p-ISSN 2460-0768 e-ISSN 2597-6044
https://doi.org/10.20961/ge.v10i1.70722

DEVELOPMENT OF WEB GIS APPLICATIONS FOR MONITORING AGRICULTURAL ACTIVITIES IN SUNGAI KAKAP DISTRICT, KUBU RAYA REGENCY

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ARTICLE INFO

Article History
Received : 21/01/23
Revised : 17/05/23
Accepted : 30/01/24

Citation:
Sugiarto, A., Tampubolon, B., and Christanto, L.M.H., (2024) Development Of Web Gis Applications For Monitoring Agricultural Activities In Sungai Kakap District, Kubu Raya Regency. GeoEco. Vol. 10, No. 1.

ABSTRACT

Good agricultural development planning requires an accurate and real-time database. This is very important to see the development and level of welfare of farmers as the spearhead of food security. Sungai Kakap Sub-district, Kubu Raya Regency is one of the sub-districts with the number of Gapoktan (23), Poktan (284), the number of members (6305) with Field Agricultural Extension Workers (PPL) since 2019 totalling 9 civil servants and 14 people helping themselves. The number of PPLs is not proportional to the number of farmer group members, making supervision of agricultural activities difficult. The presentation of information in the form of Web GIS is expected to be a solution so that assistance, guidance, and counselling carried out by the government through the agriculture office can be right on target. The purpose of this research is to build a Web GIS-based Agricultural Information System in Sungai Kakap District so that it can be used as a model for agricultural monitoring activities in other areas. The engineering method in this research uses Remote Sensing and Waterfall methods. Remote Sensing is a method of building spatial data using aerial photo interpretation techniques, while Waterfall is used to build a web GIS as a place to display spatial data. The result of this research is Software Engineering in the form of a Web GIS-based Agricultural Information System Application. This Web GIS application can then be used as a tool to monitor the agricultural activities of each farmer group member in each farmer group.

Keywords: *Monitoring; Agriculture; Web GIS; Poktan; Gapoktan*

INTRODUCTION

Indonesia has a large population, reaching 270.20 million people based on data released by BPS in September 2020 (Badan Pusat Statistik, 2020). With such a large population, an indicator of food security is a representation of national security. The spearhead of food security for a region is agriculture. Therefore agricultural development needs to be carried out with good planning. Community food security is determined by adequate agricultural production (Wardhiani, 2019). Increasing agricultural productivity is to realize

food security to improve national security (Lemhanas, 2012). To increase agricultural production, good agrarian development planning is needed. It cannot be denied that the farm sector plays a significant role in development (Mulyaningsih et al., 2018). Agricultural development planning is inseparable from the role of farmers as the frontline in realizing food security.

The reality in the field is that farmers are often underestimated and receive less attention from the Government, so agricultural production becomes less than optimal. The extent of the farm area and the limited number of Field Agricultural Extensionists (PPL) is a problem for the Government in carrying out the functions of supervision, guidance and protection of farmers. Therefore it is necessary to have a system/equipment that facilitates the control of these agricultural activities. Human resource problems related to the application of technology and management information systems are the main reasons for the difficulty in presenting information in the farm sector (Muspiroh, 2012). The application of technology in monitoring the availability of agricultural land and agricultural products, both in quality and quantity, has an essential meaning in controlling the level of food security quickly. Geographic Information System (GIS) is a tool widely used to facilitate decision-making in a plan related to spatial aspects (Jauhari, 2020). Research conducted by CV Bumi Kalimantan Lestari explains that web-based geographic information system applications make it very easy for users to get access to geospatial information in real-time, anytime, anywhere, and with any device connected to the internet (CV Bumi Kalimantan Lestasi, 2020)

Geographic Information Systems (GIS) are currently experiencing rapid development and are widely used in various human needs related to spatial information (Rosdiana et al., 2015). The decision-making process related to spatial aspects becomes more accessible by using GIS. A computer-based information system that combines map elements (geographical) and information about the map (attribute data) is designed to obtain, process, manipulate, analyze, demonstrate and display spatial data to complete planning, processing and researching problems (Sumaryono et al., 2017). The use of GIS which is oriented towards the use of spatial data, is widely used in various fields of study,

one of which is to map agricultural activities.

