

# Web-Based Geographic Information System (GIS) for Village Asset Management in Sungai Raya Village

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## Abstract

The development of information technology has led to the emergence of various systems to assist in managing spatial data, one of which is Geographic Information System (GIS). GIS offers a digital and efficient solution for asset management, especially in areas that lack integrated data systems, such as Sungai Raya Village, Batang Tuaka Subdistrict, Indragiri Hilir Regency. Currently, asset data collection in the village is not conducted systematically, which hinders the identification, monitoring, and data-based decision-making processes. This study aims to design and develop a web-based geographic information system that can digitally map village assets and visually display the information using map imagery. The system is developed using PHP programming language and MySQL database, following the waterfall model in the system development life cycle. The resulting system is expected to improve efficiency in asset identification, simplify maintenance processes, and support accurate and transparent decision-making. By implementing GIS for asset management, Sungai Raya Village is expected to manage its resources more optimally and sustainably.

**Keywords:** *Geographic Information System, Village Assets, Asset Management, Web-based GIS, Sungai Raya Village*

## 1. Introduction

The rapid advancement of technology and scientific knowledge in the modern era has enabled the effective processing and analysis of spatial data through Geographic Information Systems (GIS) [1]. GIS is a computer-based mapping technology used to manage geographic data and support decision-making across various fields, including asset management [2]. As the demand for spatial information continues to increase, GIS has evolved into a strategic tool for monitoring infrastructure conditions, supporting preventive maintenance, and optimizing resource management [3].

At the village level, the implementation of GIS remains limited, including in Sungai Raya Village, Batang Tuaka District, Indragiri Hilir Regency. The absence of a comprehensive system capable of presenting village asset information has resulted in time-consuming asset identification processes and has hindered data-driven decision-making. This condition highlights the need for an integrated system that can accurately map, store, and present village asset information.

This study aims to develop a web-based Geographic Information System (GIS) for village asset management in Sungai Raya Village using PHP and MySQL, with the Waterfall software development model. The proposed system is designed to facilitate asset data entry, visualize assets through digital maps, and support more efficient asset maintenance processes. The implementation of GIS is expected to provide accurate information, simplify decision-making, and improve the effectiveness and sustainability of village asset management [4].

Based on a literature review of ten previous studies related to Geographic Information Systems (GIS), several important findings were identified. The first study, which focused on a web-based GIS for mapping hotels and guesthouses, employed the PIECES analysis framework, the Waterfall development model, and system modeling using use case, sequence, activity, and class diagrams [5]. The second study on GIS for coconut plantation mapping in Batang Tuaka District utilized data collection methods including observation, literature review, and interviews, while system modeling was carried out using use case, sequence, and activity diagrams [6]. The third study, concerning the mapping of tailoring service locations in Tembilahan City, collected data through observation, interviews, and literature review, and adopted the Waterfall model with Unified Modeling Language (UML) modeling [7].

The fourth study developed a WebGIS application for mapping medical practice locations in Tembilahan using the Waterfall development model and UML-based system modeling [8]. The fifth study, which focused on mapping the distribution of healthcare facilities in Tembilahan City, also adopted the Waterfall model and evaluated the system using White-box Testing [9]. The sixth study developed a road maintenance complaint system using the Waterfall model, the CodeIgniter framework, Object-Oriented Analysis and Design (OOAD), Google Maps API, and MySQL as the database management system [10].

The seventh study, which mapped senior high school and vocational school locations in Surakarta City, utilized the Leaflet JavaScript Library within a web-based GIS application developed using the Waterfall model and evaluated through Black-box Testing to ensure system functionality [11]. The eighth study concerning CCTV location mapping in Jambi City adopted the Prototype development model and employed use case, activity, and class diagrams as system models, providing a foundation for integrated CCTV management [12]. The ninth study on tourism mapping in Karanganyar Regency used the Waterfall model, with data collected through interviews, observations, and literature review, and implemented structured system modeling [13]. Finally, the tenth study on mapping job seeker distribution in Magetan Regency employed the Rapid Application Development (RAD) model in system development [14].

