Geographic information system-based mapping of health facilities

Moh. Hisyam Romadhon[1], Mufti Ari Bianto[2], Eko Handoyo[3*]
[1,2,3] *Computer Engineering, Faculty of Science, Technology and Education, University of Muhammadiyah Lamongan*
[123] Jl. Raya Plalangan Plosowahyu KM 02, Lamongan, Indonesia 62218
Email: [1]mhisyamromadhon@gmail.com, [2]muftyari@gmail.com, [3]ekokurro17@gmail.com

***Abstract*—** *Health development is one of the national efforts in all aspects of life pursued by almost all sectors of the country to achieve the highest possible level of public health. According to Law No. 36 of 2009 concerning health, health is a human right and one of the elements of well-being that must be realized in accordance with the ideals of the Indonesian nation as stated in Pancasila and the 1945 Constitution of the Republic of Indonesia. The use of GIS in health facility mapping is not new, but its implementation in Lamongan Regency has unique characteristics that are relevant to local conditions and needs. The goal is to map health facilities based on geographic information systems by understanding, analyzing, and visualizing the distribution, availability, and accessibility of health facilities in the geographic area of Lamongan Regency. To support the validation of the research, the methods used are observation and literature review. The method used to develop this system is the Software Development Life Cycle (SDLC), and one of the SDLC methods chosen is Waterfall. Designing a system for mapping health facilities based on Geographic Information Systems (GIS) is important to have a good data model that includes information about health facilities. From this research, a GIS-based health facility mapping is produced from the testing conducted using the Blackbox Testing method, which provides spatial and non-spatial information displays.*

***Keywords*—** *Health Facilities, Mapping, Geographic Information Systems*

***Abstrak*—** Pembangunan kesehatan merupakan salah satu upaya nasional di segala bidang kehidupan yang diupayakan oleh hampir seluruh sektor negara untuk mencapai derajat kesehatan masyarakat yang setinggi-tingginya. Menurut Undang-undang No.36 tahun 2009 tentang kesehatan. Kesehatan merupakan hak asasi manusia dan salah satu unsur kesejahteraan yang harus diwujudkan sesuai dengan cita-cita bangsa Indonesia sebagaimana dimaksud dalam Pancasila dan Undang-Undang Dasar Negara Republik Indonesia Tahun 1945. Penggunaan SIG dalam pemetaan fasilitas kesehatan bukanlah hal baru, namun penerapannya di Kabupaten Lamongan memiliki karakteristik yang unik dan relevan dengan kondisi dan kebutuhan lokal. Dengan tujuan untuk memetakan fasilitas kesehatan berbasis sistem informasi geografis dengan memahami, menganalisis, dan memvisualisasikan distribusi, ketersediaan, dan aksesibilitas fasilitas kesehatan dalam wilayah geografis Kabupaten Lamongan. Untuk menunjang validasi penelitian, metode yang digunakan yaitu observasi dan penilaian kepustakaan. Metode yang digunakan untuk mengembangkan sistem ini adalah metode *Software Development Life Cycle (SDLC).* Salah satu metode SDLC yang dipilih adalah *Waterfall.* Desain sistem untuk memetakan fasilitas kesehatan berbasis sistem informasi geografis penting untuk memiliki model data yang baik yang mencakup informasi tentang fasilitas kesehatan. Dari penelitian ini, dihasilkan pemetaan fasilitas kesehatan berbasis sistem informasi geografis dari hasil uji yang dilakukan dengan menggunakan metode *Blackbox Testing* yang menyediakan tampilan berupa informasi spasial dan non-spasial.

***Kata kunci*—** Fasilitas Kesehatan, Pemetaan, Sistem Informasi Geografis

I. INTRODUCTION

Health development is one of the national efforts in all aspects of life, pursued by almost all sectors of the country to achieve the highest possible level of public health. Health is essentially a state of physical, mental, spiritual and social well-being that enables each individual to lead a socially and economically productive life. According to Law No. 36 of 2009 on Health, health is a fundamental human right and one of the elements of well-being that must be realised in accordance with the ideals of the Indonesian nation as outlined in Pancasila and the 1945 Constitution of the Republic of Indonesia.

