

Analysis and Design of Geographic Information Systems Mapping Agricultural and Plantation Locations in Melak District, Kutai Barat Regency

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Abstract: Geographic information system is a computer-based information system that is used to store, examine, integrate, manipulate, and display data related to the earth's surface. Melak is a non-governmental organization that was born out of concern about the increasing destruction of natural resources, and the increasingly marginalized local or indigenous people in managing natural resources and the increasingly rapid expansion of large-scale oil palm plantations which in fact threatens not only the existence of forests, but also threatens the existence of the forest. humans and other living things. Melak plays an important role in mapping the location of oil palm plantations and agriculture as well as knowing the number of oil palm tree trunks managed by organizations and independent smallholders. The purpose of this study is to design a system that can be used for mapping agricultural land and plantations using a database as a storage medium.

Index Terms: Geographical Information System , Land Mapping, Agriculture, UML.

1. Introduction

Melak District, West Kutai Regency has abundant natural resources such as in the fields of plantations, agriculture, tourism, mining, marine fisheries and in several other fields, plantations and agriculture are the most superior products [1]. Oil palm is the flagship product of Melak, oil palm plantations are the second largest plantation area after rubber plantations in Jambi province with an area of 145.175 hectares [2], but are producers of production.

The large potential of oil palm plantations in Jambi Province is mostly utilized by the people of the Jambi province or investors from abroad. So far, the high activity of oil palm plantations that are managed independently by the community, has an unfavorable impact on the environment. This is due to the lack of information and knowledge of farmers on oil palm management, as a result aspects of safety and pollution tend to be neglected. Even more risky, farmers always use land expansion methods to increase yields, not by increasing production or intensification.

Therefore, conditions like this must be immediately assisted so that farmers understand exactly how gardening also pays attention to the environment [3].

Melak is a non-governmental organization that was born out of concern about the increasing destruction of natural resources, and the increasingly marginalized local or indigenous people in managing natural resources and the increasingly rapid expansion of large-scale oil palm plantations which in fact threatens not only the existence of forests, but also threatens the existence of the forest, humans and other living things. The decline in the number of forest areas and stands, the loss of rights of local communities, especially independent smallholders due to the establishment of plantations, invites this institution to try to

do advocacy work on the three pillars of change. Namely the people, the state and the market.

For Melak the need for guidance to independent smallholders as well as supervision of the expansion of oil palm plantations is quite important in maintaining the continuity of a forest which has a considerable impact on the balance of the ecosystem, especially in West Kutai Regency.

Melak has assisted organizations and independent smallholders covering all of West Kutai Regency. In this case, Melak plays an important role in mapping the location of oil palm plantations and agriculture as well as knowing the number of oil palm tree trunks managed by organizations and independent smallholders. In this case, Melak does not yet have a technology-based system to collect data on farmers and map plantation locations and coordinate points to determine the area of plantations and the number of oil palm trees in the land of organizations and farmers. Mapping plantation locations will help the government to find out the locations used by companies for oil palm plantation management.

Based on the background of the problems above, it is necessary to have a system that can be used to map agricultural and plantation locations and can manage all farmer data. The authors are therefore interested in conducting research and then pouring it into a study entitled "Analysis and Design of Geographical Information Systems Mapping Agricultural and Plantation Locations in Melak District, West Kutai Regency".

2. Literature Review

According to [4], "System analysis plays a key role in information systems development projects. Systems analysis works closely with all project team members so that the team can develop the right system in an effective manner.

So, based on the above it can be concluded that System Analysis is a step in outlining and identifying various user needs that will be adapted for the development of a new system to be designed. And the main purpose of the system analysis activity is to understand and document the business requirements and process requirements of the new system.

