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Article

Development of MetaPolije : Cloud-Based Metabase GIS Data Analysis Platform

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Abstract: This study aims to discuss the successful development of MetaPolije. MetaPolije is a platform used for cloud-based spatial-text data analysis utilizing the metabase library. MetaPolije as an alternative solution for users who need a medium for textual data analysis while also displaying precise location data. This platform is developed following the stages of agile method, which consists of several stages, from system requirement to testing. The platform has also undergone functional, validity, and performance testing techniques to ensure its efficiency. The test results have shown that the platform is capable of functioning well according to its intended purpose. Additionally, the platform is able to accurately display visualized data analysis results, including precise location points for each datum. Therefore, it can be concluded that the MetaPolije is a viable platform that meets the standards of functional, validity, and performance testing, making it a dependable and effective tool for data analysis. MetaPolije has been successfully developed by providing the basic features needed by users when conducting spatial text data analysis. The test results indicate that MetaPolije has met the quality testing standards for software based on each specified testing indicator, covering functional, validity, and performance aspects. These features can also be customized according to the users' needs and purposes.

Keywords: metapolije, agile method, accurate result, precise location, data analysis tool

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1. Introduction

In recent years, demand has increased for processing and visualizing analyzed data, particularly when it involves textual and geospatial data. This surge in demand can be attributed to the fact that users nowadays not only require accurate results from textual data analysis, but also precise location information to be displayed [1]. Moreover, the value of the displayed data is further enhanced when it is presented in real-time.

The advent of technology has brought about a massive influx of data from various sources including social media, sensor networks, and online platforms. This deluge of information has created a need for effective techniques to analyze and derive meaningful insights from the data [2]. Traditional methods of data analysis, which primarily focused on textual data, are no longer sufficient in meeting the evolving needs of users [3].

Textual data analysis involves extracting information from unstructured text, such as articles, social media posts, and customer reviews. While accurate textual analysis is crucial, it is equally important to consider the spatial aspect of the data. Geospatial data, which includes information related to geographic locations, provides valuable context to textual data analysis [4]. By combining textual and geospatial data, users can understand it more deeply analyzed information. This integration of textual and geospatial data

allows for a more comprehensive analysis and interpretation of the information at hand [5].

Furthermore, the need for real-time data processing and visualization has become increasingly important [6]. Real-time data processing enables users to monitor and respond to changes as they happen, facilitating timely actions and interventions. For instance, in the case of disaster management, real-time analysis of social media data combined with geospatial information can help identify affected areas and allocate resources efficiently.

Visualizing analyzed data is another critical aspect of data analysis [7]. By presenting data in a visual format, users can quickly grasp complex patterns and relationships this may not be obvious in the raw data. Visualizations can take diagram and graphic formats, maps, or interactive dashboards, depending on the type of data and target audience. When combined with geospatial data, visualizations can provide a spatial context that enhances the understanding and interpretation of the analyzed information [8].

Several systems aimed at processing data analysis have been previously developed. However, this system only processes textual data. Additionally, it is only intended to solve specific topics or case studies. Therefore, if it were to be used for a different case study, the system would need to be redeveloped. This becomes ineffective for users who require a system with similar basic needs.

This research has successfully developed a cloud-based general metabase GIS data analysis platform called MetaPolije. This platform is highly customizable, allowing users to tailor it to their specific needs for data visualization. The system not only displays data visualizations based on textual analysis but also incorporates precise location-based visualizations using geospatial data. The development of this system followed the Agile method, ensuring a streamlined and efficient process [9].

One of the key features of this system is its API library, which is designed for data classification and clustering. This addition aims to improve the accuracy of data analysis results, ultimately enhancing the overall output of the system. By utilizing advanced algorithms and techniques, the system can provide users with more reliable and insightful data visualizations [10].