There are currently several hospitals in Lamongan Regency, including Muhammadiyah Lamongan Hospital, Dr Soegiri Lamongan Regional General Hospital and Fatimah Lamongan General Hospital. However, there are still some areas in Lamongan Regency that are quite far from hospitals, resulting in limited access to healthcare services for the community. To facilitate community access to health services, it is important to map the locations of existing hospitals and the areas that are not yet covered by hospitals (Askarim, 2022).

The previous research titled 'Utilization of WebGIS in Mapping the Distribution of Healthcare Services in Madiun City'. This study was based on the issue of distribution of healthcare facilities in the entire area of Madiun City, which had not been visually mapped in terms of the actual locations of healthcare facilities. By visualising the distribution of health facility locations, it is hoped that it can be used as a reference for users to find and locate health facilities. The mapping system has been implemented using a Geographic Information System

[1]Department of Computer Engineering, Faculty of Science, Technology and Education, University of Muhammadiyah Lamongan, Lamongan, 62218, Indonesia. E-mail: mhisyamromadhon@gmail.com
[2]Department of Computer Engineering, Faculty of Science, Technology and Education, University of Muhammadiyah Lamongan, Lamongan, 62218, Indonesia. E-mail: muftyari@gmail.com
[3]Department of Computer Engineering, Faculty of Science, Technology and Education, University of Muhammadiyah Lamongan, Lamongan, 62218, Indonesia. E-mail: ekokurro17@gmail.com

(GIS). The system can manage, manipulate and display spatial (geospatial) data that can be used in various fields, including healthcare. GIS can be used to assess hazards and also for evaluation and monitoring (Juwari, et al., 2023).

In this study, hospital location data in Lamongan Regency will be obtained through a field survey method (Puspitasari, et al., 2018). Subsequently, the data will be analysed, processed, and visualised within a mapping system based on Geographic Information Systems (Awangga, 2017).

This study aims to develop a geographic information system-based healthcare facility map for Lamongan Regency. The objective is to provide a comprehensive overview of healthcare facility distribution in the region and assess community access to healthcare services. Furthermore, this study aims to create a GIS-based app accessible to the public and pertinent authorities for easier health information retrieval (Arifuddin, et al., 2021).

The application of GIS in healthcare facility mapping is not a novelty; however, its usage in Lamongan Regency presents unique features that are pertinent to the local circumstances and necessities. This will contribute to preserving and enhancing the quality of life of the folks in Lamongan Regency. This research's outcomes aim to furnish comprehensive direction for effectively strategizing and constructing an upgraded healthcare system whilst augmenting the populace's access to crucial healthcare provisions. This will contribute to preserving and enhancing the quality of life of the folks in Lamongan Regency. This will contribute to preserving and enhancing the quality of life of the folks in Lamongan Regency.

II. METHOD

To develop this system, the author used the Software Development Life Cycle (SDLC) methodology. One of the SDLC methods chosen for use in this research is the waterfall method, which is widely used in software engineering. The waterfall method is considered appropriate because each stage must be completed gradually and sequentially. Each stage must wait for the previous stage to be completed before proceeding to the next stage.

A. Requirement Analysis

Needs analysis is the initial phase of Geographic Information System (GIS)-based health facility mapping and involves identifying and understanding the requirements that the system to be developed must meet. This is done through processes such as site observations, interviews with relevant stakeholders including hospitals, and a review of literature related to research needs. The needs analysis will include the identification of functional and non-functional requirements for the Geographic Information System-based healthcare facility mapping under study.

B. Design System

In this phase, the objective is to present a thorough evaluation of the system's performance and user interface. This aids in defining the overall system architecture and specific aspects. The Object-Oriented Analysis and Design (OOAD) methodology incorporates use cases and interface designs to develop healthcare facility mapping based on geographic information systems.

