|Jurnal Ilmu Komputer dan Sistem Informasi |JIKSI|Vol. 5| No. 3|Oct|Year 2024|

Web-Based Geographic Information System (GIS) for Mapping Senior High Schools in Muara Enim Regency

Azka Kurniasti[1*]

Abstract

Muara Enim Regency, located in South Sumatra Province, faces challenges in managing and disseminating data related to Senior High Schools (SMA). The local Department of Education still performs data management manually, leading to inefficiencies, delays, and frequent errors. Additionally, limited access to comprehensive information regarding school locations and profiles results in unequal distribution of student enrollment across schools. This study develops a Web-Based Geographic Information System (GIS) designed to map Senior High Schools in Muara Enim Regency. The system was built using the Web Engineering methodology, with HTML and PHP for development and MySQL as the database management system. The GIS platform enables the Department of Education to record, manage, and analyze school data efficiently, while also allowing the public particularly parents and prospective students to easily search for and view accurate school information and geographical locations.

Keywords

Geographic Information System (GIS), Mapping, Web-Based Application, Muara Enim

Article History

Received 03 August 2024
Accepted 21 October 2024

How to Cite

Kurniasti, A, (2024). Web-Based Geographic Information System (GIS) for Mapping Senior High Schools in Muara Enim Regency, (JIKSI), 5(3), [73-80].

[1*] Universitas Bina Darma, Indonesia, Corresponding email: kurniastiazka@gmail.com

Introduction

Technological advancements have profoundly transformed how data and information are collected, processed, and disseminated in nearly every sector of modern society, including education. The integration of digital technologies has enhanced the efficiency, accuracy, and accessibility of information management systems, enabling institutions to make better-informed decisions. Among the most influential innovations in this area is the Geographic Information System (GIS), a technology that combines spatial (geographic) and non-spatial (attribute) data for visualization, mapping, and analytical purposes (Anugerah et al., 2016). GIS technology facilitates the representation of real-world phenomena in digital form, allowing users to analyze spatial relationships and patterns that are critical for planning and policy-making.

In the education sector, GIS plays a pivotal role in supporting strategic decision-making by providing visual and data-driven insights into school locations, accessibility, and resource allocation. Educational planners and government agencies can utilize GIS to identify areas underserved by schools, analyze student distribution, and optimize infrastructure development. Beyond administrative use, GIS applications also serve the public by offering transparent access to information about school locations, accreditation statuses, and available facilities. Thus, GIS functions as both a managerial and participatory tool, aligning with broader efforts to enhance educational equity and data transparency.

However, in Muara Enim Regency, the management of Senior High School (SMA) data remains largely manual, relying on paper-based documentation and static spreadsheets. As observed by Rosdania et al. (2016), such manual processes often lead to data redundancy, inaccuracies, and difficulties in information retrieval. The absence of a digital mapping system not only limits the efficiency of education offices in monitoring and planning but also restricts public access to relevant information. For instance, parents and students may face challenges in locating nearby schools or comparing educational facilities. Consequently, decision-making related to school selection, infrastructure planning, and student distribution becomes less effective.

The lack of a structured digital platform also contributes to uneven student distribution across schools in Muara Enim Regency. Some schools experience excessive enrollment, resulting in overcrowded classrooms, while others suffer from underutilization of facilities. This imbalance reflects an information gap between education authorities and the public. As Wibowo et al. (2018) highlight, the implementation of a Web-Based Geographic Information System (WebGIS) can address these challenges by integrating digital maps with comprehensive school databases. A WebGIS not only provides spatial visualization but also allows real-time data updates, making it a powerful tool for both policy analysis and community engagement.

The WebGIS platform offers significant benefits for education governance. For administrators, it provides a centralized and interactive system that simplifies data management and reporting. For the public, it enhances accessibility by enabling users to view school profiles, facilities, and locations through web interfaces accessible via computers or mobile devices. This democratization of information aligns with Indonesia's broader digital transformation agenda in public services, promoting transparency, accountability, and efficiency in regional governance. Moreover, it supports evidence-based decision-making for school development and helps ensure equitable access to education across different geographic regions.