According to [5-7] that Geographic Information System (GIS) is a computer-based system that has 4 (four) device components in handling geographic data, including:

1. Data retrieval
2. Data management, including storage and maintenance
3. Manipulating and analyzing data
4. Presenting the data

Based on the above understanding, GIS can function as an integrated data bank, which can guide spatial and non-spatial data in an integrated database. The modeling and analysis system can be used as a means of evaluating regional potential and spatial planning. Geographically referenced management system, useful for managing operations and administration of geographic locations. GIS also visualizes and interprets data into a number of ways that will present relationships, trends and patterns in more understandable forms such as maps, charts and report[8]. GIS is also useful as a computational mapping system that can present a map that suits your needs. GIS can be used for scientific investigations, resource management, development planning, cartography and route planning [9-13]. For example, in this case, the designed GIS can help display accurate location information for Base Transceiver Station (BTS) at PT. XL Axiata and planning potential new locations that have not been reached by the BTS network at PT XL Axiata. In addition, it can display information such as a map of the location, type, number and operational costs of the BTS.

3. Methodology

To produce good research and in accordance with the research objectives, a research flow is made according to the research title and contains the steps taken in the research as Fig.1 research framework with waterfall model [4,14]. The waterfall model is a static model and it approaches systems development in linear and sequential manner, completing one activity before the other [15]. The following are the research steps that the author describes through the research flow, namely:

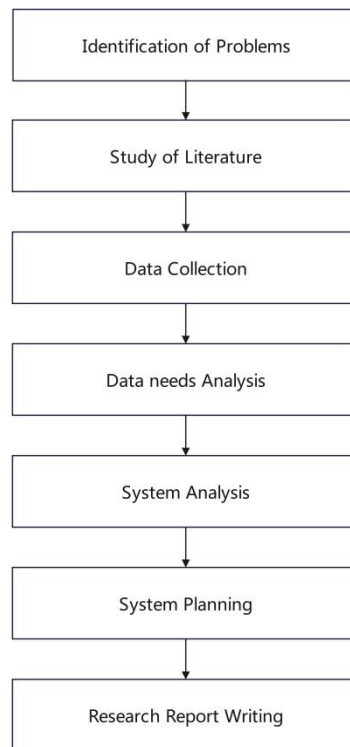


Fig. 1. Research Framework

3.1. Identification Of Problem

In this stage, the researcher identifies the existing problems, namely formulating the problem to be studied. With the formulation of the problem, the research will be clear and directed.

3.2. Study Of Literature

The first thing to do in making this thesis is to conduct a literature study. This activity is carried out with the intention of studying and understanding the theories that serve as guidelines and references for solving the problems discussed in this thesis and studying research that is relevant to the problem under study.

3.3. Study Of Literature

As a very useful supporting material for the author to find or collect the data needed in this study, the author uses 2 (two) ways, namely:

1. Documentation Collection

Research with this documentation collection method is carried out by collecting documents related to the research, namely farmer data, farmer land data, and farmer land coordinate data in Melak District.

2. Interview

The author conducts field research by conducting interviews with related parties to obtain the data needed by the author. This is done so that the author knows what activities are being carried out. To obtain accurate and relevant data in order to produce an application design that suits your needs. Interviews were conducted in two forms, namely structured interviews (conducted through questions that had been prepared in accordance with the problems to be studied). Meanwhile, unstructured interview.

3.4. Data Needs Analysis

The next stage is the data requirements analysis stage. At this stage, an analysis of the data obtained is carried out to obtain data that is really needed in the research. This is done with the aim of grouping the data to obtain valid and relevant conclusions.

3.5. System Analysis

In this step, analysis of the information system that is currently running in Melak is carried out to find out the problems that exist in the Geographic Information System mapping the location of agriculture and plantations in Melak, so that it is known what the weaknesses and shortcomings are in the Geographical information system.

3.6. Research Report Writing

At this stage, the author makes a report from the research which contains a research report on the problems and solutions that exist in the object studied by the author, namely the Geographic Information System mapping the location of agriculture and plantations in Melak, the theories taken by the author which are used as support in the research. , the author's way of conducting research, research results and analysis as well as some complements from the research report.

4. Result and Discussion

4.1. Brief Description of Melak

To facilitate the author in conducting research on Geographic Information Systems Mapping plantations and agriculture of Melak, the author will explain about what Melak is.