C. Implementatiton

The system architecture design will form the basis for implementing the system. This architecture encompasses the primary components of the system, including interfaces, integration with maps, and geographic data, utilising text editors such as Visual Studio Code for coding to fulfil the requirements for mapping geographic information system-based healthcare facilities.

The File Geodatabase requires a particular structure for storing geographical data, including details on hospitals and roads. This structure should consist of appropriate tables, clear table relationships, and effective indexing to optimize data processing performance.

D. System Testing

The following stage involves system testing to assess the system's design and implementation outcomes. During this stage, black-box testing will be carried out to appraise the functionality of the program's development, including the interface, functions and alignment with healthcare facility mapping in geographic information systems.

E. Programme Implementation and Maintenance

At this point, the software is primed for usage and can be operated by users. Furthermore, this study is restricted to executing the programme without any ensuing system upkeep.

III. RESULTS AND DISCUSSION

A. Web Design Result

1. Home Page

The homepage is the first page of the system, featuring an introduction and information about healthcare facility mapping based on geographic information systems. A landing page button is also provided, linking to the healthcare facility map page. To gain a clearer understanding, refer to Figure 1.

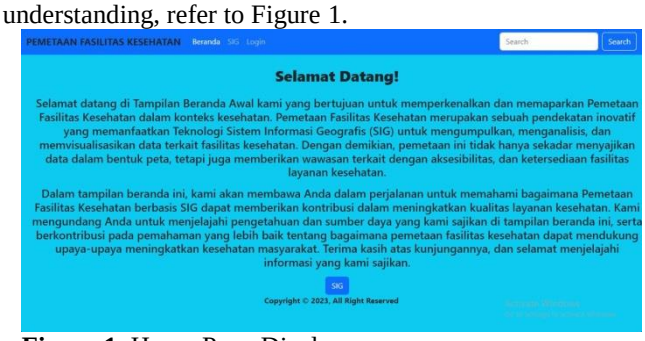

Figure 1. Home Page Display

On this website, visitors will find introductory information about the geographic information system-based map of healthcare facilities, which has been collected, analysed, and visualised. The website is designed to provide an overview of the healthcare services available.

On this website, the goal is to promote comprehension of geographic information system-based healthcare facility mapping. The map and accompanying resources provided can aid in supporting public health efforts.

In Figure 1, a landing page button labelled 'GIS' is present. Clicking this button directs visitors to the GIS page, where a map is displayed which has been previously digitised from the data collected, analysed, and visualised for healthcare facilities.

2. GIS Page

The GIS page is dedicated to showcasing maps derived from analysed data collected on healthcare centres and represented visually. Here, viewers may comprehensively interact with geographic information in an intelligible and lucid format. They may manipulate the map by choosing specific data overlays, looking up particular locations, and adjusting the zoom level as required. The GIS page serves the purpose of facilitating efficient and effective exploration and comprehension of geographic data. It has revolutionised our interaction with geographic data, rendering it more accessible and visually engaging. For a more comprehensive comprehension, kindly refer to Figure 2.

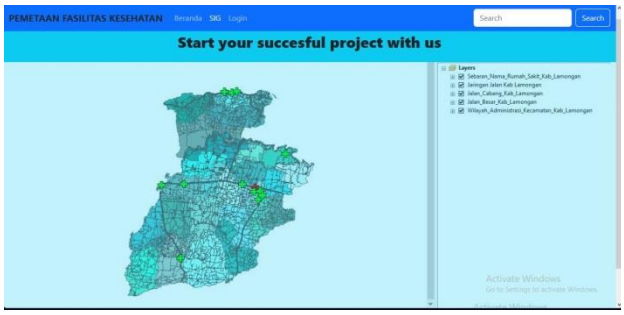

Figure 2. GIS Page Display

In Figure 2, a map is presented that is the outcome of data collection, analysis, and visualization. A layer menu is present which represents layers that combine to create a complete visual portrayal of the real world within the program. This results in the map as presented in Figure 2.