Therefore, this study aims to design and implement a Web-Based Geographic Information System (WebGIS) for mapping Senior High Schools in Muara Enim Regency using the Web Engineering approach. This methodological framework provides a structured and systematic process for web-based system development, encompassing analysis, design, implementation, and evaluation stages. By adopting this approach, the research seeks to develop an application that not only visualizes the distribution of high schools but also supports data-driven educational planning and policy formulation. Ultimately, the system aspires to contribute to improved educational governance and public accessibility through the application of modern geospatial technologies.

Methodology

Web Engineering Framework

Web Engineering refers to the application of systematic and disciplined approaches to web-based system development. It adopts fundamental software engineering principles while emphasizing flexibility and iterative design specific to web environments (Hadinata & Udariansyah, 2020). The development stages in this study include:

1. Customer Communication: Collecting user requirements through interviews and observations at the Department of Education.
2. Planning: Defining project objectives, scope, and resource allocation.
3. Modeling: Designing system structures using Unified Modeling Language (UML) diagrams such as use case, activity, and class diagrams.
4. Construction: Implementing the system using HTML, PHP, and MySQL.
5. Delivery and Feedback: Deploying the system and conducting user testing for feedback and improvement.

System Requirements

Analysis The system's main users include administrators and public users, each with specific functions, Administrators have the ability to add, edit, and delete school data as needed. They can also manage information related to infrastructure and facilities to ensure that all records are accurate and up to date. In addition, administrators are able to generate detailed school reports that provide comprehensive insights into institutional performance and resources. Public users can search for schools based on specific criteria such as name, location, or accreditation status. They are also able to view detailed school profiles, including available facilities and key information. Furthermore, users can access interactive maps that help them locate schools geographically with ease and accuracy.

UML Modeling

System functionality was modeled using the Unified Modeling Language (UML), which illustrates relationships between users and system components.

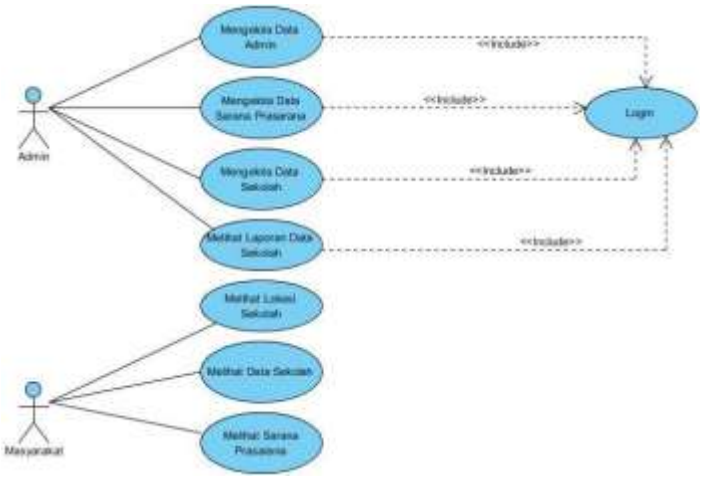

Figure 1. Use Case Diagram

Two actors are identified: Administrator and Public User. Administrators must log in to manage data, whereas public users can freely browse school information and locations.

Process Flow Design

The system's process flows are visualized using Activity Diagrams for both administrator and user interactions.

Administrator Activity Diagram Describes sequential operations such as logging in, managing school data, updating facilities, and generating reports.

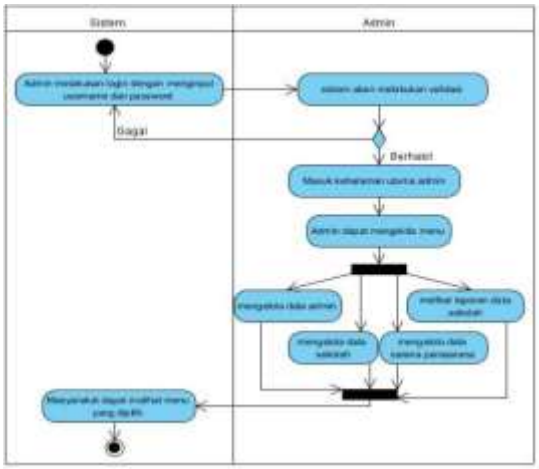

Figure 2. Administrator Activity Diagram

Public User Activity Diagram Shows user interactions such as accessing the homepage, viewing maps, selecting school details, and exploring facilities.