The review of previous studies indicates that most GIS applications have been developed as web-based systems utilizing digital mapping technologies, although their objectives vary, including mapping public facilities, educational institutions, healthcare services, tourism, and regional development planning. Based on this comparative analysis, the present study proposes the development of a web-based Geographic Information System (GIS) for mapping village assets in Sungai Raya Village. The system is developed using PHP and MySQL and distinguishes itself from previous studies through its development framework, system design, and user interface, specifically tailored to support comprehensive village asset management through interactive digital mapping.

## 2. Research Methodology

### 2.1. The paper should have the following structure

This study employed a qualitative research approach to obtain an in-depth understanding of the phenomenon of village asset management using a Geographic Information System (GIS). Data were collected through interviews, observations, and documentation, enabling the researchers to gain a comprehensive and contextual understanding of the actual conditions in Sungai Raya Village. This approach provided opportunities to explore the meanings, experiences, and social dynamics associated with the implementation of GIS in village asset management [15].

### 2.2. Research Framework

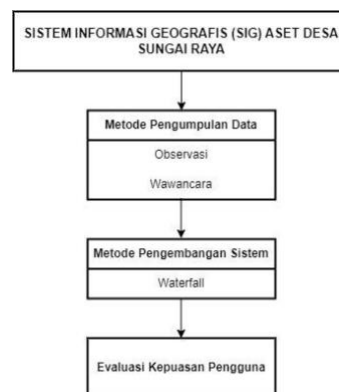


Fig. 1: Research Framework

The research framework illustrates the sequence of activities carried out in this study, starting from data collection, system development, and ending with user evaluation. The main methods employed in this research are described as follows:

#### 1. Metode Pengumpulan Data

Data were collected to support the development of the Village Asset Geographic Information System (GIS). The data collection techniques employed in this study included:

- Observation, conducted to obtain information regarding the actual condition of village assets and the existing asset management processes at the research site.
- Interviews, conducted with village officials to gather information about village assets and to identify the system requirements for the proposed GIS.

#### 2. System Development Model

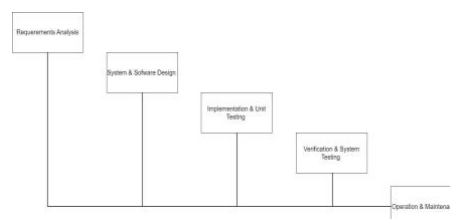


Fig. 2: Waterfall Model

The system was developed using the Software Development Life Cycle (SDLC) with the Waterfall model, which consists of the following phases:

- a. Requirements Analysis, aimed at identifying user requirements and defining the system scope, including system analysis using the PIECES framework.
- b. System Design, involving the design of the system architecture using Unified Modeling Language (UML), including use case, activity, sequence, deployment, and class diagrams.
- c. Implementation and Unit Testing, involving the development of the application using PHP and MySQL, followed by unit testing using the White-box Testing method.
- d. System Verification and Testing, conducted using the Black-box Testing method to ensure that all system functions operate according to the specified requirements.
- e. Operation and Maintenance, during which the system is deployed, monitored, and evaluated to support corrective actions and future enhancements whenever necessary.

### 3. User Satisfaction Evaluation

A user satisfaction evaluation was conducted to measure users' perceptions of the developed Geographic Information System (GIS). Data were collected through questionnaires, and the results were presented using charts and graphs. The evaluation was intended to:

- a. Assess the level of user satisfaction with the GIS.
- b. Provide transparency regarding the research findings.
- c. Serve as a basis for future system improvement and further development.

## 3. Results and Discussion

### 3.1. Introduction

This section presents the results of the development of the Geographic Information System (GIS) for Village Asset Management in Sungai Raya Village. The research was carried out through the stages of requirements analysis, system design, implementation, and system testing. The results demonstrate the effectiveness of the proposed system in supporting the inventory and management of village assets in a more efficient and organized manner.