In the layer menu, users organize, visualize, and analyze different types of geographic data in a structured and logical way. Each layer can represent various types of geographic information, including roadmaps, administrative boundaries, data points, or polygonal regions, enabling users to combine data from various sources into a coherent or interconnected map display.

Within the layer menu, each individual layer possesses distinctive properties and features, including symbolization, labels, and particular analysis settings. Moreover, these layers can be organised in a particular sequence to regulate the display levels and enhance map legibility.

In healthcare facility mapping using geographic information systems, comprehension of layers is vital. Proper use of layers enables an efficient and informative organisation and presentation of geographic information, leading to improved decision-making in various applications, including spatial planning and environmental monitoring, as can be seen in Figure 3.

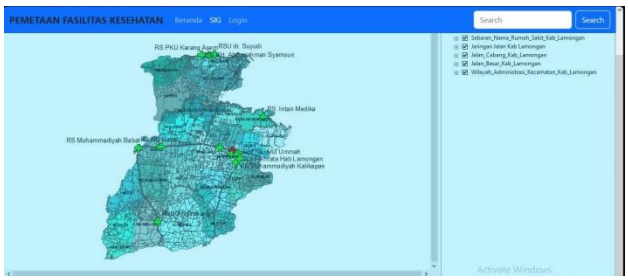

Figure 3. Map Set on Layer

In Figure 3 above, a map of Lamongan Regency comprises several layers. These involve polygon layers denoting sub-districts within Lamongan Regency, and data points indicating the locations of hospitals in Lamongan Regency. Labels and symbolization within these layers play a critical role in geographic mapping by providing extra information and visualizing geographic data in a clear and comprehensible manner.

A layer containing labels comprises of text or descriptions located on mapping features such as points, lines, or regions, providing identification or supplemental information. These labels may encompass place names, data measurements, or other pertinent attributes. By correctly employing labels, maps may become more informative and comprehensible.

While a layer may contain symbolization, symbolization is simply the process of determining how map elements are visually represented. This encompasses the selection of colours, sizes, shapes, and types of symbols used to depict geographic features. Effective symbolization enables users to rapidly recognise and comprehend the meaning of map elements. As in Figure 3 above, in geographic information system-based mapping for healthcare facilities, users can identify hospital locations through symbols such as a plus sign. Nonetheless, the symbols employed must correspond with the features of the visualized data, demonstrated in Figure 4.

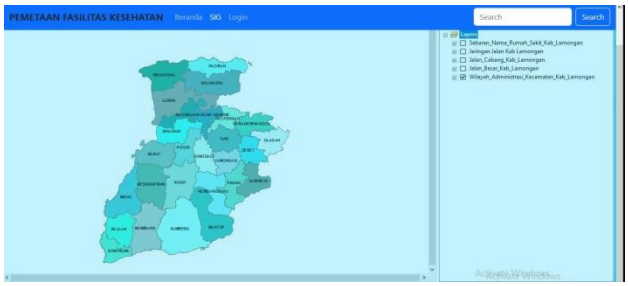

Figure 4. Sub-district and District Administration Layer of Lamongan

The Sub-district and Lamongan Regency Administrative Region Layers, shown in Figure 4, are utilized in mapping the administrative regions within Lamongan, a regency situated in the East Java Province of Indonesia. These layers display the administrative borders that separate sub-districts and the regency in that region.

The sub-district administrative layer is characterized by lines or boundaries demarcating the borders of sub-districts in Lamongan. On the other hand, the regency administrative layer shows the administrative boundaries of Lamongan Regency with adjacent regencies or

provinces. This information is essential in administrative mapping as it enables users to easily observe how the region is segmented into different sub-districts and how its administrative limits are identified, as exemplified in Figure 5.