The Melak Sub-District Organization is a non-governmental organization that was born out of concern about the increasing destruction of natural resources, and the increasingly marginalized local community in natural resource management and the rapid expansion of large-scale oil palm plantations which in fact threatens not only the existence of forests, but also threatens the existence of the forest. humans and other living things. The decline in the number of forest areas and stands, the loss of local community rights caused by the establishment of plantations invites this institution to try to do advocacy work on the three pillars of change. Namely the people, the state and the market.

The great desire that wants to be carried in this organization is how the Melak District can become an open organization and involve various parties in the work of the organization, the involvement of these parties is expected to really side with the people and for the sake of the people, for that the involvement of the parties becomes the media control over the work of the organization. the big hope of this institution is how it can work more focused and systematic.

4.2. System Requirements Analysis

System requirements analysis is the process of breaking the system into several sub-systems with a smaller scope, with the intention of making it easier to identify problems, obstacles, and opportunities that exist in the system, as well as to find out system needs. So that in the end will be able to propose methods of improvement on the system. This stage is one of the important stages, because errors in identifying problems in the system will lead to misperceptions when you want to design the system. This will result in a less effective design made.

In this section it will be shown how the actual system process occurs, identifying system requirements, both functional requirements and non-functional requirements. Functional requirements are directly related to the processes that must be carried out by the system or information obtained from the system, while non-functional requirements are in the form of the nature of behavior that must be possessed by the system as a support so that the system can function as expected. Based on the results of the analysis of the promotion system in Melak District, it is necessary to define functional and non-functional requirements for the development needs of a promotional information system in Melak District.

4.3. System Modelling

The system modeling is made using UML (Unified Modeling Language) which consists of Use Case Diagrams, and GUI (Graphic User Interface Display).

4.3.1 Use Case Diagram

Based on the analysis of system requirements, it can be defined actors and use cases that play a role, namely in the following table 1 actor definition and table 2 definition of use case :

Table 1. Actor Definition

	Actor	Description
1.	Admin	The admin on duty can do the following: a) Login b) Managing Officer Data c) Managing Mapping Data d) Print Report e) Logout
2	Officer	The officer on duty can do the following: a) Login b) Managing Partner Data c) Managing Factory Data d) Managing Farmer Data e) Managing Land Data f) Managing Coordinate Data g) logout

Table 2. Definition of Use Case

#	Id Use Case	Use Case	Description
1	UC 01	Login	Performed by the user of the authentication facility and authorize Admins and Officers to enter the system.
2	UC 02	Managing Data Partner	Conducted by Officers to see, add, change and delete Partner Data
3	UC 03	Managing Factory Data	Performed by Officers to view, add, change and delete Data Factory.
4	UC 04	Managing Data Farmer	Conducted by Officers to see, add, change and delete Farmer Data
5	UC 05	Managing Land Data	Performed by Officers to view, add, change and delete Data Land
6	UC 06	Managing Coordinate Data	Performed by Officers to view, add, change and delete Data Coordinate.
7	UC 07	Managing Data Officer	Done by Admin to see, adding, changing and deleting Melak District Officer Data
8	UC 08	Managing Data Mapping	Performed by Admin to view, search, changing and deleting Land Mapping Data in Melak District
9	UC 09	Print Report	Done by Admin to print reports Farmer Data and Land Data.
10	UC 10	Logout	Performed by Officers and Admins for out of the system.