The paddy-wet agricultural land in Kubu Raya Regency in July 2018 reached 17,000 hectares, and the planting potential was 13,792 hectares (Momon, 2002). Sungai Kakap Subdistrict is one of the subdistricts that is a priority for agricultural development in Kubu Raya Regency. The number of farmer groups in this sub-district is in the most significant order among farmer groups in other sub-districts. Based on data from Kuburaya Regency in Figures for 2020, it is known that Sungai Kakap District consists of 15 villages with a total of 284 farmer groups, 23 Gapoktan and 6305 members (BPS, 2020). The number of farmer group members is not comparable to the number of Field Agricultural Extension (PPL) owned by the Agricultural Extension Center (BPP) Sungai Kakap District. The number of PPLs owned by BPP Sungai Kakap District is nine people with PNS status and 14 with honorary positions.

The number of PPL that is not proportional to a large number of farmer groups and their members will make it challenging to monitor agricultural activities that can be carried out by the Government. The ease of presenting agricultural activity data in the form of a Geographic Information System (GIS) is expected to be a solution and make it easier for PPL to monitor agricultural activities so that all kinds of assistance and transfer of knowledge for members of farmer groups carried out by PPL and the Agriculture Service can be right on target. This research aims to establish a Geographic Information System (GIS) for monitoring agricultural activities in the form of a Web GIS application in Sungai Kakap District which can be used as a model for developing research locations and in other areas.

MATERIALS AND METHODS

Research Design

This research uses the Research and Development (R&D) method. The framework used in this study is as shown in **Figure 1**.

The development theory used in this research is the Waterfall development model (see **Figure 2**). The Waterfall model is used to build a web GIS as a place to display spatial data. The waterfall method is a sequential work method, system development as data processing so that it can run well (Kurniawati & Badrul, 2021).

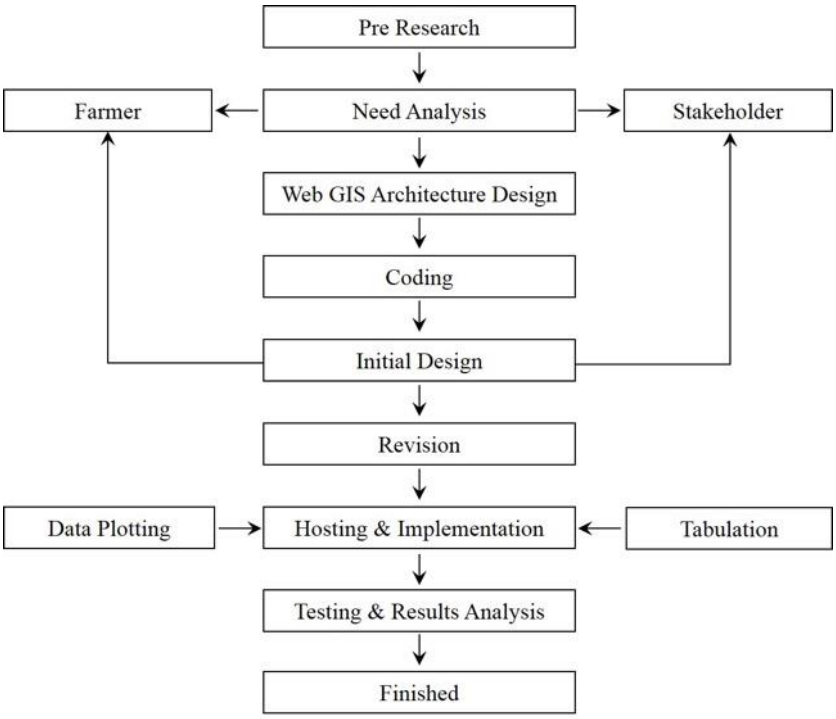

Figure 1. Flowchart of Web GIS Software Engineering

The waterfall method method or often called the classic life cycle, describes a systematic and sequential software development approach, starting with the specification of user requirements and then proceeding through the stages of planning, modeling, construction, and delivery of the system to customers/users (deployment), ending with support for the complete software produced (Pressman, 2012; Wiro Sasmito, 2017).