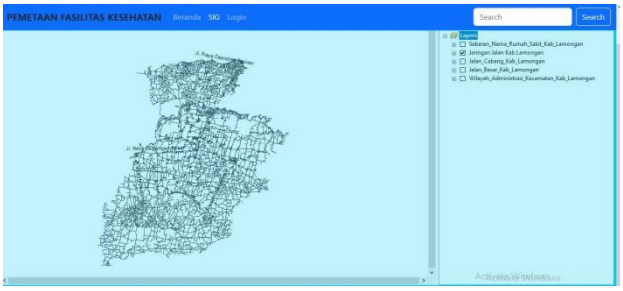

Figure 5. Lamongan Regency Road Network Layer

The road network layer of Lamongan Regency, as shown in Figure 5, is instrumental in GIS-based healthcare facility mapping outcomes. Such network data offers an essential framework for mapping healthcare facilities. Through this data, mapping can pinpoint optimum locations for healthcare facilities, accounting for accessibility from diverse areas. This implies that healthcare facilities can be placed in a strategic manner, guaranteeing accessibility to a maximum number of occupants in Lamongan Regency.

The availability of road network data facilitates comprehensive accessibility analysis. This entails computing travel durations from different regions to specific healthcare amenities, providing a clearer insight into inaccessible areas. In Figure 5 above, cartography can form the basis for designing strategies and allocating resources to cater to the medical requirements of the community in Lamongan Regency.

In addition to aiding healthcare facility planning, the road network layer is also pivotal in emergency transportation route planning. This is crucial particularly in life-threatening medical emergencies where swift action can be the difference between life and death. Using GIS-based mapping with road network data allows for emergency services, such as ambulances, to respond with precision, speed and efficiency.

Therefore, the road network layer in Lamongan Regency is a crucial element that facilitates the effectiveness and informativeness of GIS-based mapping of healthcare facilities. Such mapping aids the local government, healthcare providers, and other stakeholders in the planning, management, and monitoring of transportation infrastructure that bolsters healthcare services. With improved access to healthcare facilities, it is anticipated that healthcare services and community well-being in Lamongan Regency will be improved. Figure 6 shows the layout of main and branch roads in Lamongan Regency.

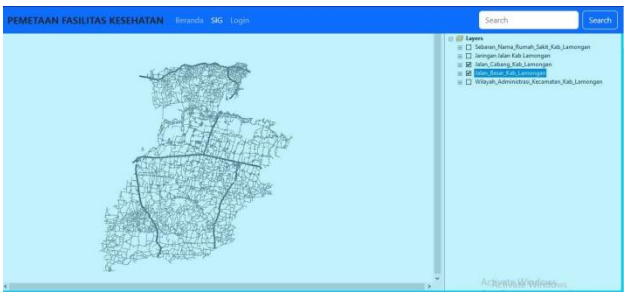

Figure 6. Lamongan District Major Roads and Branch Roads Layer

In Figure 6 above, the layers of branch roads and main roads within Lamongan Regency are critical to the results of healthcare facility mapping based on Geographic Information System (GIS). This data aids in the accessibility of healthcare facilities from different locations within Lamongan Regency.

Examining Figure 6 above, the branch roads layer illustrates a collection of smaller roads, such as local roads and access to rural areas. This data facilitates the plotting of healthcare facilities in remote zones that may not have direct connections to primary roads. It promotes fair planning of healthcare facilities that cater to the requirements of communities in rural environments.

Meanwhile, the main roads layer illustrates the key road network and transportation arteries that link different areas in Lamongan Regency. This dataset assists in identifying crucial healthcare facility locations along the main routes. It permits healthcare facilities to offer faster and more efficient services, particularly during emergency situations.

The intersection of minor and major road layers allows for comprehensive and sustainable mapping of healthcare facilities. This aids in the effort to guarantee that all inhabitants of Lamongan Regency have sufficient access to healthcare services. The following presents an outline of the layer of hospitals and road network, as presented in Figure 7.