The cloud-based nature of this platform offers numerous advantages. Firstly, easily access your data anytime, anywhere as long as you have an internet connection. This flexibility allows users to analyze and visualize data conveniently, without being restricted by physical location or time constraints [11].

Furthermore, the cloud-based infrastructure enables seamless collaboration among multiple users. This is particularly beneficial for teams or organizations that need to work together on data analysis projects. The platform provides a centralized space where team members can share and access data, as well as collaborate on visualizations and analyses. This promotes efficiency, accuracy, and teamwork, ultimately leading to better outcomes [12].

The precision of the location-based visualizations is another noteworthy aspect of this platform. By leveraging geospatial data, the system can accurately display data points on a map, allowing users to gain deeper understanding of spatial patterns and relationships.

The customization options offered by MetaPolije are also worth highlighting. Users can tailor the platform to suit their specific needs and preferences, ensuring that the visualizations and analyses generated align with their objectives. This flexibility empowers users to explore and present data in a way that is most meaningful and impactful to their particular field or industry. This feature is the highlight of MetaPolije. Its ability to be customized according to user needs sets MetaPolije apart from similar data analysis platforms.

2. Materials and Methods

This study aims to discuss the development of a cloud-based GIS data analysis platform using the metabase framework, following the Agile method.

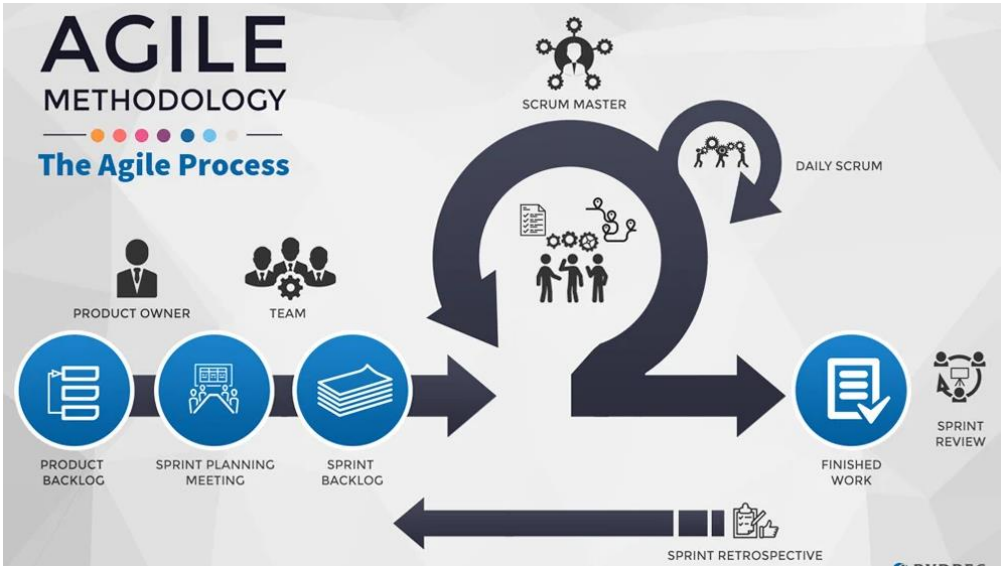


Figure 1. Agile method diagram

The Agile method was chosen for the development stages of this platform due to its numerous advantages and suitability for this project [13]. The development stages of the cloud-based metabase GIS data analysis platform, in accordance with the Agile method [14], are as follows :