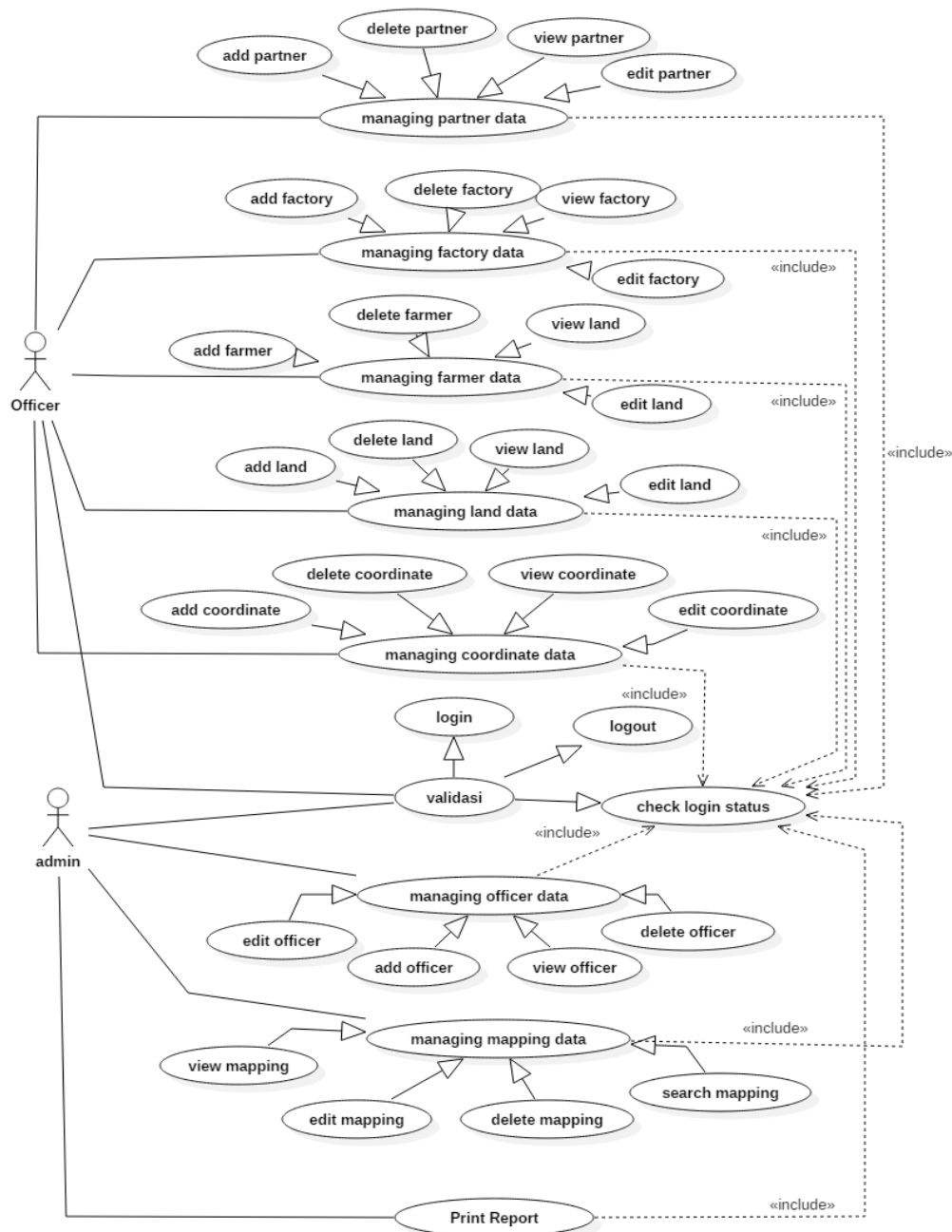
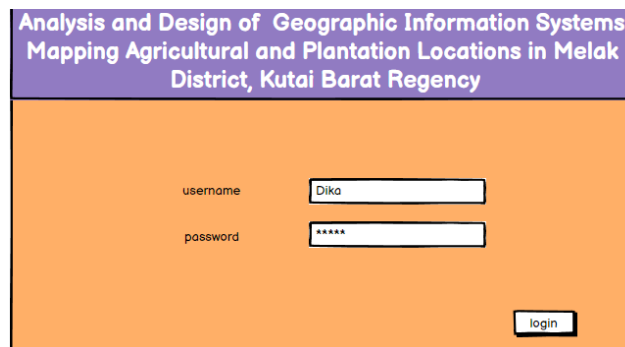


Fig. 2. Use Case Diagram

Use Case Diagrams describe the activities that will be processed by the system such as the login process, processing farmer data, processing mapping data, accessing coordinates and logging out as shown in the following fig 2 use case diagram. In Fig.2 of the use case, it can be seen that officers can manage the partner data menu, factory data, coordinate data, land data, farmer data with officers can add, edit and delete data. Admins can manage the officer data menu and mapping data by adding, searching, deleting and editing data.

