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DEVELOPMENT OF RICEFIELD MAPPING SYSTEM IN UJUNG PADANG SIMALUNGUN REGENCY

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Abstract: Geographic Information System (GIS) is an information technology that functions to collect, manage, store, and present all data related to the geographical conditions of an area that develops online. Many agencies or companies have not implemented geographic information system technology to obtain the necessary information, one of which is the Simalungun Regency Agriculture Service. The Agriculture Service of Simalungun Regency still does not have a system to utilize rice farming land; it is difficult to find information on rice farming land. The distance of rice farming land is very far. Given the various problems that exist, the purpose of making a Geographic Information System (GIS) can help the Simalungun Regency Agriculture Service in carrying out data processing, to improve performance in uniting agricultural land to be more efficient and effective, and make it easier to obtain information or access to agricultural land data. Paddy. The design of this system uses the waterfall method, which includes software requirements analysis, design, program code generation, testing, support, or maintenance. The results obtained with this system will allow users to see various rice farming lands in Ujung Padang District, Simalungun Regency, accompanied by village names, addresses, number of farmers, harvest production, coordinate points, and website-based agricultural land location routes.

Keywords: geographic information system (GIS); mapping; rice farming land

Abstrak: Sistem Informasi Geografis (SIG) merupakan suatu teknologi informasi yang berfungsi untuk mengumpulkan, mengelola, menyimpan, dan menyajikan segala data yang berkaitan dengan kondisi geografis suatu wilayah yang berkembang secara *online*. Banyak berbagai instansi atau perusahaan yang belum menerapkan teknologi sistem informasi geografis untuk memperoleh berbagai informasi yang diperlukan, salah satunya Dinas Pertanian Kabupaten Simalungun. Dinas Pertanian Kabupaten Simalungun masih belum memiliki sistem yang dapat memetakan lahan pertanian padi, sulitnya dalam mengetahui informasi lokasi lahan pertanian padi, jarak tempuh ke lahan pertanian padi yang sangat jauh. Dengan adanya berbagai permasalahan yang ada maka tujuan dibuatnya Sistem Informasi Geografis (SIG) dapat membantu Dinas Pertanian Kabupaten Simalungun dalam melakakukan pengolahan data, untuk meningkatkan kinerja dalam memantau lahan pertanian padi menjadi lebih efesien dan efektif, dan mempermudah dalam memperoleh informasi atau akses terhadap data lahan pertanian padi. Perancangan sistem ini menggunakan metode *waterfall* yang meliputi analisis kebutuhan perangkat lunak, desain, pembuatan kode program, pengujian, pendukung atau pemeliharaan. Hasil yang diperoleh dengan adanya sistem ini nantinya pengguna dapat melihat berbagai lahan pertanian padi yang ada di Kecamatan Ujung Padang Kabupaten Simalungun yang disertai dengan nama desa, alamat, jumlah petani, produksi panen, titik koordinat, dan rute ke lokasi lahan pertanian padi yang berbasis website.

Kata kunci: lahan pertanian padi; pemetaan; sistem informasi geografis (SIG)

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INTRODUCTION

The development of information technology is currently happening so rapidly and affects the way humans work both in terms of time and the resulting output [1]. This information technology has various variations that have the purpose or use of each field, such as information technology engaged in agriculture, which is Geographic Information Systems (GIS). According to [2] Geographic Information System (GIS) is a computer system that can manipulate and store various information related to geography.