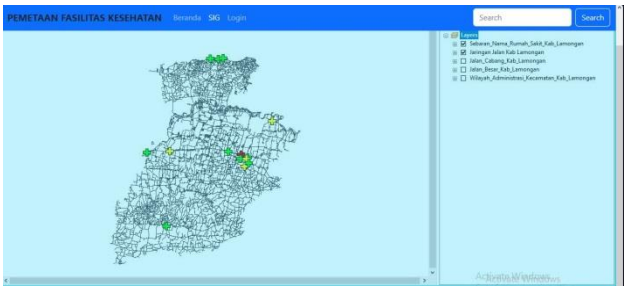

Figure 7. Hospital and Road Network Layer

The layer, as shown in Figure 7, which displays the distribution of hospital names in Lamongan Regency, is a crucial element in the results of Geographic Information System (GIS)-based healthcare facility mapping. This data provides a visual overview of the locations and distribution of hospitals in the regency. With this information, healthcare facility placement planning can become more efficient and responsive to the needs of the community.

The amalgamation of the hospital nomenclature dispersion layer and the thoroughfare lattice produces a

robust framework for devising, administering, and scrutinising healthcare amenities in Lamongan Regency.

3. Login Page

This login page acts as the access point for users, including system administrators and healthcare researchers, seeking the geographical data essential for generating healthcare facility maps. Users can input the required credentials to gain entry into the Geographic Information System (GIS) supporting healthcare facility mapping via this login page. Below is the display of the login page in Figure 8.

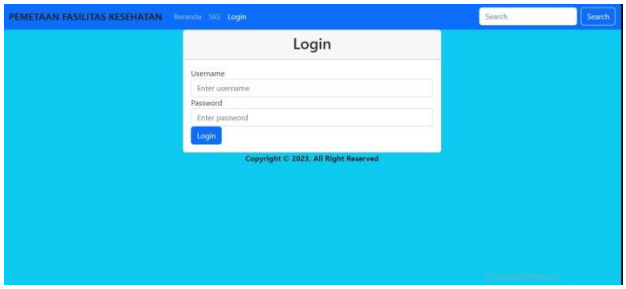

Figure 8. Login Page Display

In Figure 8, we observe the login webpage for user verification. Users are required to provide personal identification data, including a username, password, or other essential information to gain entry into the system. The prime objective is to authenticate that the user seeking access holds valid access rights.

Authentication security is imperative for users as it safeguards sensitive data and information from unauthorised access. It is the primary defence against threats that assists users in preventing security breaches and protecting user privacy. Moreover, the login page identifies users and provides appropriate access to specific features and data within the system. In essence, authentication forms a vital basis for upholding the security and credibility of web-based systems.

4. Health Facilities

Geographic Information System (GIS)-based healthcare facility mapping is a useful tool for planning, managing, and monitoring healthcare facilities. As shown in Figure 9, this mapping provides a clear view of the distribution and locations of healthcare facilities in Lamongan Regency

Figure 9. Distribution of Hospital Locations

In the image above, symbols (+) of three colours indicate the hospital distribution locations across Lamongan Regency, with each colour representing a specific type of hospital. Type D hospitals are represented by yellow symbols, Type C hospitals by green symbols, and Type B hospitals by red symbols, as demonstrated in Figure 9.

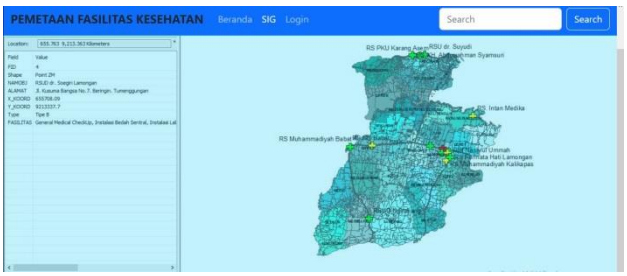

Figure 10. Hospital Information

In Figure 10, healthcare facility mapping using GIS enables users to retrieve comprehensive information regarding a particular healthcare facility by clicking on the icon or symbol on the map. Such an interface permits swift and effortless access to critical data concerning healthcare facilities in a given region.

In Figure 4.14, it is an example that when we click on the symbol on the map with the name RSUD dr. Soegiri Lamongan, detailed information about the hospital facility will appear as shown in the image above.

