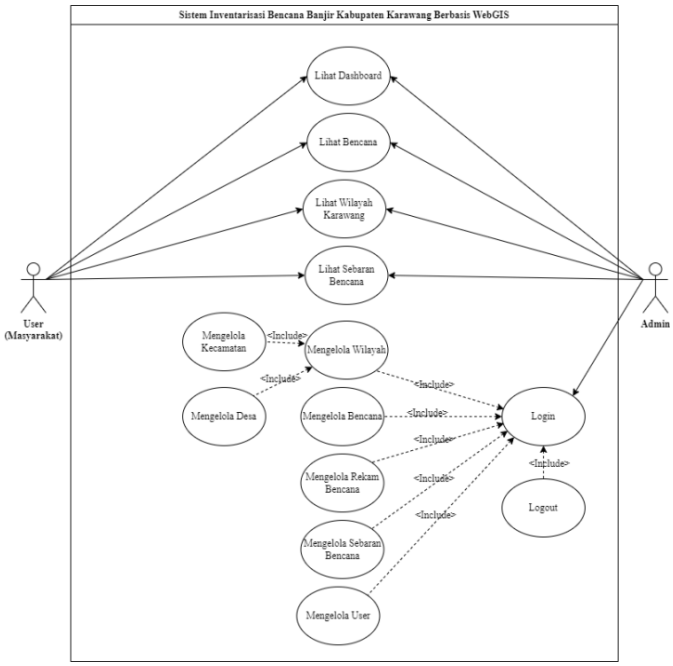

Figure 2. Use Case Diagram

2. Interface Design

WebGIS-based Karawang Regency flood disaster inventory system design is made with a user-friendly and easy-to-understand interface design.

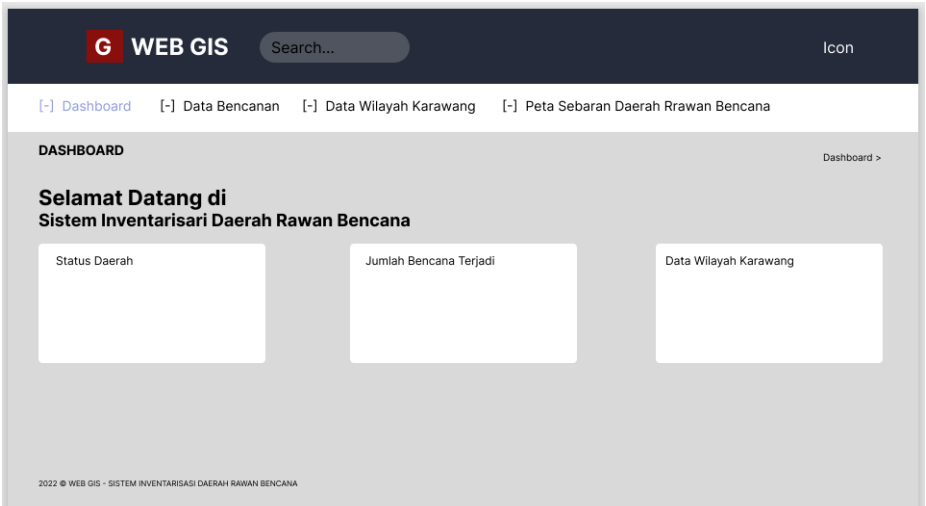

Figure 3. Dashboard User

Figure 3, the main page that appears when the user (community) first enters the webGIS, on this page the user is immediately presented with brief information, such as the status of the area, the number of disasters that have occurred, and Karawang area data.