Several studies on Geographic Information Systems (GIS) that have been carried out previously include the Application of Geographic Information System Search for Health Centers in East Lampung Regency [3], explaining that this application aims to provide information on the location of health centers and health facilities in East Lampung Regency. Design and Build a Geographic Information System to Find the Location of MSMEs in Madiun City [4] This research describes the location and information about MSMEs in Madiun City. Geographic Information System Mapping the Location of Malang City Bird Contest Android Based [5] with this system can make it easier for chirping mania from Malang city and outside Malang city to find out where the location of bird contest spreads, especially in Malang city. Geographic Information System for the Distribution of MSMEs in Cimahi City [6] This research contains the mapping of the location of MSMEs in Cimahi City, which aims to facilitate future management. Geographic Information System for Mapping Coconut Gardens and Coconut Copra Production in Tasikmalaya Regency [7] explained that the geographic information system mapping coconut plantations in Tasikmalaya Regency can provide information in the form of coconut production data showing the name of the area, production, production, and the number of owners. Plantation. Information System for Land Use and Production of Food Crops in Kediri Regency, East Java [8] explained that applying this geographic information system is useful for providing information on the location of Kediri Regency and knowing several types of land plants found in the sub-district. Geographic Information System for Malaria Patients in Creme Taba Village, Lubuklinggau City [9] explained that this geographic information system could help the government tackle, malaria sufferers. Application of the Haversine Formula in Geographic Information Systems Nearest Distance Search Futsal Field Locations [10] This study aims to build a geographic information system that displays information and futsal field locations presented on a digital map. Geographic Information System was looking for travel location routes in Palangka Raya City Based on the Website [11]. This study aims to provide information about finding the shortest route for travel location objects in Palangka Raya City. Information on Small and Medium Industries (IKM) in Pidie Regency Based on Geographic Information Systems [12] explains that displaying the location and information about small and medium industries in Pidie Regency in digital maps.

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Simalungun Regency is the location of rice farming land that is commonly found. Based on data on the area of rice farming land and yields at the Simalungun Regency Agriculture Office, it shows several agricultural land areas with varying land areas and yields.

Based on data released by BPS Simalungun in 2020, Ujung Padang District, Simalungun Regency has an area of 23,188 hectares with a population of 40,552 people. Ujung Padang District, Simalungun Regency, also consists of 20 villages with 805 ha of rice farming land (paddy fields) with a rice production of 6,885 tons. As an area included in the agricultural category of Ujung Padang District, Simalungun Regency is one of the areas where the majority of the population has a livelihood by farming, one of which is rice farming.

The Simalungun Regency Agriculture Service does not yet have a system that can monitor the amount of land or rice-producing areas in Ujung Padang District, Simalungun Regency online; limited access to data on rice farming in the area, monitoring of rice farming is carried out by surveying to a direct location which is a very far distance from the Simalungun Regency Agriculture Service office and takes a long time to reach the location, the mapping of rice farming land is still on paper, agricultural data owned by not all agencies can see the data directly, because extension workers or regional admins hold the data.

This can lead to a lot of time and cost in optimizing the potential of rice farming for investors and a lack of analysis of potential rice producers to find out which areas produce large or small amounts of rice for future decision making.

The research objectives that are expected to be written are to build a geographic information system for the Agriculture Service of Simalungun Regency in the data processing process, which was previously carried out manually online, to build an information system as a visualization of the mapping of rice farming land in Ujung Padang District, Simalungun Regency which is useful for obtaining various information for future decision making, applying a mapping Geographic Information System (GIS) in finding the location of rice farming land in Ujung Padang District, Simalungun Regency.

METHOD

According to [13], the waterfall method is a method with a systematic development model for software development and software development. The waterfall method has the following stages:

1. Requirements Definition
   The need search process is intensified and focused on software. To know the nature of the program to be made, the software engineer must understand the information domain of the software, for example, the required functions and the user interface. These 2 activities (search for system and software requirements) must be documented and shown to the customer.
2. System and Software Design

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This process is used to convert the above requirements into a representation in the form of a software "blueprint" before coding begins. The design must be able to implement the requirements mentioned in the previous stage. Like the previous 2 activities, this process must also be documented as the software configuration.

3. Implementation and Unit Testing
   To be understood by the machine, in this case, the computer, the design must be transformed into a form that can be understood by the machine, namely into a programming language through the coding process. This stage is the implementation of the design stage, which the programmer will technically do.
4. Integration and System Testing
   Something that is made must be tested, likewise with software. All software functions must be tested to free the software from errors, and the results must be to previously defined requirements.
5. Operation and Maintenance
   Maintenance of software is needed, including development, because the software is not always like that. When running, there may still be small errors that were not found before, or there are additional features that do not exist in the software. Development is needed when there is a change external to the company, such as a change in the operating system or other devices.