### 3.2. Requirements Analysis

The requirements analysis was conducted to ensure that the developed system meets the actual conditions and operational needs of the village. The PIECES framework was employed to identify existing problems and determine the improvements provided through the implementation of the Geographic Information System (GIS).

#### 3.2.1 Pieces Analysis

The results of the PIECES analysis indicate the following:

1. Performance: The previous manual process was slow and prone to errors, whereas the digital system accelerates asset recording and reporting.
2. Information: Asset data, which were previously scattered across multiple records, are now stored in a centralized and structured database and presented through an interactive digital map.
3. Economics: The system reduces operational costs associated with manual record-keeping and repetitive administrative tasks.
4. Control: User access control minimizes the risk of data manipulation and improves accountability.
5. Efficiency: Asset information can be searched and retrieved more quickly through the GIS-based digital interface.
6. Service: Transparency is enhanced because asset information can be accessed more openly and efficiently.

#### 3.2.2 Functional Requirements

The system was designed to provide the following functionalities:

1. Display village asset data along with their corresponding attributes.
2. Visualize village assets using an interactive digital map.
3. Manage asset data, including adding, editing, and deleting records.
4. Provide search and filtering features for asset information.
5. Generate statistical reports related to village assets.
6. Support role-based user access control.

#### 3.2.3 Non-Functional Requirements

The system is required to satisfy several non-functional characteristics, including online availability, security, responsiveness, usability, scalability, cross-platform compatibility, and ease of maintenance.

### 3.3 System Design

The system design phase was carried out using Unified Modeling Language (UML) to visualize the structure and interactions of the proposed system. The system was modeled using use case, activity, sequence, deployment, and class diagrams to define business processes, data structures, and interactions between users and the system.

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#### a. Administrator Use Case Diagram

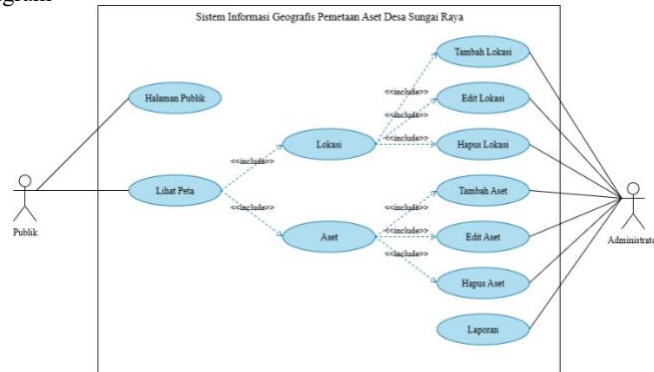


Fig. 3: Use Case Diagram

Figure 3 illustrates the Use Case Diagram of the Geographic Information System (GIS) for Village Asset Management in Sungai Raya Village. The system involves two actors: Public and Administrator. The Public actor is only authorized to access the asset map displayed on the main page. In contrast, the Administrator has full privileges to manage the system, including adding, editing, and deleting location and asset data. The Administrator is also responsible for generating reports related to asset and location information stored in the system.

#### b. Login Activity Diagram

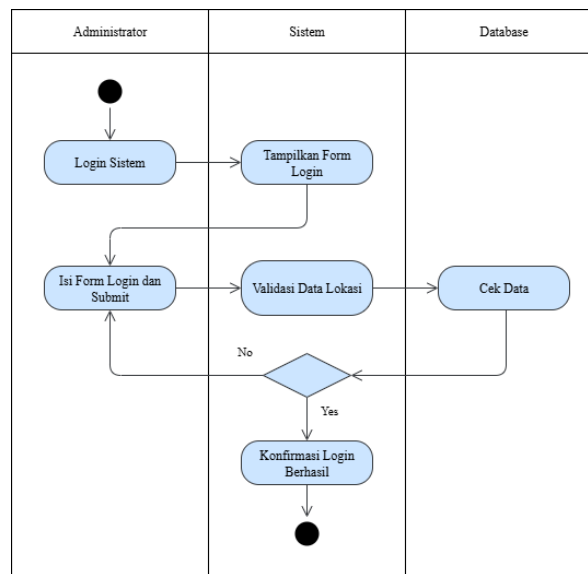


Fig. 4: Login Activity Diagram

Figure 4 illustrates the login process. The Administrator accesses the login page, enters the required credentials, and submits the login request. The system validates the submitted data against the database. If the credentials are invalid, the Administrator is prompted to re-enter the information. Otherwise, the login process is successfully completed, and access to the system is granted.