B. Blackbox Testing

During the black box testing phase, software is tested without relying on any knowledge of the internal structure or source code of the application being tested. The main focus of this testing is to assess the functionality and features that can be observed by end-users. For the purpose of this test, the GIS-based healthcare facility mapping system will undergo a functional testing process, without examining its internal implementation details. In the context of GIS-based healthcare facility mapping, objective testing is implemented to ensure proper system functioning in accordance with established specifications and objectives. Table 1 provides a breakdown of functional testing classifications.

Table 1 Functional Testing

Test Scenario	Testing Steps	Expectation of Results	Testing Results	Description
Map Appearance	Testing the map display	Display the map	Successful, data is successfully visualised	Accurate data visualisation and analysis
Facility Detail View	Click on the health facility symbol	Display facility details	Successful, Health facilities successfully displayed	Facility details including full information
Device Accessibility	Access the site using a mobile device	Responsive display	Successful, responsive display	Responsive site on mobile devices
Data Security	Attempt to access data with an unauthorised account	Not allowed access	Successful, data can be secured	The system secures data from unauthorised access
External Data Integration	Integration test with external data	Well-integrated data	Successful, the data is well-integrated	External data connected without error

Testing of the map display is critical to the success of the GIS-based healthcare facility mapping system. The aim of this testing is to ensure that the system's map

accurately represents data and provides informative visualisations for users. Successful testing outcomes are reached when data is effectively visualised.

IV. CONCLUSION

Based on the results of the conducted research, the following conclusions can be drawn:

1. Geographic Information System (GIS)-based health facility mapping facilitates users in finding healthcare facilities according to their needs. This improves the accessibility of healthcare services, especially in remote or densely populated urban areas.
2. The visualization of healthcare facility locations has significant potential to enhance the quality of life and well-being of the community by providing better access to necessary healthcare.
3. The implementation of GIS enables users to quickly and easily access geographic information. This results in improved accessibility to crucial geographic data, such as maps, locations, and related attributes.

ACKNOWLEDGEMENTS

The author would like to thank the supervisors, and all parties who have helped in the implementation and preparation of the thesis that cannot be mentioned one by one, for the help and encouragement given to the author during the research process.

REFERENCES

Amini, F. (2022) Pemetaan Pola Sebaran Fasilitas Kesehatan Tingkat II Menggunakan Metode Nearest Neighbour Analysis Di Kota Bandar Lampung 2022, Digital Repositry UNILA.

Aprillya, M.R. and Chasanah, U. (2022) 'Geographic Information System Multi Attribute Utility Theory for Flood Mitigation in Agricultural Sector', Matrik: Jurnal Manajemen, Teknik Informatika, dan Rekayasa Komputer, 22(1), pp. 117–128. Available at: https://doi.org/10.30812/matrik.v22i1.1511.

Aprillya, M.R., Chasanah, U. and Bianto, M.A. (2022) 'Webmap Application Training As An Effort For Flood Mitigation In The Agricultural Sector In Dlanggu Village, Lamongan Regency, East Java, Indonesia', International Journal Of Community Service, 2(1), pp. 78–87. Available at: https://doi.org/10.51601/ijcs.v2i1.65.

Ardiansyah, H. and Bianto, M.A. (2022) 'Implementation of License Plate Recognition Monitoring System using Neural Network on Solar Powered Microcontroller', Indonesian Vocational Research Journal, 2(1), p. 105. Available at: https://doi.org/10.30587/ivrj.v2i1.4949.

Askarim, H. (2022) Sistem Informasi Geografis Pemetaan Fasilitas Kesehatan Di Kabupaten Sragen Berbasis Web. Universitas Muhammadiyah Surakarta.

Awangga, R.M. (2017) 'Pengantar Sistem Informasi Geografis', p. 126.

Bimantoro, S.W. et al. (2023) 'Pemetaan Objek Wisata Kota Jayapura Berbasis GIS', Journal Technology and Information System (J-TIS), pp. 108–115.