1. Planning and Requirement Gathering. The first stage of the Agile development process is the planning and requirement gathering phase. In this stage, the project team identifies the goals, objectives, and requirements of the platform [15]. We collaborate with stakeholders, such as users and clients, to understand their needs and expectations. This stage ensures that the platform's development aligns with the desired outcomes and addresses the specific requirements of the users.
2. User Stories and Backlog Creation. Once the requirements are gathered, the project team create user stories that briefly explain the functionality of the platform from the user's perspective [16]. These user stories help in defining the features and functionalities of the platform. The user stories are then prioritized and added to the backlog, which is a list of tasks to be completed during the development process. The backlog is continuously updated and adjusted throughout the development cycle.
3. Sprint Planning. In the Agile method, development is divided into iterations called sprints [17]. Each sprint typically lasts a set period of time (usually 2 to 4 weeks). Before the start of each sprint, the project team holds a sprint planning meeting. During this meeting, the team selects a set of user stories from the backlog to be developed and completed during the sprint. The team estimates the effort for each user story and assigns it to individual team members.
4. Development and Testing [18]. Once the sprint planning is complete, the development and testing phase begins. The team members work on their assigned user stories and develop the required functionalities of the platform. Continuous integration and testing is performed to ensure the quality and stability of the platform.
5. Sprint Review and Retrospective [19]. At the end of each sprint, there is a sprint review and retrospective. During a sprint review, the team demonstrates the completed functionality and gathers feedback. This feedback will help further develop and improve the platform. Retrospectives allow teams to reflect on the sprint, identify

opportunities for improvement, and discuss strategies to improve the development process in future sprints.

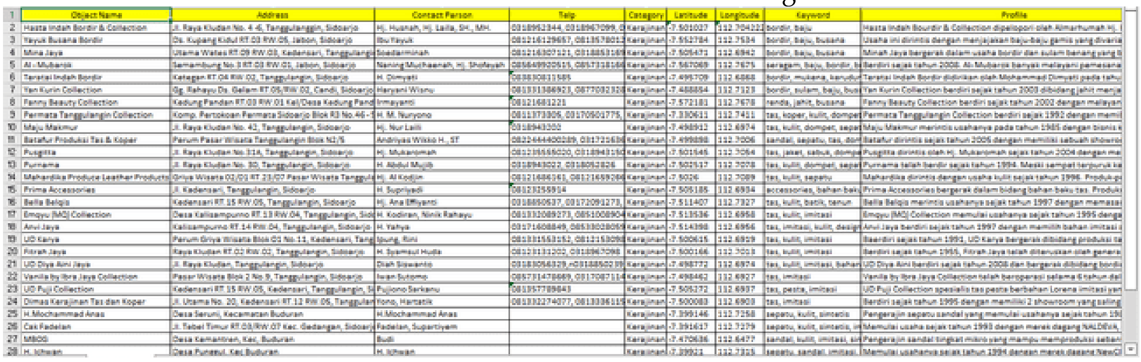
6. Iterative Development and Continuous Improvement. The Agile method emphasizes iterative development and continuous improvement [20]. After each sprint, the development team incorporates the feedback received during the sprint review and retrospective meetings. They refine the platform's functionalities, address any issues or bugs, and add new features based on the evolving requirements. This iterative approach ensures that the platform is continuously improved and aligned with the users' needs and expectations.

3. Results and Discussion

The process of system analysis involves several stages. Each stage plays a crucial role in ensuring that the data used for analysis is accurate, reliable, and accessible [21]. By following these steps, organizations can make informed decisions based on the insights gained from analyzing their data.

The first stage is planning and gathering requirement which divided into two sub phases as below :

The first sub phase is the needs analysis. In this phase, primary data is collected, which consists of location data, data categories, and complete profiles of each data based on available location points. Filtering is also done in this stage to remove invalid and biased data. The data that has been collected is shown in Figure 2.