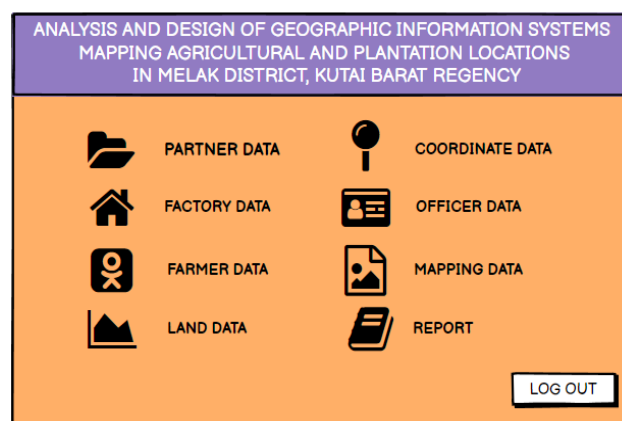
4.3.2. GUI (Graphic User Interface Display)

Based following is a GUI from the analysis and design of a geographic information system mapping the location of agriculture and plantations in the Melak sub-district, West Kutai Regency as follows in Fig 3:



The login display interface features a purple header with the title "Analysis and Design of Geographic Information Systems Mapping Agricultural and Plantation Locations in Melak District, Kutai Barat Regency". Below the header, on an orange background, are two input fields: "username" with the value "Dika" and "password" with masked characters "*****". A "login" button is positioned at the bottom right.

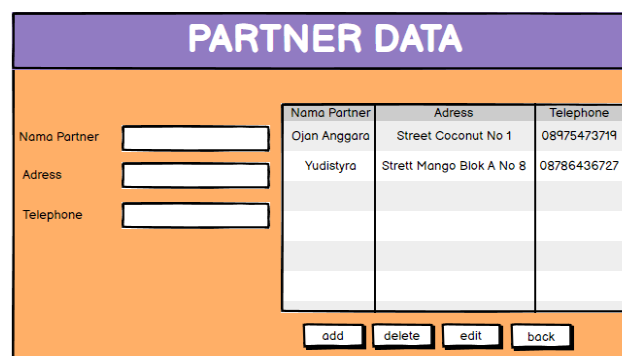
Fig. 3. Login Display this is the initial display of the system. actors can enter a username and password to enter the system.



The main menu display interface has a purple header with the title "ANALYSIS AND DESIGN OF GEOGRAPHIC INFORMATION SYSTEMS MAPPING AGRICULTURAL AND PLANTATION LOCATIONS IN MELAK DISTRICT, KUTAI BARAT REGENCY". The main area, on an orange background, contains eight menu items arranged in two columns, each with an icon and text: "PARTNER DATA" (folder icon), "FACTORY DATA" (house icon), "FARMER DATA" (person with X icon), "LAND DATA" (mountain icon), "COORDINATE DATA" (location pin icon), "OFFICER DATA" (person card icon), "MAPPING DATA" (map icon), and "REPORT" (document icon). A "LOG OUT" button is located at the bottom right.

Fig. 4. Main Menu Display

Fig.4 is main menu system display after the actor or officer enters the system with a username and password. displays several menus in the system, namely partner data menus, land data, mapping data, worker data, farmer data, officer data and reports.



The Partner Data interface features a purple header with the title "PARTNER DATA". On an orange background, there are three input fields on the left: "Nama Partner", "Adress", and "Telephone". To the right is a table with three columns: "Nama Partner", "Adress", and "Telephone". The table contains two rows of data. Below the table are four buttons: "add", "delete", "edit", and "back".