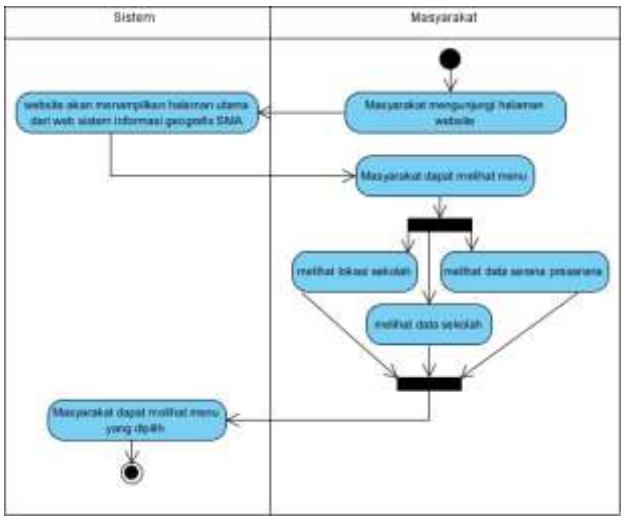

Figure 3. Public User Activity Diagram

Class Diagram

The Class Diagram defines relationships between system entities, including attributes, operations, and interdependencies. The main entities are School, Administrator, Facilities, and Reports.

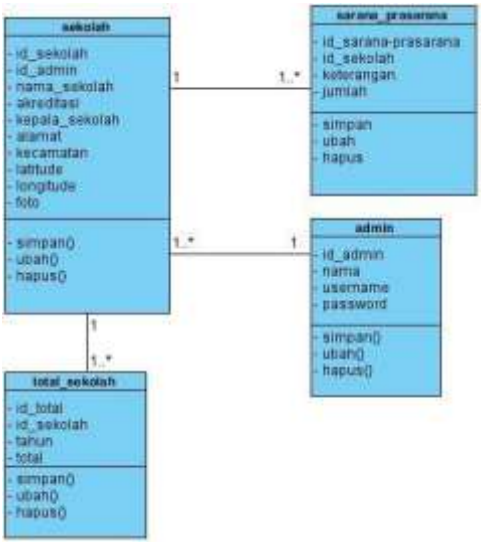

Figure 4. Class Diagram

Results and Discussion

The developed Web-Based GIS provides a visual mapping platform for the Department of Education and the public. It enables dynamic interaction with educational data and supports informed decision-making regarding school management and selection.

Key Features:

1. Homepage Displays an interactive map showing the distribution of Senior High Schools in Muara Enim Regency, along with a search feature that filters schools by district, accreditation, or status (public/private).
2. School Profile Page Contains detailed information such as school accreditation, principal's name, address, available facilities, and photos.
3. Admin Login Page Provides secure access for administrators using a username and password.
4. Admin Dashboard Contains menus for data management, facility entry, report generation, password modification, and logout.
5. School Data Management Page Allows administrators to add, edit, or delete school information, including name, address, accreditation, and geographic coordinates.
6. Facilities Data Page Enables entry of facility information such as classrooms, laboratories, and libraries.
7. Report Generation Page Allows administrators to export school data reports in tabular or summary form for analysis and documentation.

Discussion

The development of the Web-Based Geographic Information System (WebGIS) for mapping Senior High Schools (SMA) in Muara Enim Regency has demonstrated the effectiveness of integrating spatial data visualization with dynamic web-based data management. The system bridges the gap between educational administration and public information accessibility by providing an interactive, data-driven digital platform. Consistent with Anugerah et al. (2016), the implementation of GIS technologies enables the combination of spatial and non-spatial data, thereby transforming raw datasets into meaningful visual insights that support decision-making. Through this integration, the WebGIS provides not only a geographic representation of school distribution but also real-time access to key institutional information, including accreditation status, available facilities, and geographic coordinates.