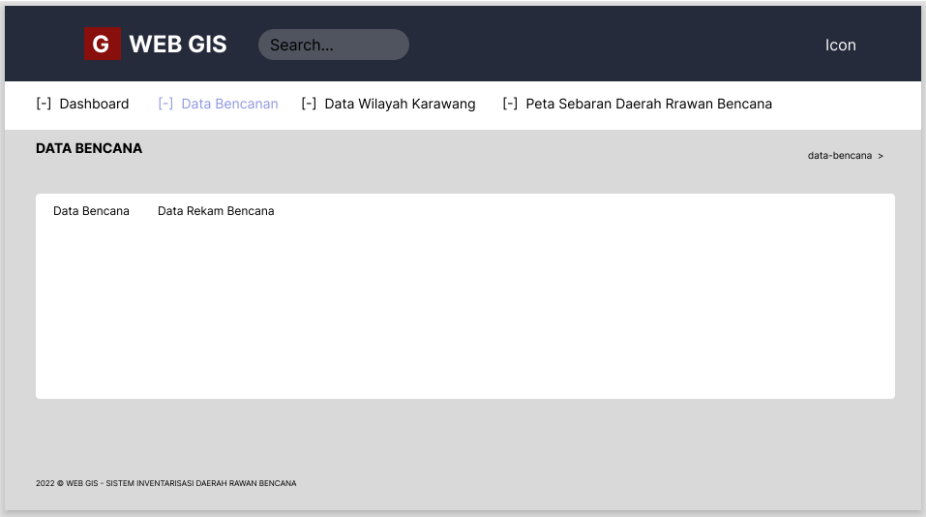

Figure 4. User Disaster Data

In **Figure 4** above, the user as the community can see disaster data and disaster record data, in the disaster record data submenu the user will get a lot of information in it.

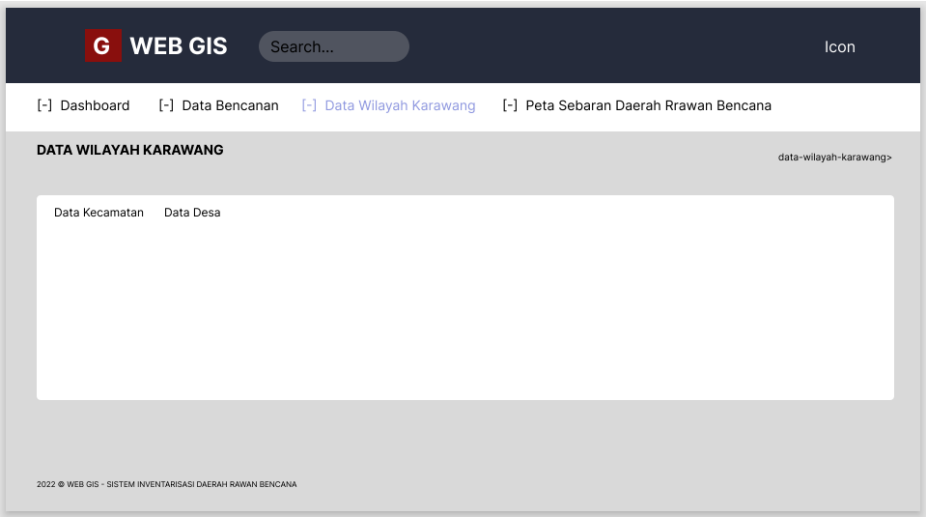

Figure 5. Karawang Area Data

In **Figure 5,** the user will immediately show information related to village data and sub-district data.