Chasanah, U. and Handoyo, E. (2021) 'Analisis Tingkat Kegempaan Wilayah Jawa Timur berbasis Distribusi Spasial dan Temporal Magnitude Of Completeness (Mc), A-Value Dan B-Value', Indonesian Journal of Applied Physics, 11(2), p. 210. Available at: https://doi.org/10.13057/ijap.v11i2.45984.

Hendi, I.N. (2020) Rancang Bangun Sistem Informasi Desa Binaan Universitas Pembangunan Panca Budi Berbasis Web.

Jivera, T. and Sumarno (2023) 'Perancangan Sistem Geodatabase Backbone Telekomunikasi Nasional', pp. 139–144.

Juwari, Susanti, P. and Moch. Yusuf Asyari (2023) 'Pemanfaatan Webgis Pada Pemetaan Sebaran Layanan Kesehatan Kota Madiun', SATIN - Sains dan Teknologi Informasi, 9(1). Available at: https://doi.org/10.33372/stn.v9i1.958.

Kasim, M.R. et al. (2022) 'Pendampingan Pemetaan Potensi Desa di Desa Paddinging Kecamatan Sanrobone Kabupaten Takalar Assistance In Mapping Village Potentials at Paddinging Village Sanrobone District Takalar Regency', 6(2), pp. 428–436. Available at: http://journal.unhas.ac.id/index.php/panritaabdi.

Kautsar, A. Al and Fauziah, R.A. (2021) 'Analisis Geodatabase Untuk Persiapan Pembelajaran Tatap Muka Tinglat SD Di Kecamatan Sukasari Kota Bandung', 9(1), pp. 186–194.

Neyfa, B.C. and Tamara, D. (2016) 'Perancangan Aplikasi E-Canteen Berbasis Android Dengan Menggunakan Metode Object Oriented Analysis & Design (OOAD)', Bmj, 1(6001), pp. 107–109. Available at: https://doi.org/10.1136/bmj.1.6001.107.

Purnama, R.I. (2023) 'Pemetaan Perguruan Tinggi Di Kota Padang Berbasis GIS', 2(1), pp. 41–46.

Puspitasari, S.R., Awaluddin, M. and Firdaus, H.S. (2018) 'Pembuatan Aplikasi Webgis Untuk Informasi Persebaran Sarana Dan Fasilitas Kesehatan Di Kabupaten Kudus', Jurnal Geodesi Undip, 7(3), pp. 1–10.

Putri, A. and Yulfa, A. (2023) 'Jurnal buana', Buana, 7(2), pp. 436–451.

Putri, S.B. et al. (2023) 'Pemetaan Daerah Rawan Bencana Dalam Upaya Mitigasi Bencana Berbasis GIS Di Kecamatan Sungai Raya Kepulauan Kabupaten Bengkayang Provinsi Kalimantan Barat', 4(2), pp. 107–118.

Rahmat, D.P., Antoni, D. and Suroyo, H. (2021) 'Sistem Informasi Geografis Pemetaan Area Menggunakan Arcgis (Studi Kasus Lokasi Organisasi Masyarakat (Ormas) Keagamaan Di Kota Palembang)', Jurnal Nasional Ilmu Komputer, 2(4), pp. 257–267. Available at: https://doi.org/10.47747/jurnalnik.v2i4.537.

Shodiq, M. and Saputra, B.D. (2022) 'Grey Forecasting Model Untuk Peramalan Harga Ikan Budidaya', JURIKOM (Jurnal Riset Komputer), 9(6), p. 1770. Available at: https://doi.org/10.30865/jurikom.v9i6.5120.

Usdeldi and Damanik, F.V. (2020) 'JAAB : Jurnal of Applied Accounting And Business Pendahuluan Landasan Teori', Jurnal of Applied Accounting And Business, 2(2), pp. 86–93.

Zulhelmi and Ria Yusian, D. (2019) 'Merancang Sistem Informasi Pemetaan Lokasi Rumah Sakit SSeluruh Kota Banda Dan Aceh Besar', Journal of Informatics and Computer Science, 5(2), pp. 133–142.