1	Object Name	Address	Contact Person	Telp	Category	Latitude	Longitude	Keyword	Profile
2	Hasta Indah Bordir & Collection	Jl. Raya Kludan No. 4-6, Tanggulangin, Sidoarjo	Hj. Husnah, Hj. Laila, SH., MH.	0318952344, 0318967099, 0	Kerajinan	-7.501027	112.704222	bordir, baju	Hasta Indah Bourdir & Collection dipelopori oleh Almarhumah Hj. I
3	Yayuk Busana Bordir	Ds. Kupang Kidul RT.03 RW.05, Jabon, Sidoarjo	Ibu Yayuk	081216129657, 081357801	Kerajinan	-7.552784	112.7534	bordir, baju, busana	Usaha ini dirintis dengan menjajakan baju-baju gamis yang divaria
4	Mina Jaya	Utama Wates RT.09 RW.03, Kedensari, Tanggulangi	Soedarminah	081216307121, 03188531	Kerajinan	-7.505471	112.6942	bordir, baju, busana	Minah Jaya bergerak dalam usaha bordir dan sulam benang yang b
5	Al - Mubarok	Semambung No.3 RT.03 RW.01, Jabon, Sidoarjo	Naning Muchasanah, Hj. Shofiyah	085649920515, 08573181	Kerajinan	-7.567069	112.7675	seragam, baju, bordir, b	Berdiri sejak tahun 2008. Al-Mubarok banyak melayani pemesana
6	Teratai Indah Bordir	Ketegan RT.04 RW.02, Tanggulangin, Sidoarjo	H. Dimyati	0318830811585	Kerajinan	-7.495709	112.6868	bordir, mukena, kerudur	Teratai Indah Bordir didirikan oleh Mohammad Dimyati pada tahu
7	Yen Kurin Collection	Gg. Rahayu Ds. Gelam RT.05/RW.02, Candi, Sidoarjo	Haryani Wisnu	081331386923, 08770323	Kerajinan	-7.488854	112.7123	bordir, sulam, baju, bus	Yen Kurin Collection berdiri sejak tahun 2003 dibidang jahit menja
8	Fanny Beauty Collection	Kedung Pandan RT.03 RW.01 Kel/Desa Kedung Pand	Irmayanti	08121681221	Kerajinan	-7.572181	112.7678	renda, jahit, busana	Fanny Beauty Collection berdiri sejak tahun 2002 dengan melayan
9	Permata Tanggulangin Collection	Komp. Pertokoan Permata Sidoarjo Blok R3 No.46-5	H. M. Nuryono	0811373306, 03170901775,	Kerajinan	-7.330611	112.7411	tas, koper, kulit, dompet	Permata Tanggulangin Collection berdiri sejak 1992 dengan memil
10	Maju Makmur	Jl. Raya Kludan No. 42, Tanggulangin, Sidoarjo	Hj. Nur Laili	0318943202	Kerajinan	-7.498912	112.6974	tas, kulit, dompet, sepat	Maju Makmur merintis usahanya pada tahun 1985 dengan bisnis k
11	Batafur Produksi Tas & Koper	Perum Pasar Wisata Tanggulangin Blok N2/5	Andriyas Wikko H., ST	082244400289, 03172163	Kerajinan	-7.499898	112.7006	sandal, sepatu, tas, dom	Batafur dirintis sejak tahun 2005 dengan memiliki sebuah showro
12	Pusgitta	Jl. Raya Kludan No.31A, Tanggulangin, Sidoarjo	Hj. Mukaromah	081235565020, 03189431	Kerajinan	-7.501545	112.7054	tas, jaket, sabuk, dompe	Pusgitta dirintis oleh Hj. Mukaromah sejak tahun 2004 dengan me
13	Purnama	Jl. Raya Kludan No. 30, Tanggulangin, Sidoarjo	H. Abdul Mujib	0318943022, 0318052826	Kerajinan	-7.502517	112.7078	tas, kulit, dompet, sepa	Purnama telah berdir sejak tahun 1994. Masi sempat terjuruk ke
14	Mahardika Produce Leather Products	Griya Wisata 02/01 RT 21/07 Pasar Wisata Tanggula	Hj. Al Kodjin	08121686161, 0812165926	Kerajinan	-7.5026	112.7089	tas, kulit, sepatu	Mahardika dirintis dengan usaha kulit sejak tahun 1996. Produk-p