#### c. View Location Activity Diagram

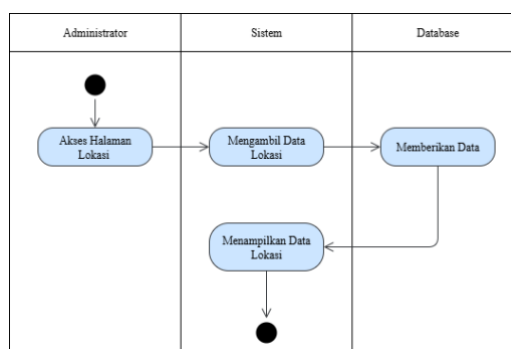


Fig. 5: View Location Activity Diagram

Figure 5 presents the workflow for viewing location data. The Administrator requests the location information, after which the system retrieves the corresponding data from the database and displays it, enabling the Administrator to monitor the recorded locations.

d. Add Location Activity Diagram

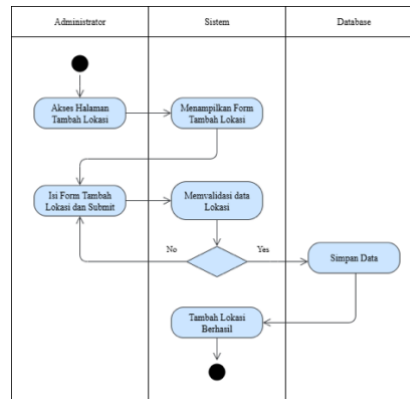


Fig. 6: Add Location Activity Diagram

Figure 6 illustrates the process of adding a new location. The Administrator accesses the location input page, completes the required form, and submits the data. The system validates the input, and if the validation is successful, the new location is stored in the database and a confirmation message is displayed.

e. Edit Location Activity Diagram

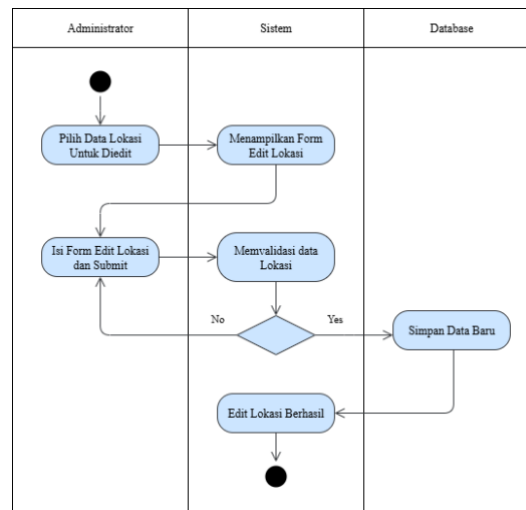


Fig. 7: Edit Location Activity Diagram

Figure 7 illustrates the workflow for updating location information. The Administrator selects the location to be modified, and the system displays the corresponding edit form. After the updated information is validated successfully, the changes are saved to the database, and the system confirms that the update has been completed.

f. Delete Location Activity Diagram

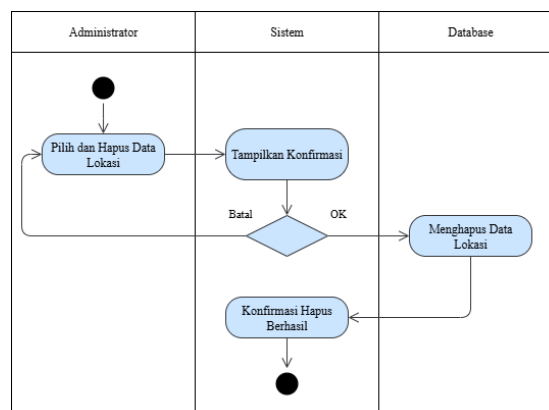


Fig. 8: Delete Location Activity Diagram

Figure 8 illustrates the process of deleting location data. The Administrator selects a location to be removed, and the system requests confirmation before performing the deletion. Once the action is confirmed, the selected location is removed from the database, and the system displays a notification indicating that the deletion has been completed successfully.