From an administrative perspective, the system significantly enhances efficiency in data collection, entry, and maintenance. Previously, school data were managed manually using documents and spreadsheets, leading to duplication, inaccuracy, and delayed reporting. The WebGIS addresses these challenges by enabling education officers to input, edit, and update school information directly through a centralized interface. As highlighted by Rosdania et al. (2016), manual data handling often results in fragmented records and limited accessibility—issues that are now mitigated through the structured data management approach adopted in this system. The digital database built on MySQL ensures consistency and integrity, while the web-based interface allows multi-user collaboration, ensuring that the most recent data are always available for administrative decision-making.

For the public, the WebGIS provides an interactive and user-friendly experience through an online map that allows users to locate schools, explore profiles, and compare available facilities. The integration of the Google Maps API enriches the system with real-time geographic visualization, making it intuitive for users to view school locations relative to their own position. This functionality supports parents, students, and policymakers in making informed choices regarding school selection, enrollment planning, and educational investment.

Moreover, the web-based access eliminates the need for physical visits to education offices, thus saving time and resources while fostering greater transparency and public participation.

From a technical standpoint, the system was developed using Visual Studio Code as the Integrated Development Environment (IDE), with HTML, PHP, and MySQL serving as the primary development technologies. This combination provides flexibility, scalability, and compatibility across platforms. The modular architecture allows future expansion—such as adding data analytics, real-time updates, or integration with other educational databases—without significant restructuring. The use of open-source technologies also makes the system cost-effective and sustainable for long-term operation, which is particularly beneficial for regional education offices with limited IT budgets.

In comparison to previous manual data management processes, the implementation of WebGIS has resulted in a notable increase in efficiency, accuracy, and transparency. Data processing times have been reduced, reporting cycles are faster, and the likelihood of data duplication or inconsistency has been minimized. The ability to visualize data spatially also enhances strategic decision-making, enabling education authorities to identify underserved areas, plan for new school construction, and allocate resources more equitably. This improvement aligns with Wibowo et al. (2018), who emphasize that WebGIS provides a powerful decision-support tool by integrating visualization, information management, and communication within a single system.

Beyond its immediate operational advantages, the WebGIS also contributes to good governance and digital transformation in public services. It supports the principles of openness, accountability, and efficiency promoted in Indonesia's digital government agenda. By providing transparent access to educational data, the system builds community trust and encourages stakeholder collaboration. Moreover, the WebGIS can serve as a prototype for similar implementations in other regions, promoting equitable access to education through data-driven policy planning. Ultimately, this initiative demonstrates how the adoption of GIS technology in the education sector can enhance not only administrative performance but also the broader goal of sustainable educational development in Muara Enim Regency.

Conclusion and Recommendations

The study successfully designed and implemented a Web-Based Geographic Information System (GIS) for mapping Senior High Schools in Muara Enim Regency. The system provides both administrators and public users with accurate, up-to-date information on school locations and profiles. The GIS enhances the effectiveness of educational data management and decision-making processes at the Department of Education of Muara Enim Regency. The system can serve as a reference model for developing similar applications in other regions to promote equitable access to educational resources.

Disclosure Statement

The authors declare no conflict of interest. This study was conducted solely for academic purposes within the Faculty of Computer Science, Universitas Bina Darma.

Acknowledgments

The authors express their deepest gratitude to the Department of Education of Muara Enim Regency for providing access to school data, and to the Faculty of Computer Science, Universitas Bina Darma, for offering research facilities and academic guidance throughout this study.

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Biographical Notes

AZKA KURNIASTI Undergraduate student, Faculty of Computer Science, Universitas Bina Darma, Palembang. Her research interests include geographic information systems, web-based application development, and spatial data visualization in education.