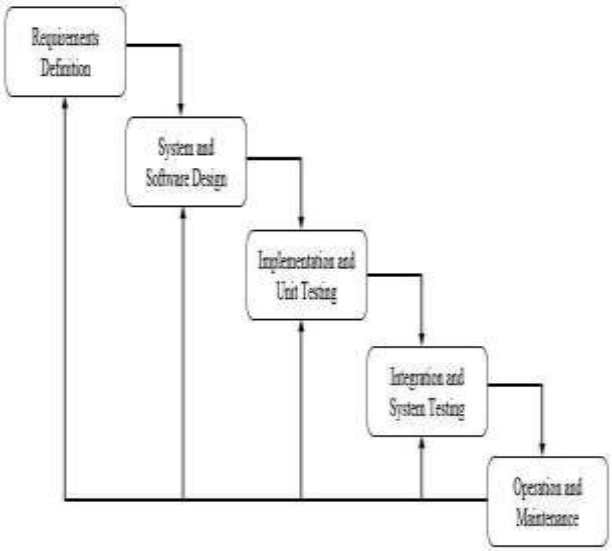

Figure 1. Stages of the Waterfall Method

This study uses a descriptive qualitative method. According to [14], qualitative methods are not mathematical or use formulas but are absolute to process data which is carried out to understand empirical phenomena, especially looking for as many pictures as possible about these phenomena without detailing them in the relationships between interrelated variables. This research method is descriptive, which will be used to describe the research results and the variables in the research accurately.

Descriptive qualitative methods were used to collect data with research instruments, analyze data, and collect information from the Simalungun Agriculture Service to describe the location of rice farms in Ujung Padang District, Simalungun Regency.

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RESULT AND DISCUSSION

Problem analysis

The problem that will be studied in the research is that there is not yet a Geographic Information System (GIS) that can assist the Agriculture Service of Simalungun Regency in utilizing rice farming land in Ujung Padang Simalungun District; it is difficult to find information on rice farming land in Ujung Padang Simalungun District, it is difficult to know there is no information system based on digitalization that can be used for this location. The distance from the Simalungun Regency Agriculture Service to rice farming land in Ujung Padang Simalungun District is far.

Data analysis

The data requirements used are in the form of input data on the system to be designed, namely data about the location of agricultural rice lands in Ujung Padang Simalungun District, such as input for rice farming land location, rice area, the average production of rice yields, sub-districts, districts, and the coordinates of the location of the rice fields. The output results to be obtained are in the form of information on the location of rice farming land, rice land area, the average production of rice yields, sub-districts, districts, and coordinates for the location of rice farms in the form of a digital map that has a description of each location of rice farming land used. located in Ujung Padang Simalungun District.

Table 1. Name of Village, Land Area, Number of Farmers, and Estimated Rice Harvest Yield in Simalungun Regency

Village Name	Land Area (Ha)	Number of Farmers (Persons)	Yields	
			MT 1	MT 2
Nagori Kampung Lalang	200	104	4	4,5
Nagori Tanjung Rapuan	5	125	5	5,5
Nagori Ujung Padang	200	104	4,5	4
Tinjowan	5	3	5	4,5
Banjar Hulu	139	143	4, 5	5
Rawa Masin	35	65	4	6
Sei Merbo	25	30	5,5	5,1
Huta Parik	80	82	5	4,5
Teratak Nagodang	75	24	4,5	4
Sordang Baru	159	109	4	4,1
Sordang Bolon	18	9	5	4,5
Pulo Pitu	11	19	4,5	4,5

Based on table 1 data, rice farming in the Ujung Padang Simalungun Sub-district in the development of this Geographic Information System (GIS) requires the existence of coordinate points. Coordinate points are an important component to know everything about the

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study of astronomy calculations, usually related to the time and position of celestial bodies in a place of observation [12]. The coordinate points consist of latitude and longitude points to determine the location points of villages with rice farming land in this Geographic Information System (GIS). Later, as for the coordinate points, namely:

Table 2. Coordinate Point of Rice Farming Land in Ujung Padang District, Simalungun