#### g. Class Diagram

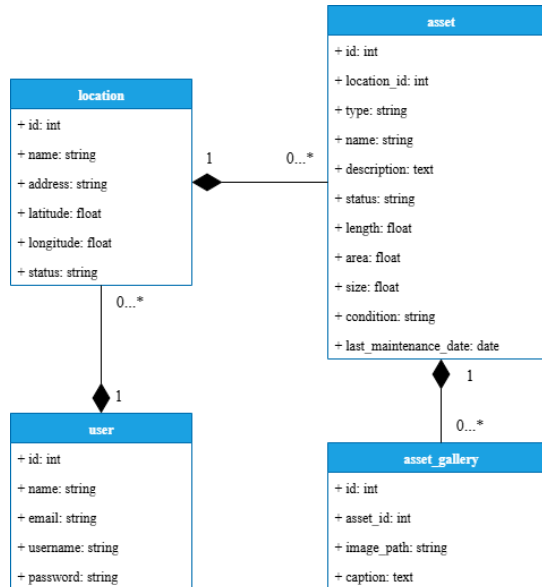


Fig. 9: Class Diagram

Figure 9 presents the Class Diagram of the proposed system, which consists of four primary classes: User, Location, Asset, and Asset\_Gallery. Each class contains attributes corresponding to its specific functionality. The relationships among these classes are defined as follows:

1. A User can be associated with zero or more Location records.
2. Each Location can be associated with zero or more Asset records.
3. Each Asset can have zero or more related Asset\_Gallery entries, which store supporting image information associated with the asset.

### 3.4. System Implementation

#### a. Landing Page

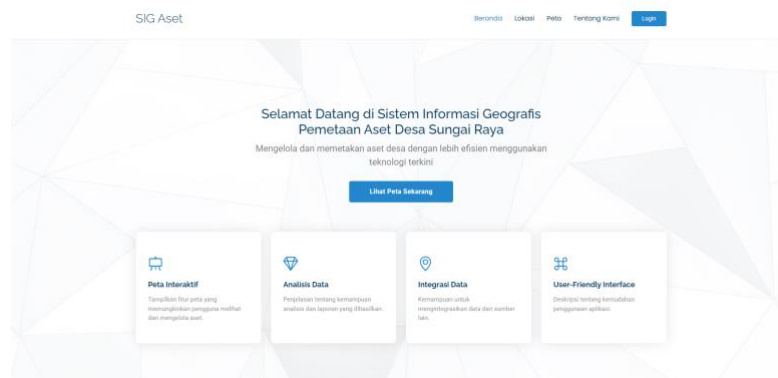


Fig. 10: Landing Page

Figure 10 presents the initial interface of the Village Asset Geographic Information System (GIS). The top navigation bar contains the Home, Locations, Map, About Us, and Login menus. The main section features a hero banner displaying the system title, a brief description, and a View Map Now button as the primary call-to-action. Below the hero section, four feature cards are presented, namely Interactive Map, Data Analysis, Data Integration, and User-Friendly Interface, each accompanied by an icon and a brief description.