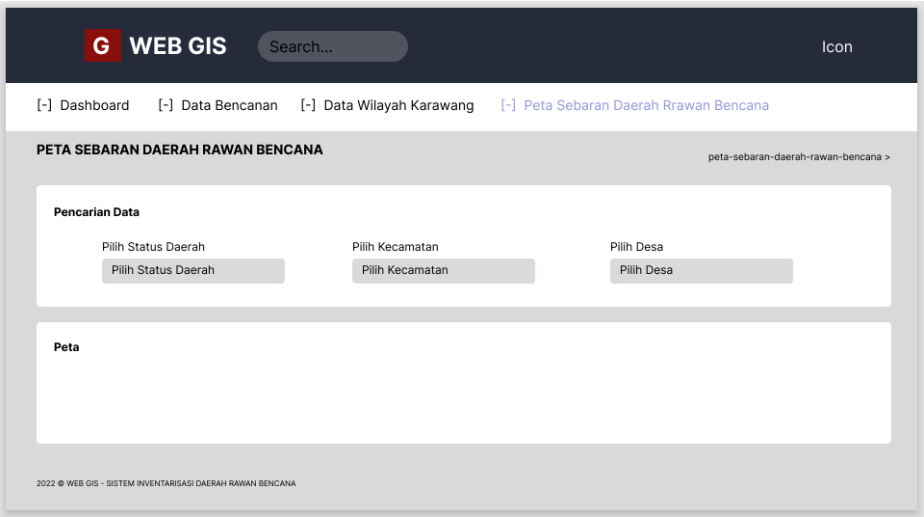

Figure 6. Map of the Distribution of Disaster-prone Areas

In **Figure 6,** displays a map display and data search, the map here is intended to visualize points where disasters occur form the entire data.

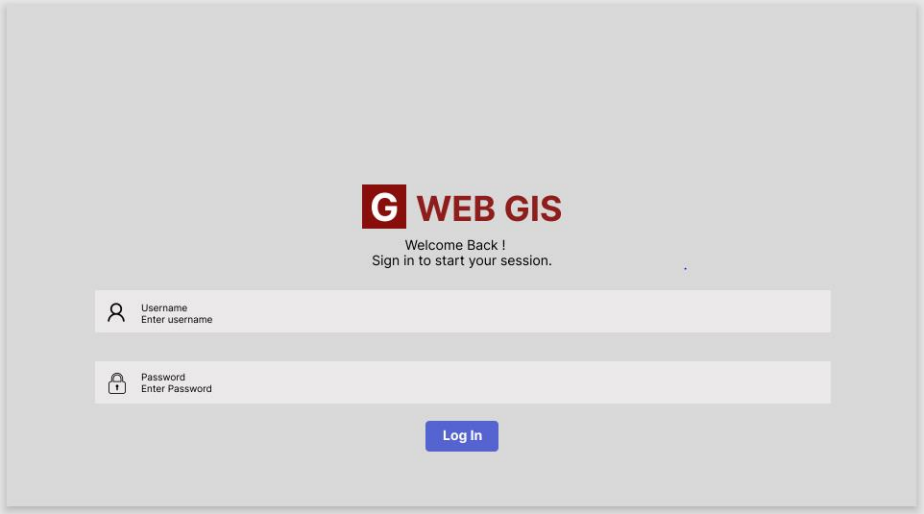

Figure 7. Login Admin

In **Figure 7,** the admin login menu will display an admin login form page that can be accessed and used by the admin to make changes to data on webGIS. In the admin login form, BPBD employees as the admin will be asked to enter a valid username and password address so they can enter the admin page.

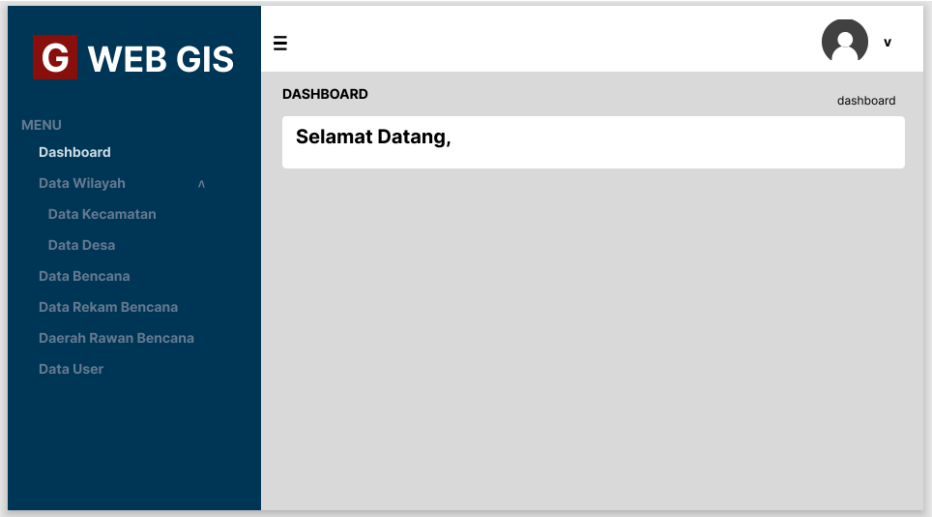

Figure 8. Dashboard Admin

In **Figure 8,** an admin can manage data starting from adding, changing, deleting, and saving data. Admin has full access rights and authority to manage regional data, disaster data, disaster record data, disaster-prone areas, and user data.