No	Village Name	Coordinate Point	
		Latitude	*Longitude*
1	Kampung Lalang	3.072548	99.530604
2	Nagori Tanjung Rapuan	3.072548	99.530604
3	Nagori Ujung Padang	3.073577	99.533390
4	Tinjowan	3.101317	99.508655
5	Banjar Hulu	3.101746	99.508704
6	Rawa Masin	3.072548	99.530604
7	Sei Merbo	3.074819	99.483111
8	Huta Park	3.067681	99.520044
9	Teratak Nagodang	3.045662	99.468488
10	Sordang Baru	2.990132	99.443201
11	Serdang Bolon	2.990833	99.443974
12	Pulo Pitu	3.032465	99.524176

At this stage, it contains the user interface in a system.

a. Main Menu Display

The main menu display is the start page that will appear when the program is run. This page contains the Home menu, Rice Land Data, online Rice Land Map, About, and Land Data Reports for the Simalungun Regency Agriculture Office.

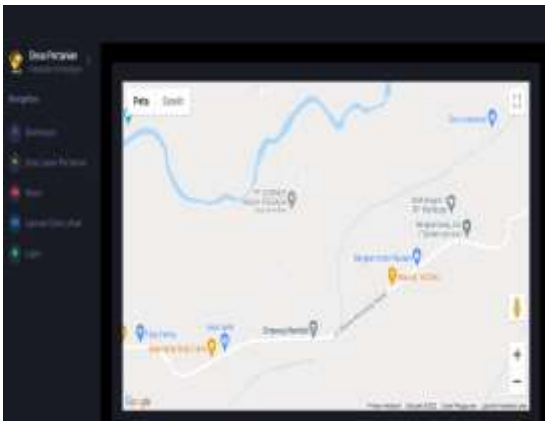

Figure 3. Main Menu Display

b. Online Map View

The online map menu regarding rice farming land in the Simalungun Regency area provides information about the location area's location. The online map display can be seen in Figure 4:

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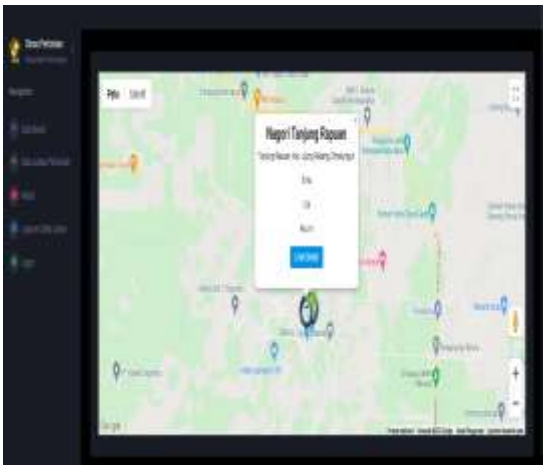

Figure 4. Online Map Display

c. Rice Farming Land Data Display

The rice farm data menu contains a collection of various rice farms in the Simalungun Regency area to provide information about the name of the location and detailed information about the area. The display of the rice farm data menu can be seen in Figure 5:

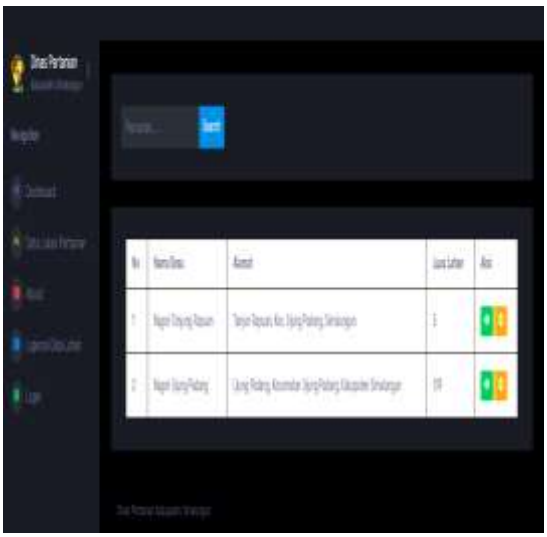

Figure 5. Display of Rice Agricultural Land Data

d. Rice Farming Location Detail View

The Menu Details for the Location of Rice Farms in the Simalungun Regency area provides complete information about the area where the rice farms are located. A detailed view of the location of rice farming land can be seen in Figure 6:

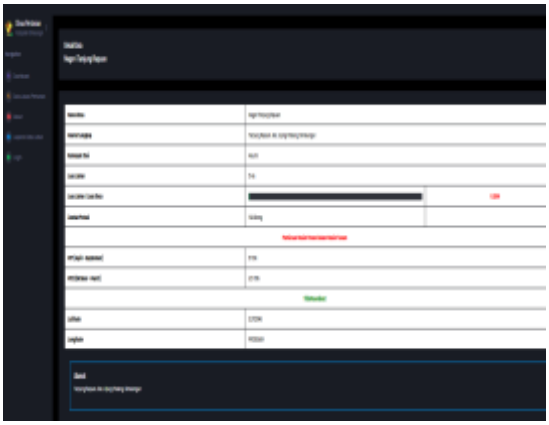

Figure 6. Display of Detailed Location of Rice Farming Land

e. Admin Login Display

This form can only be filled out by the admin who will manage data regarding rice farming land and other admin data. The admin login page can be seen in Figure 7:

Figure 7. Admin Login Display

From picture 7. admin login, admin is asked to fill in username and password. Then press the login button to enter the admin page. And if the username and password match, the admin

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page will appear, which can be seen in Figure 8:

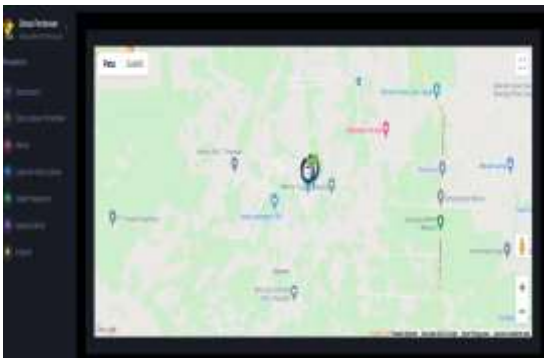

Figure 8. Admin Main Page Display

f. Display of Rice Farming Land Location Data on the Admin Page

In this menu, the admin can see data on rice farming land in the Simalungun Regency area with a view that can be seen in Figure 9:

Figure 9. Display of Rice Farming Land Location Data on the Admin Page

g. Display Add Location Data for Rice Farming

To add data for rice farming land, the admin will fill out a form as shown in Figure 10, which is then stored and displayed on the list of names for the locations of the paddy fields that have been recorded.

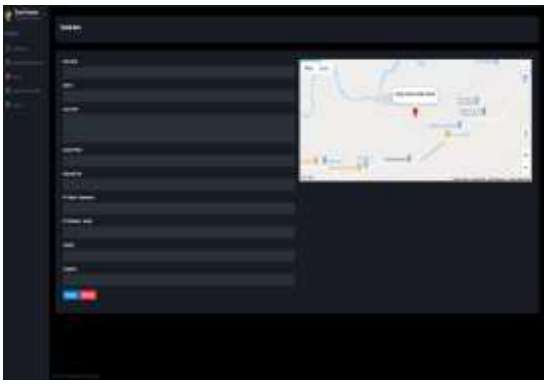

Figure 10. Data Display Add Location Data for Rice Farming

h. Edit Display of Rice Farming Land Location Data

To add data for rice farming land can be done by pressing the edit or delete button in the list of locations for rice farming in the section you want to edit or delete. If you press the edit button, a form will appear for editing. Then the admin can save the edits, and it will be directly displayed on the list of names for the locations of the rice farms that have been recorded, as shown in Figure 11:

Figure 11. Edit Display of Rice Farming Land Location Data

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CONCLUSION

From the results of the design and implementation analysis that resulted in an online mapping system for rice farming land in Ujung Padang District Simalungun, which was applied at the Simalungun Regency Agriculture Service using the Google Maps API, this system contained rice agricultural land data in the form of maps of agricultural rice land, land area, the number of farmers, farmer groups, and estimates of rice yields on rice farms in Ujung Padang Simalungun District, and data collection on the location of villages that have rice farming land in Ujung Padang Simalungun District.

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