15	Prima Accessories	Jl. Kedensari, Tanggulangin, Sidoarjo	H. Supriyadi	08123255914	Kerajinan	-7.505185	112.6934	accessories, bahan bak	Prima Accessories bergerak dalam bidang bahan baku tas. Produk
16	Bella Belgis	Kedensari RT.15 RW.05, Tanggulangin, Sidoarjo	Hj. Ana Effiyanti	0318850537, 03172091273,	Kerajinan	-7.511407	112.7327	tas, kulit, batik, tenun	Bella Belgis merintis usahanya sejak tahun 1997 dengan memasa
17	Emqyu (MQ) Collection	Desa Kalisampurno RT.13 RW.04, Tanggulangin, Sid	H. Kodiran, Ninik Rahayu	081332089273, 08510089	Kerajinan	-7.513536	112.6958	tas, kulit, imitasi	Emqyu (MQ) Collection memulai usahanya sejak tahun 1995 denga
18	Anvi Jaya	Kalisampurno RT.14 RW.04, Tanggulangin, Sidoarjo	H. Yahya	03171608849, 0853302805	Kerajinan	-7.514398	112.6956	tas, imitasi, kulit, design	Anvi Jaya berdiri sejak tahun 1997 dengan memilih bahan imitasi
19	UD Karya	Perum Griya Wisata Blok O1 No.11, Kedensari, Tang	Ipung, Rini	08131553152, 081215309	Kerajinan	-7.500615	112.6929	tas, kulit, imitasi	Baerdiri sejak tahun 1991, UD Karya bergerak dibidang produksi ta
20	Fitrah Jaya	Raya Kludan RT.02 RW.02, Tanggulangin, Sidoarjo	H. Syamsul Huda	08123131202, 0318967098	Kerajinan	-7.500166	112.7013	tas, kulit, imitasi	Berdiri sejak tahun 1995, Fitrah Jaya telah diteruskan oleh genera
21	UD Diya Aini Jaya	Jl. Raya Kludan, Tanggulangin, Sidoarjo	Diah Siswanto	03183056329,+03188502	Kerajinan	-7.498772	112.6974	tas, kulit, imitasi, bahan	UD Diya Aini berdiri sejak tahun 2008 dan bergerak dibidang bordi
22	Vanila by Ibra Jaya Collection	Pasar Wisata Blok 2 No.9, Tanggulangin, Sidoarjo	Iwan Sutomo	085731478669, 03170871	Kerajinan	-7.498462	112.6927	tas, imitasi	Vanila by Ibra Jaya Collection telah beroperasi selama 6 tahun dal
23	UD Fuji Collection	Kedensari RT.15 RW.05, Kedensari, Tanggulangin, Si	Pujiono Sarkanu	081357789843	Kerajinan	-7.505272	112.6937	tas, pesta, imitasi	UD Fuji Collection spesialis tas pesta berbahan Lorena imitasi yan
24	Dimas Kerajinan Tas dan Koper	Jl. Utama No. 20, Kedensari RT.12 RW.05, Tanggulan	Yono, Hartatik	081332274077, 08133361	Kerajinan	-7.500083	112.6903	tas, imitasi	Berdiri sejak tahun 1995 dengan memiliki 2 showroom yang saling
25	H.Mochammad Anas	Desa Seruni, Kecamatan Buduran	H.Mochammad Anas		Kerajinan	-7.399146	112.7258	sepatu, kulit, sintetis	Pengerajin sepatu sandal yang memulai usahanya sejak tahun 19
26	Cak Fadelan	Jl. Tebel Timur RT.03/RW.07 Kec. Gedangan, Sidoarj	Fadelan, Supartiyem		Kerajinan	-7.391617	112.7279	sepatu, kulit, sintetis, in	Memulai usaha sejak tahun 1993 dengan merek dagang NALDEVA,
27	MBOG	Desa Kemantren, Kec. Buduran	Budi		Kerajinan	-7.470636	112.6477	sandal, kulit, imitasi, sir	Pengerajin sandal tingkat mikro yang mampu memproduksi seban
28	H. Ichwan	Desa Pungasul, Kec Buduran	H. Ichwan		Kerajinan	-7.39921	112.7315	sepatu, sandal, imitasi,	Memulai usahanya sejak tahun 1994 dengan merek dagang NewCi