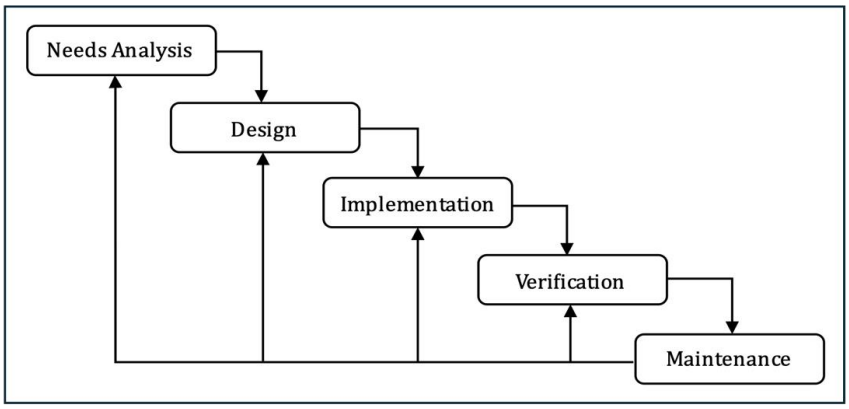

Figure 2. Waterfall Model

The Waterfall method consists of 5 stages, namely;

Needs Analysis

This needs analysis stage is used to analyze the usefulness of the software so that the boundaries of the software requirements can be determined. This information is obtained through interviews, surveys, and FGDs with users (PPL, Poktan and related Stakeholders).

Design

The design stage deals with technical architecture, such as required tools/features, data layers, services, and security used to describe the logic of usability analysis that will be implemented technically. It is very important to provide a complete picture of what needs to be done and how the software will look.

Implementation

The implementation stage consists of the coding process in the form of compiling software modules, integrating them with the hyperlink system and administrator settings, and checking the functionality of each module.

Testing

The testing stage is carried out to identify possible system failures and discrepancies between commands and data responses displayed.

Maintenance

The maintenance stage is the final stage of the waterfall method, which consists of fixing errors, improving the Implementation of system units, and improving the system as needed. This stage can take place dynamically in the form of adjusting system needs, including the addition of new modules.

Data Collection Technique

The data collection process in the field uses remote sensing methods. The Remote Sensing method is used to build spatial data using image interpretation techniques. Remote sensing is a technique of collecting information about an object and its environment from a distance without physical contact (Handayani & Setiyadi, 2003). Aerial photo interpretation in this study includes data tapping and use. Data tapping from aerial photographs is in the form of identifying objects and elements depicted on aerial photographs and presented in thematic maps in the form of land ownership plots of farmer group members (see **Figure 3**).

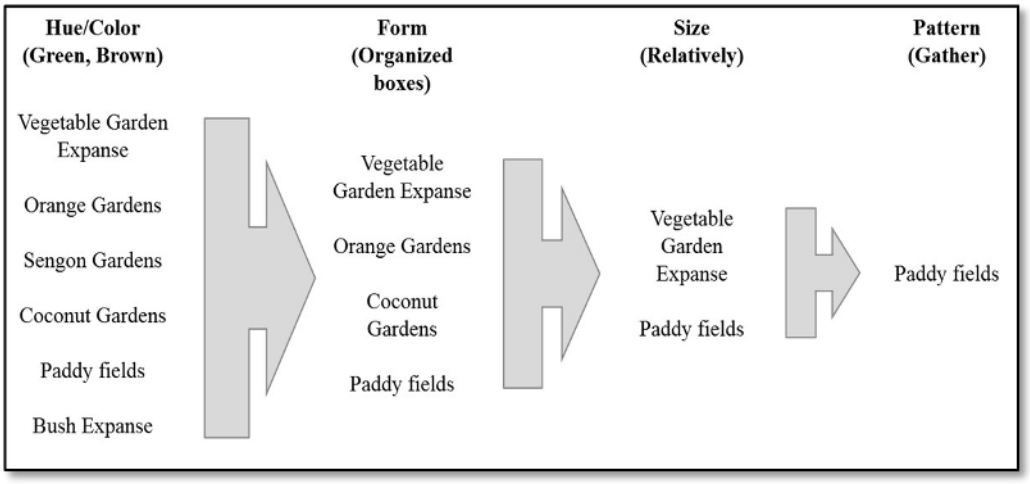

Figure 3. Remote Sensing Image Interpretation

The focus of this research is all poktan in the Gapoktan on the expanse of agricultural areas that have defined regional boundaries, data collection techniques are carried out using census techniques for all poktan in agricultural areas that have defined regional boundaries. The main data collection tools in this research are; Aerial photos taken by drones; Questionnaire; GPS; and Cameras. The data analysis technique in this study uses a Geographic Information System, where the data that has been collected through a data collection tool will be processed using a GIS application and presented in the form of a map in the package of a GIS Web-based Overlay Agricultural Information System Application. Furthermore, the data presented can be used for monitoring agricultural activities in each group within the Gapoktan.