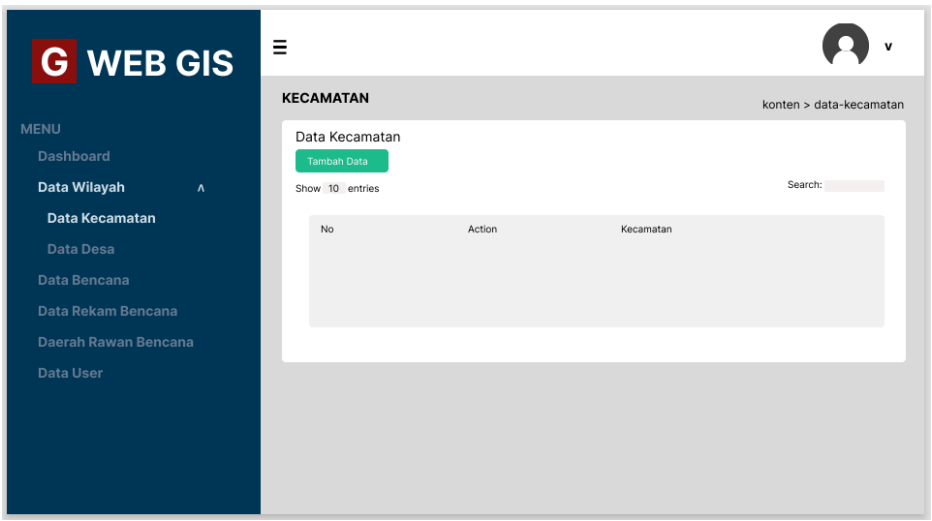

Figure 9. Admin District Data Menu

Figure 9 displays the sub-district data input page manu by admin. Admin can add district data.

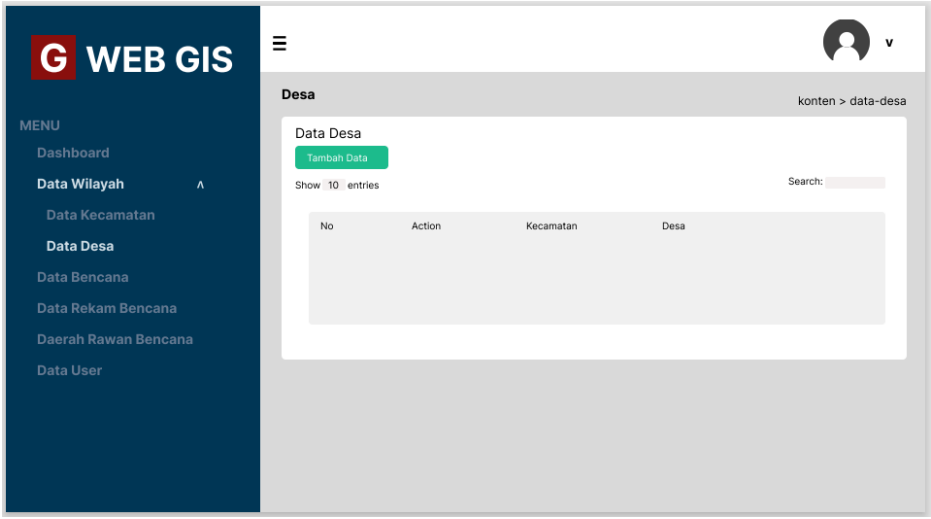

Figure 10. Admin Village Data Menu

In **Figure 10,** admin can add village data by selecting add data.