## b. Login Page

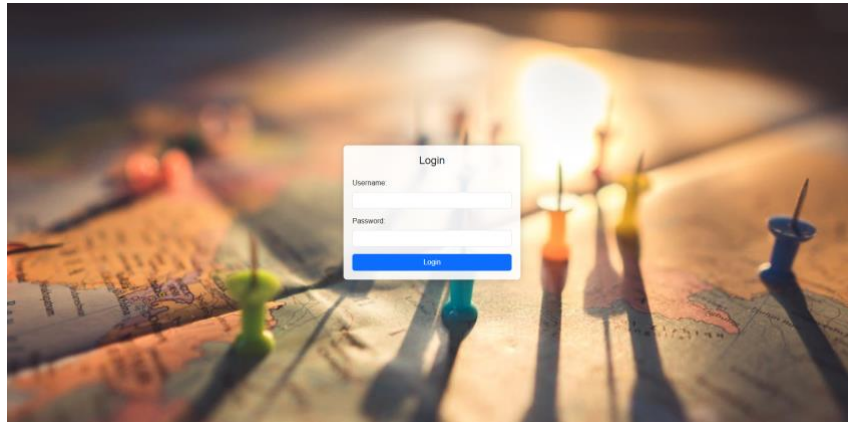


Fig. 11: Login Page

Figure 11 illustrates the login page, which features a clean and simple interface. At the center of the page is a login card containing two input fields, Username and Password, along with a Login button. The background consists of a blurred digital map with location markers, emphasizing the geospatial context of the system.

## c. Dashboard Page

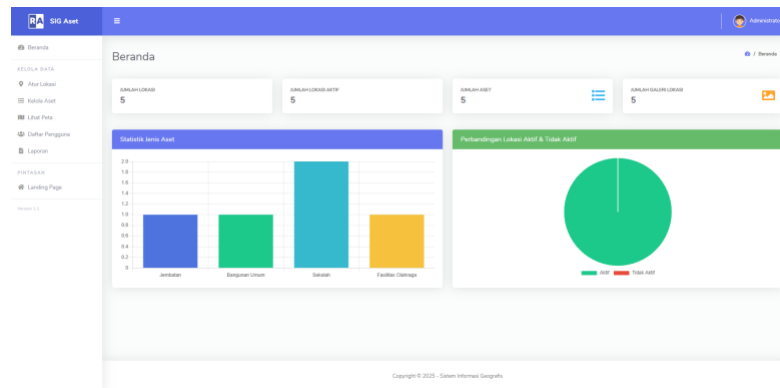


Fig. 12: Dashboard Page

Figure 12 presents the Administrator dashboard. The main section displays four summary cards showing the Total Locations, Active Locations, Total Assets, and Location Gallery statistics. At the bottom of the page, two graphical visualizations are provided: a bar chart illustrating the distribution of asset categories and a pie chart comparing active and inactive locations. These visualizations provide comprehensive statistical information to support decision-making.

## d. Location List Page

| No. | Name                 | Alamat         | Latitude          | Longitude        | Status | Aksi             |
|-----|----------------------|----------------|-------------------|------------------|--------|------------------|
| 1.  | Los Paser Ban        | Il Dermaga     | -0.31746809980562 | 103.098022446342 | aktif  | Lihat Edit Hapus |
| 2.  | Lapangan VNI         | Il Hutan       | -0.31770082788952 | 103.09779373171  | aktif  | Lihat Edit Hapus |
| 3.  | Gedung Pasut         | Il perindukian | -0.31832364950806 | 103.096754056    | aktif  | Lihat Edit Hapus |
| 4.  | Jembatan             | Il Dermaga     | -0.31722958626159 | 103.09763280292  | aktif  | Lihat Edit Hapus |
| 5.  | Lapangan Pasut Bunda | Il allanang    | -0.33444502089243 | 103.09025874613  | aktif  | Lihat Edit Hapus |

Fig. 13: Location List Page

Figure 13 illustrates the location management page. The main section contains the Location List table, which is equipped with search functionality and an option to adjust the number of displayed entries. The table includes the columns No., Location Name, Address, Latitude, Longitude, Status, and Action. The Action column provides View, Edit, and Delete buttons for each record. A Add button is located at the top-right corner to create a new location entry, while pagination controls are displayed at the bottom of the table.