RESULTS AND DISCUSSION

WebGIS Application Design Results

The results of designing a Web GIS application for agricultural activities in the Sungai Kakap District area consist of several displays contained in the Web GIS application, including the following images;

Admin Home

The admin homepage is a homepage with broad roles/access rights (see **Figure 4**). The authority that can be exercised by the admin is, among others, being able to upload spatial/spatial data such as the boundaries of the expanse area and its attribute data, tabulation, and data management of Gapoktan, Poktan, and farmers.

Figure 4. Home Agricultural Information System Admin

Home Administrator / Super Admin (GIS Web Manager)

The Administrator's Homepage is intended for Web GIS Managers, in this case, it is held by the implementer of agricultural development, namely the Food and Agriculture Security Office of Kubu Raya Regency (see **Figure 5**). Administrator's Homepage is a homepage with unlimited roles/access rights covering Information System Management, User Management, and serving as Data Validator. Administrators can access, check, validate and post data on a public display.

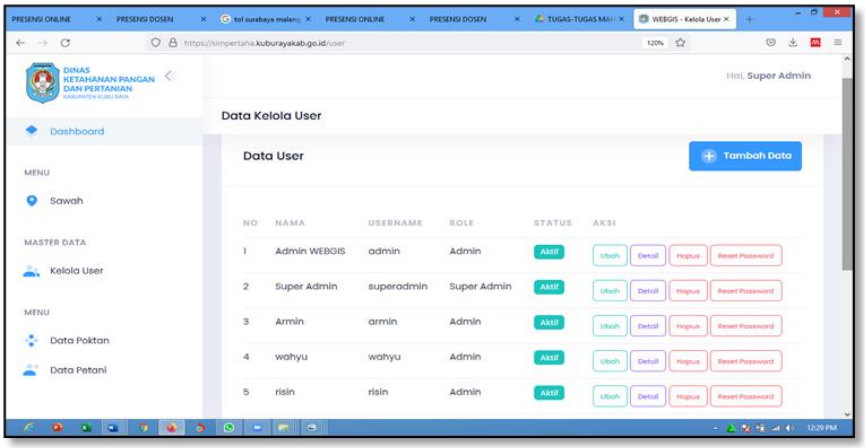

Figure 5. Home Administrator (Website Manager) Agricultural Information System

Home User

The user's homepage is intended for the public (community) access areas, which is a homepage with limited access rights/roles that can only view and cannot change data (see **Figure 6**). The community can access or check the data displayed by the system related to information on members of farmer groups (poktan), land ownership, land area, types of agricultural production, production achievements, and the completeness of agricultural facilities and infrastructure owned.

Figure 6. Home Agricultural Information System Users

CONCLUSIONS

GIS Web-Based Agricultural Information System provides convenience for stakeholders to be able to access information on agricultural activities in a precise, accurate, and real-time manner. Administrators, supervisors, PPLs, and users can access Web GIS anytime, anywhere, and with any type of device connected to the internet network. Information related to farmer groups in general such as farmer group membership, farmer group administrative apparatus, location, land area, superior commodities, and agricultural infrastructure owned by farmer groups can be accessed quickly and precisely. WebGIS-Based Agricultural Information System Application is a dynamic web that can be updated continuously related to farmer information and developed according to the needs of agricultural activities. The addition of data and information can be done periodically every year.

This GIS Web-Based Agricultural Information System is equipped with administrators and users with different roles/roles with limited access according to their interests. This Web-Based

Agricultural Information System for the Kakap River Area can be used as a basis for planning or making decisions in agricultural development. The development activities held later can be carried out using a spatial database displayed on the GIS Web page so that if there is a change such as land ownership, it can be updated quickly and dynamically.

The need for digitization in agricultural development activities through the GIS Web-Based Agricultural Activity Information System so that the process of planning, coaching, counseling, and monitoring agricultural activities becomes more effective and efficient. Digitization in agricultural development activities is a strategic matter to achieve growth targets and increase agricultural productivity, to increase contributions in the agricultural sector in Kuburaya Regency.

ACKNOWLEDGMENTS

The author expresses his gratitude to the Kuburaya Regency Government, especially the Food and Agriculture Security Service (DKPP), Agricultural Extension Center (BPP), Gapoktan-Poktan Sungai Kakap Sub-district who have assisted and collaborated in research completion effort.

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