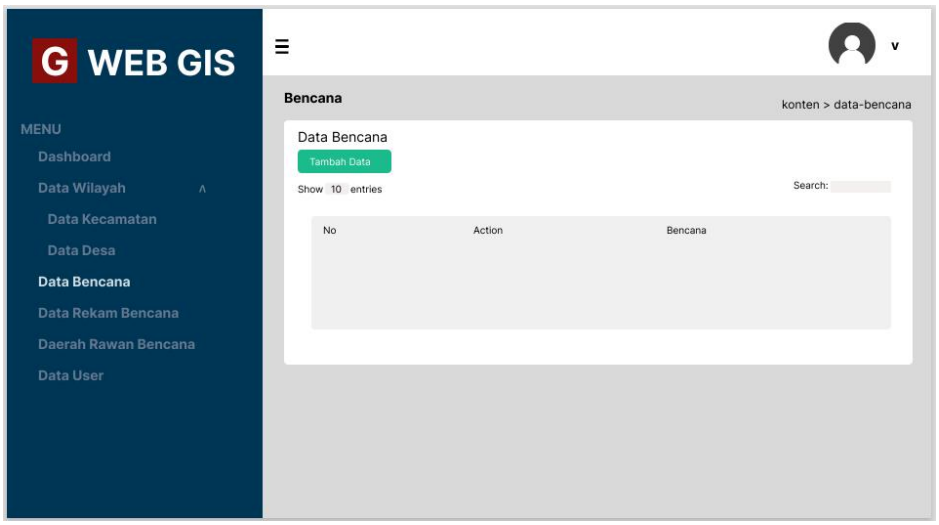

Figure 11. Admin Disaster Data Menu

In **Figure 11,** page for admin to add disaster data.

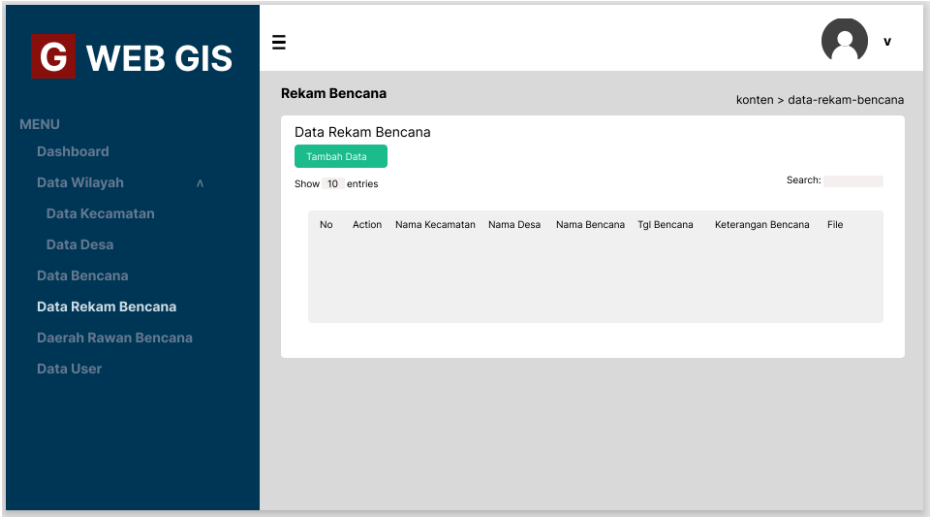

Figure 12. Admin Disaster Record Data Menu

In **Figure 12,** page for admin to add disaster data in details.