Nama Partner	Adress	Telephone
Ojan Anggara	Street Coconut No 1	08975473719
Yudistyra	Strett Mango Blok A No 8	08786436727

Fig. 5. Partner Data

Partner Data shows officers can add, delete, edit partner data. the data that can be entered is the partner's name, the partner's address, and the partner's phone number. It can be seen in Fig.5.

LAND DATA

Location

Large

Location	Large
Empas Village	5 Ha
Empakuq Village	3 Ha

add delete edit back

Fig. 6. Land Data

Land Data shows location and large of the location. The officers can add, delete, edit land data. the data that can be entered is the location and large land. It can be seen in Fig.6.

FARMER DATA

Nama Farmer

Address

Telephone

Nama Farmer	Adress	Telephone
Zaki	Street Coconut No 11	08975473719
Mr Bejo	Strett Mango Blok C No 81	08786436727

add delete edit back

Fig. 7. Farmer Data

Farmer data shows farmer name, address, and telephone. This information is to record farmers. The officers can add, delete, edit farmer data. the data that can be entered is the farmer's name, the farmer's address, and the farmerr's phone number. It can be seen in Fig.7.

MAPPING DATA

search

Area Mapping

Location

Coordinate Point

Large

Area Mapping	Location	Coordinate Point	Large
Kab Melak	Melak	-	2 Ha

add delete edit back

Fig. 8. Mapping Data

Data mapping is used to map plantation areas in Kubar and the total size of these areas. The officers can add, delete, edit mapping data. the data that can be entered is the area mapping, location, coordinate point, and large. officers can also search for data that has been entered. It can be seen in Fig.8.

Fig. 9 shows Map Plantation Areas in Kubar. The area is divided by different colors based on the palm company.

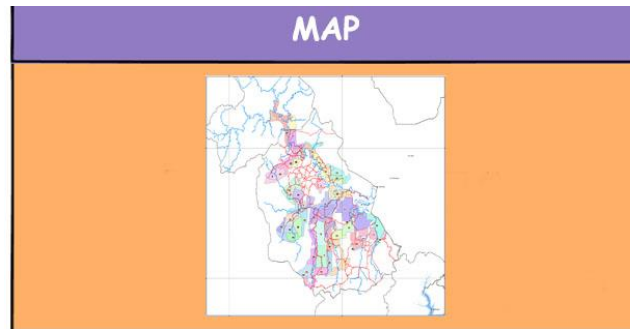


Fig. 9. Map Plantation Areas

5. Conclusion

After the author has implemented the Geographic Information System for Mapping Plantations and Agriculture in Melak District, West Kutai Regency, the author can draw several conclusions as follows. A system designed to assist Melak District in mapping plantations and agriculture. This research produces a system design consisting of Mapping features using coordinate points, features for adding farmer data profiles, partner data features, factory data features. Geographic Information System for Mapping Agriculture and Plantations in Melak District with an android-based basis, making it easier for the Jambi equivalent foundation as a user in mapping plantations and agriculture as well as inputting farmer data along with factory data and partner data. After conducting interviews by asking several questions to the Melak District officers, the officers really needed a system that could be used for land mapping and farmer profile data collection easily using a smartphone-based system.

The design of a Geographic Information System for Mapping the Location of Agricultural and Plantation Land in Melak District, West Kutai Regency, identified several weaknesses, namely: The system that has been designed requires a large internal storage media, as for suggestions for further researchers to use an oracle database to ensure the speed of data access. The system that has been designed can run well on a minimum android operating system 4.4.2 (KITKAT) with a minimum RAM capacity of 2 GB to be able to run the system properly as for suggestions for further researchers in order to improve system performance so that it can run well on all versions of the system current android operation. The design of the system in this research is only up to the stage of collecting data on farmers and collecting data on farmers' land, for further researchers it is expected to record farmer's land activities such as production activities, planting, fertilizing and cleaning pests so that all farmer activities can be monitored.

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