### 3.5. System Testing

System testing was conducted to ensure that the Geographic Information System (GIS) for Village Asset Management in Sungai Raya Village operates according to the development objectives and can be effectively used by its intended users. The evaluation consisted of two main aspects: functional testing and usability testing.

Functional testing was performed to verify that each feature of the GIS application functions in accordance with the system requirements defined during the design phase. The results of the functional testing are presented in Table 1.

**Table 1:** Functional Testing Results

| No. | Function                 | Testing Question                                                                               | Yes | No |
|-----|--------------------------|------------------------------------------------------------------------------------------------|-----|----|
| 1   | Login                    | Does the login feature function properly to provide access to the system?                      | ✓   |    |
| 2   | Asset Management         | Does the village asset management feature operate correctly?                                   | ✓   |    |
| 3   | Asset Location Mapping   | Can the system accurately display the locations of village assets on the map?                  | ✓   |    |
| 4   | Asset Coordinates        | Can the geographic coordinates of each asset be stored and displayed correctly?                | ✓   |    |
| 5   | Interactive Map          | Does the interactive map clearly visualize the distribution of village assets?                 | ✓   |    |
| 6   | Asset Gallery            | Can the image gallery for each asset be displayed correctly on the corresponding map location? | ✓   |    |
| 7   | Information Articles     | Can general information and articles about the village be accessed successfully?               | ✓   |    |
| 8   | Organizational Structure | Is the village organizational structure displayed correctly?                                   | ✓   |    |
| 9   | Asset Statistics         | Can the system present asset statistics in an informative manner?                              | ✓   |    |
| 10  | Landing Page             | Does the landing page present the introductory information properly?                           | ✓   |    |

Based on the results presented in Table 1, all tested functionalities achieved positive outcomes. Every core feature was successfully implemented without any significant technical issues. These results indicate that the proposed system satisfies the specified functional requirements and is capable of supporting village asset management effectively.

## 4. Conclusion

Based on the results of the research and development of the Geographic Information System (GIS) for Village Asset Management in Sungai Raya Village, it can be concluded that the proposed system was successfully designed and implemented as a web-based application capable of digitally mapping village assets and presenting them through an interactive map interface. The developed system facilitates more effective and efficient asset inventory and management processes for village administrators. Furthermore, it improves the accessibility and transparency of village asset information, thereby supporting more efficient monitoring, maintenance, and spatially informed decision-making.

In addition, the implementation of the GIS has proven to reduce the time and effort required for identifying village assets while providing an early mechanism for detecting asset damage or deterioration that was previously difficult to achieve through manual procedures. The application was developed using PHP and MySQL, following the Waterfall software development model, which includes the stages of requirements analysis, system design, implementation, testing, and maintenance. The proposed GIS for village asset management has the potential to serve as a reference model for other villages seeking to adopt digital asset management systems, thereby promoting more effective, transparent, and sustainable management of village resources.