Figure 2. Primary data that has been collected

Once the data is collected, a filtering process is performed to remove invalid or skewed data. This is important to ensure that the data used for analysis is reliable and unbiased. Invalid data can include data points that are missing or incomplete, while biased data can be influenced by personal opinions or preferences.

The second sub phase is data digitization, which involves converting the data collected in the previous stage into data stored in a PostgreSQL database with the following table relations:

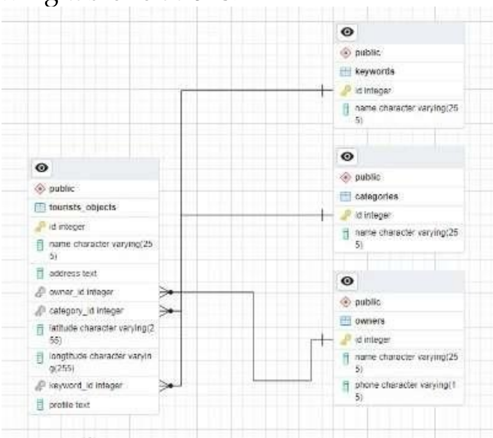


Figure 3. Data relation

Once the data is filtered, the next step is to digitize it. The collected data is saved in a database and converted into a format that can be manipulated. In this case, the data is stored in a PostgreSQL database, which allows for efficient storage and retrieval of the data. The digitized data is then organized into tables with appropriate relations. This helps to establish a structured and organized database, making it easier to analyze and retrieve the data. The table relations ensure that the data is properly linked and can be accessed in a meaningful way.

The second stage is user stories and backlog creation. In this stage, the primary focus is on gathering accurate and relevant data. This involves collecting data from various sources, such as surveys, interviews, and existing databases. The data collected includes information about the location of the data, the categories it belongs to, and a complete profile of each data point. This stage as basic to describe sprint planning.

The next stage is development and testing. In this stage used to set up metabase. Metabase is a powerful data visualization and analysis tool. This allows users to create interactive dashboards and reports, making data easier to understand and interpret. In addition to metabase construction, built-in libraries for data classification and clustering are also implemented. These libraries provide advanced data analysis techniques such as machine learning algorithms for classifying and grouping data. This identifies patterns and relationships within your data, enabling deeper analysis and insight.

During this stage, a dashboard is also set up to visualize the results of the data analysis. This dashboard can be used to display the analysis results according to the user's needs. The menu options or icons displayed on the dashboard are as shown in Figure 4.