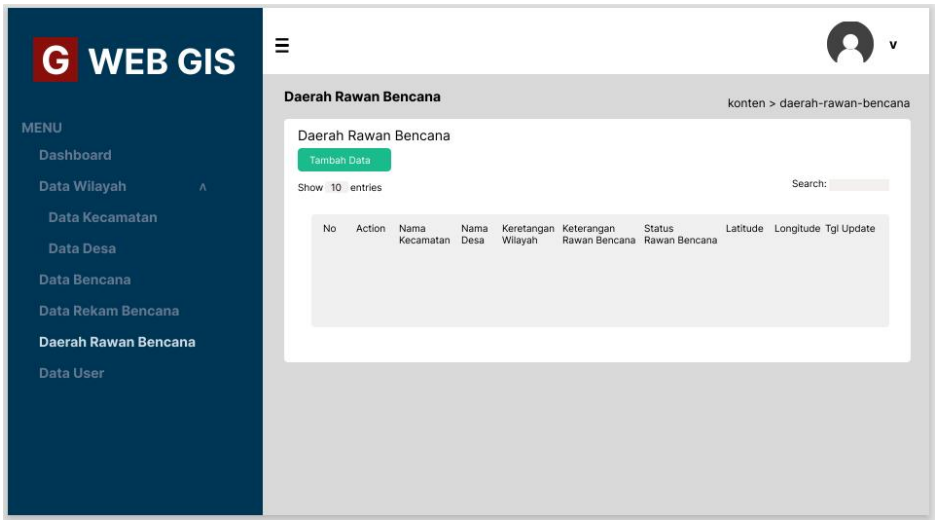

Figure 13. Disaster-prone Area Menu

In **Figure 13,** admin can add location point data on the map by entering the latitude and longitude of an area.

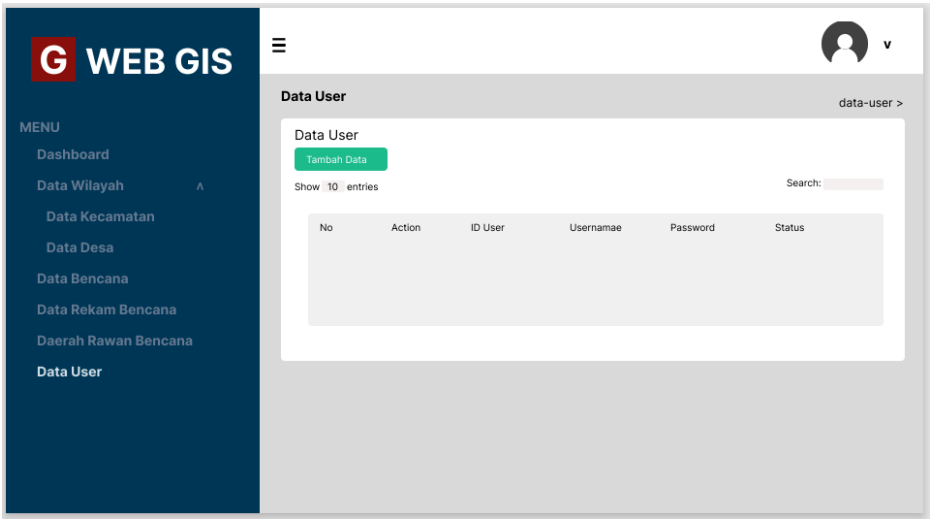

Figure 14. Menu Data User

In **Figure 14,** page for user data input. The admin can add users so that the user as a community has role on this admin page, and the admin can turn off the user's active status after his interests are complete.

System Coding

System coding is done with XAMPP software and visual studio code. To get the coordinates of a place on a computer, you can do it with Google Maps. Latitude and longitude use a decimal degree format in a form such as 41.40338, 2.17403 (latitude before longitude) ensuring the first number of latitude is between -90 and 90, while the first number of longitude is between -180 and 180.

System Testing

The results of testing using the black box method on a WebGIS-based flood disaster inventory system are valid.

CONCLUSION

Based on the results of the research and discussion that have been described, it can be concluded that :

1. Compiling a WebGIS system for flood disaster inventory can provide significant benefits for both parties. This system can assist the government in planning and decision-making processes in preventing and controlling flood disasters, as well as providing accurate and fast information for the public abour the state of flooding in their area. This can help the government and society in dealing with flood problems more effectively and efficiently. Communities can access a WebGIS-based flood disaster inventory.
2. The results of the WebGIS testing of the flood inventory in Karawang Regency show that the system can function properly and meets the specified specifications. This can show that the system can be used effectively and efficiently in the prevention and control of floods in Karawang Regency.

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