## References

- [1] B. Rianto, "Website Penyediaan Informasi Rumah Jos Kab. Inhil," JUTI-UNISI (JurnalTenikIndustriUNISI), vol. 3, no. 1, pp. 35–42, 2019.
- [2] A. H. Rinaldo, Muhammad Irwansyah, "Sistem Informasi Geografis untuk Pemetaan Lahan Pertanian di Kecamatan Rawang Panca Arga dengan Menggunakan ArcGIS," J. Bid. Apl. Tek. Sipil dan Sains, vol. 3, no. 1, pp. 40–50, 2023, doi: <https://doi.org/10.36294/jurnal%20batas.v3i1.3793>.
- [3] Z. Rahmatika and R. D. Hapsari, "Peran United Nations High Commissioner for Refugees (Unhcr) Dalam Menangani Pengungsi Sudan Selatan Pada Masa Pandemi Covid-19 Di Ethiopia Pada Tahun 2019 – 2020," Glob. Policy J. Int. Relations, vol. 9, no. 1, pp. 84–97, 2021, doi: 10.33005/jgp.v9i1.2667.
- [4] L. Masriansyah, Go Digital and Customer Relationship Marketing sebagai Strategi Pemulihan Bisnis UMKM yang Efektif dan Efisien di Masa Adaptasi New Normal, vol. 2, no. 6, 2020. [Online]. Available: <https://www.ptonline.com/articles/how-to-get-better-mfi-results%0Amuhammadkahfi16060474066@mhs.unesa.ac.id>
- [5] D. Suraya, D. Yuli Prasetyo, and I. Ilyas, "Sistem Informasi Geografis Pemetaan Hotel dan Wisma Berbasis Web di Kota Tembilahan," J. Sist. Inf. dan Sist. Komput., vol. 8, no. 2, pp. 73–83, 2023, doi: 10.51717/simkom.v8i2.138.
- [6] B. Rianto and F. Yunita, "Sistem Informasi Geografis untuk Pemetaan Perkebunan Kelapa (Studi Kasus : Parit 7 Sungai Raya Kecamatan Batang Tuaka Kabupaten Indragiri Hilir)," J. Intra Tech, vol. 4, no. 1, pp. 1–6, 2020.
- [7] N. Suwanti and Usman, "Sistem Informasi Geografis (Sig) Pemetaan Lokasi Penjajah Pakai Di Kota Tembilahan Berbasis Web," J. Perangkat Lunak, vol. 3, no. 3, pp. 84–97, 2021, doi: 10.32520/jupel.v3i3.1694.
- [8] Nina Megalina Marsalis, "Sistem Informasi Pemetaan Praktek Dokter Tembilahan Berbasis Web," J. Perangkat Lunak, vol. 5, no. 2, pp. 142–151, 2023.

- [9] D. Tarmizi and M. R. Ridha, "Sistem Informasi Geografis Berbasis Web Persebaran Fasilitas Pelayanan Kesehatan Di Kota Tembilahan," *J. Perangkat Lunak*, vol. 3, no. 3, pp. 111–123, 2021, doi: 10.32520/jupel.v3i3.1703.
- [10] H. M. Nur and V. Maarif, "Sistem Informasi Pengaduan Perbaikan Jalan Desa (Program SIG) Berbasis Web," *Comput. Sci.*, vol. 3, no. 2, pp. 50–57, 2023, doi: 10.31294/coscience.v3i2.1963.
- [11] R. Renaldi and D. A. Anggoro, "Sistem Informasi Geografis Pemetaan Sekolah Menengah Atas/Sederajat di Kota Surakarta menggunakan Leaflet Javascript Library berbasis Website," *Emit. J. Tek. Elektro*, vol. 20, no. 2, pp. 109–116, 2020, doi: 10.23917/emitor.v20i02.10945.
- [12] J. Jupri and S. Assegaff, "Sistem Informasi Geografis (SIG) Titik CCTV Di Kota Jambi Berbasis Web," *J. Manaj. Sist. Inf.*, vol. 7, no. 3, pp. 394–406, 2022, doi: 10.33998/jurnalmsi.2022.7.3.177.
- [13] R. B. B. Sumantri, R. A. Setiawan, and A. S. Sandi A, "Sistem Informasi Geografis Untuk Pemetaan Pariwisata Kabupaten Karanganyar Berbasis Web," *J. Manaj. Inform. dan Komputerisasi Akunt.*, vol. 6, no. 1, pp. 1–9, 2022, doi: 10.46880/jmika.vol6no1.pp1-9.
- [14] M. R. P. Marwana, "Rancang Bangun Sistem Informasi Geografis Persebaran Data Pencari Kerja Berbasis Web," *Semin. Nas. Teknol. Inf. dan Komun.*, vol. 5, no. 1, pp. 65–72, 2022.
- [15] N. Istiqomah, Lisdawati, and Adiyono, "Reinterpretasi Metode Pembelajaran Sejarah Kebudayaan Islam : Optimalisasi Implementasi dalam Kurikulum 2013 di Madrasah Aliyah Pendahuluan," *IQRA J. Islam. Educ.*, vol. 6, no. 1, pp. 85–106, 2023.