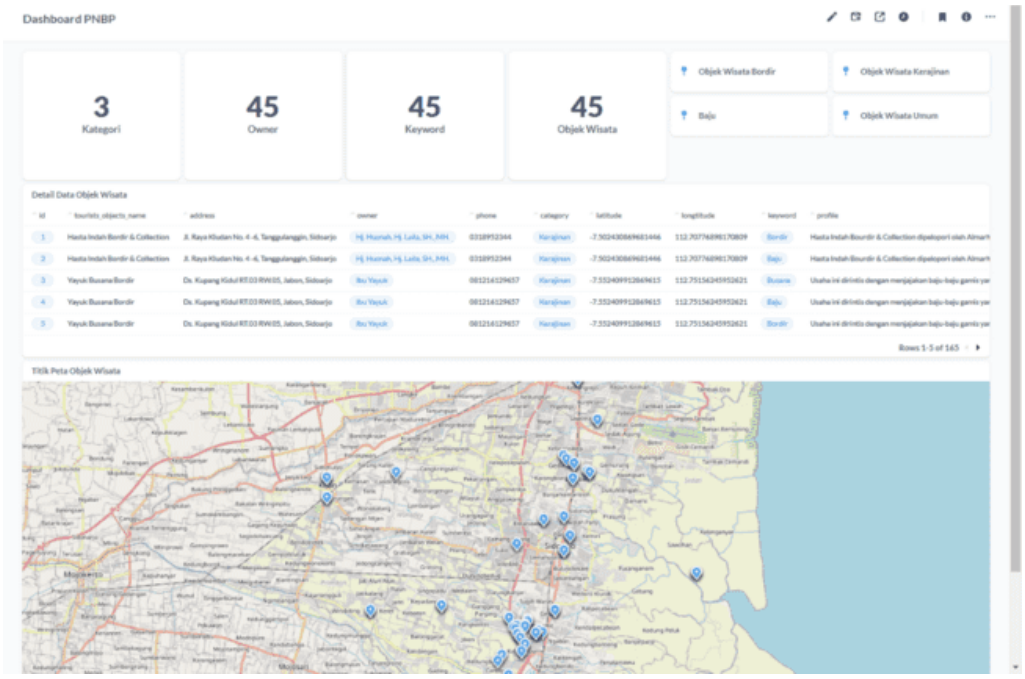


Figure 4. Dashboard menu icon

When users access this cloud-based GIS data analysis platform, they only need to select one of the available menus/icons on the dashboard. For example, if a user selects the "crafts" menu, the system will display the locations of the points that fall into the crafts category as depicted in Figure 5.

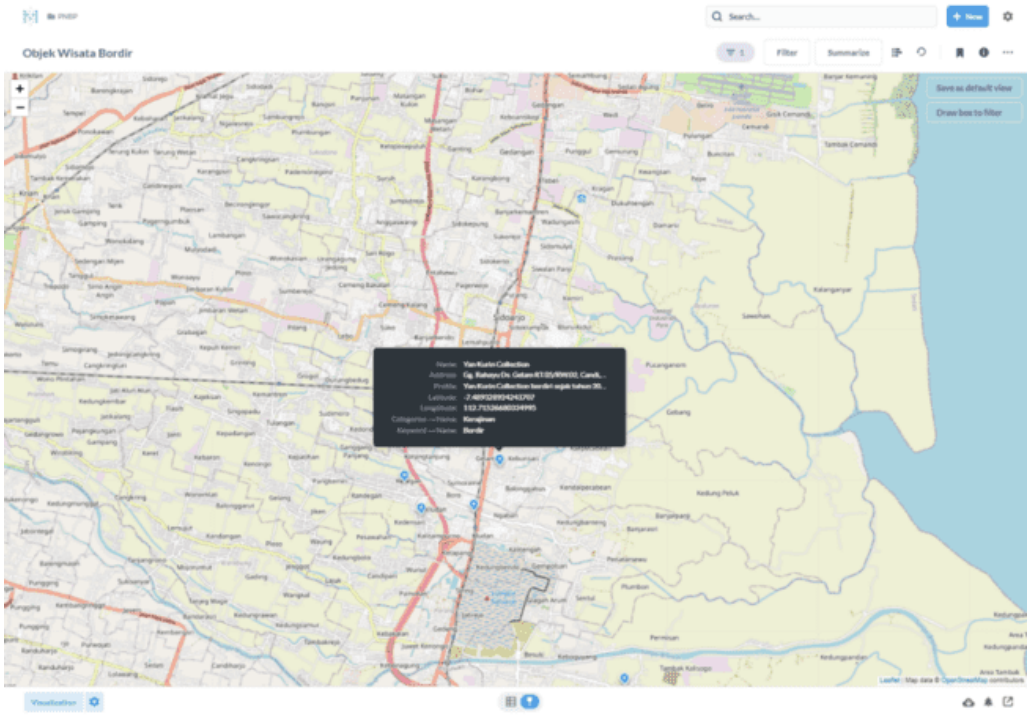


Figure 5. Display location based on category

The displayed data includes the profiles of each data point. Additionally, the data is real-time, and the time required to access and display the data analysis results is only around 1.46 seconds. This is made possible because the platform for this GIS data analysis is cloud-based. Therefore, the resources for data storage and access are extensive and fast [22].

After each sub modul had developed than the next step is platform testing. Platform testing is an important step in any software or application development process. This ensures that the platform works as intended, meets user needs, and operates efficiently. For MetaPolije, testing focused on his three main areas: functional testing, validity testing, and performance testing [23].

Functional testing is essential to ensure that the platform functions properly and meets the needs of the users [24]. This includes testing various features of the platform to ensure they work as expected. This includes testing data analysis features, visualization tools, and user interfaces.

Validity testing, on the other hand, assesses the accuracy and reliability of the data analysis results displayed by the platform [25]. This testing ensures that the platform provides accurate and valid information to the users. It involves comparing the results obtained from the platform with known data sets or benchmarks to verify their accuracy.

Performance testing evaluates the performance and responsiveness of the platform, particularly in terms of the time required for users to access and interact with it [26]. This testing helps identify any performance bottlenecks or issues that may affect the user experience.

Table 1 depicted the result of MetaPolije platform testing based on functionality, validity and performance.

Table 1. Platform testing result

Testing area	Description	Testing Method	Result
Functionality	Test all feature	Manual direct testing	All features are functioning properly.
Validity	Test accuracy and reliability data	Manual direct testing	Platform provides accurate and valid information
Performance	Platform speed test	tools.keycdn.com	Access time only 1.46 seconds

Through functional testing, it was determined that the platform met the functional requirements and operated smoothly. The validity testing conducted on the metabase GIS data analysis platform showed that the results were consistent and reliable. The performance testing conducted on the platform indicated that it performed efficiently and provided a smooth user experience.

Based on the above test results, it can be stated that the developed MetaPolije is deemed suitable in terms of functional, validity, and performance aspects of the system. Overall, the testing results indicate that the developed cloud-based metabase GIS data analysis platform is suitable for use. It meets the functional requirements, provides accurate and valid data analysis results, and performs efficiently. The testing process ensures that the platform is reliable and meets the needs of the users.

4. Conclusions

This study aims to discuss the successful development of a cloud-based metabase GIS data analysis platform called MetaPolije, which follows the Agile method system development life cycle. The Agile method consists of several stages. The platform has also undergone functional, validity, and performance testing techniques to ensure its efficiency. The test results have shown that the platform is capable of functioning well according to its intended purpose. Additionally, the platform is able to accurately display visualized data analysis results, including precise location points for each data. The time required to access and display the data analysis results is also remarkably short, taking only 1.46 seconds. Therefore, it can be concluded that the MetaPolije is a viable platform that meets the standards of functional, validity, and performance testing, making it a dependable and effective tool for data analysis. For the next stage, MetaPolije can be implemented according to user needs. This is because the features in MetaPolije are basic features needed when conducting spatial-text data analysis. Category sorting can be adjusted to the user's objectives.

5. Patents

The copyright of Metapolije platform is registered at the Directorate General of Intellectual Property (DJKI) of the Ministry of Law and Human Rights with registration number EC002023117464 and recording number 000550419.

Supplementary Materials: The following supporting information can be downloaded at: https://docs.google.com/spreadsheets/d/17lAW5zXpmzfhiSOGRMY4TMFn0OVu0A6s/edit?usp=sharing&ouid=103152318735925438998&rtpof=true&sd=true

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https://docs.google.com/spreadsheets/d/17lAW5zXpmzfhiSOGRMY4TMFn0OVu0A6s/edit?usp=sharing&ouid=103152318735925438998&rtpof=true&sd=true.

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Conflicts of Interest: The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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