

# 4. An Implementation of Web Based GIS for

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# An Implementation of Web Based GIS for Distribution of Freshwater Fish Ponds

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**Abstract**— Geographical Information System is a term in the field of mapping which has a scope of how a system can unify geographic objects and their information. Freshwater fishery is the business of the majority of residents of South Bengkulu Regency covering tilapia and catfish. The solution is to create a web-based Freshwater Fish Pond GIS application using the PHP programming language. Making a database using MySQL, and for geolocation storage using Google Fusion Tables. The web that will be created will later display the GIS Web-based Freshwater Fish Pond Distribution Mapping in South Bengkulu Regency. Each pond will be accompanied by information such as the name of the owner, type of fish, type of pond, and location of the pond. It is known that the number of ponds in 4 villages in 2 districts in South Bengkulu Regency has reached 100 ponds consisting of 80 tilapia fish ponds, 20 catfish ponds.

**Keywords**—GIS, Freshwater Fish Pond, MySQL, phpMyAdmin, WEB.

## I. INTRODUCTION

The development of technology has been increasing rapidly along with the increasing human ability to processing information. The required data can be processed in such a way as to be able to become information that are accurate, timely and relevant.

Information is very important for management in decision making. Information can be obtained from an information system (information system). Robert A. Leitch and K. Roscoe

Davis writes "an information system is a system within an organization that. meet needs processing daily transaction data, supporting operations, managerial and strategic activities of a company organization and provide certain outside parties with the necessary reports [1].

Meanwhile, Geographic Information System (GIS) or Geographic Information System (GIS) is defined as: information system used to enter, store, recall, process, analyze and generate geo-referenced data or geospatial data, to support decision making in the planning and management of land use, natural resources, transportation environment, city facilities, and other public services [2].

Freshwater fish farming is getting more and more lucrative. According to the UN Food Agency report, in 2021

fish consumption per capita of world population will reach 19.6 kg per year [3] [4]. Although currently more fish consumption is supplied by marine fish, in 2020 freshwater fish production will overtake capture fisheries production. Why is that, because capture fisheries production will decrease due to overfishing [5].

Therefore, in order to meet the fish needs of the world community, it is necessary to increase the production of freshwater fish cultivation as a substitute for marine fish [6] [7]. So that we can provide space for marine life to reproduce. Moreover, Indonesia is the right place to cultivate fresh fish because it has enough land to make fish ponds [8] [9]. The distribution of freshwater fish ponds in South Bengkulu Regency is generally found in lowland areas. The number of freshwater fish ponds has changed from year to year [10]. This is caused by several factors such as the opening of new pond land, conversion of pond land functions and other factors, both natural and human. So it is very important to know the percentage of distribution of freshwater fish ponds from year to year, in order to monitor the production of freshwater aquaculture [11].

To find out the distribution of the pond, you can use Geographic Information System technology [12] [13] [14] [15]. GIS is defined as a series of activities to collect, organize, process, and analyze spatial data so that it can be presented in the form of desktop applications or web-based applications. All data to be used in GIS must first be made a spatial database, so that all information will be in the form of layers of spatial information [16], then it can be overlaid with one another so that the percentage of freshwater fish pond land and its distribution can be determined in the research area [17] [18].

When searching for a place, it certainly requires a location or a position. This location or position information is known as geographic information. Currently the most widely known geographic information is Google Maps [19] [20]. Thus, the need for a web-based information system for the distribution of freshwater fish pond locations so that people in South Bengkulu Regency can take advantage of the facilities that have been provided [21].

The formulation of the problem in this study is how to display the map information of the distribution of freshwater fish ponds in South Bengkulu Regency in the form of a web?

The purpose of this study is to create a geographic information system about the distribution of web-based freshwater fish ponds so that users can find out the location of the distribution of freshwater fish ponds in the South Bengkulu Regency and know the graph of the yield of freshwater fish harvests in each area from year to year [22] [23]. The benefits of this research are expected to be utilized by related parties for the benefit of strategic policy making in terms of the development of fishery production in South Bengkulu Regency and the production of a geographic information system product, which can be used as a reference for the Government and the people of South Bengkulu Regency or people from outside the region. South Bengkulu Regency to determine the location of the distribution of freshwater fish ponds [24].

## II. RELATED WORK

### A. Geographic Information System

Geographic Information System (GIS) is a computer system used to enter, store, examine, integrate, manipulate, analyze, and display data related to locations on the earth's surface. GIS is a special system for processing databases containing geographic reference data and having spatial information [2].

GIS is a system designed to work with spatially referenced data or geographic coordinates. GIS has the ability to perform data processing and perform certain operations by displaying and analyzing data. GIS applications are currently growing not only in terms of the number of applications but also in terms of the variety of applications [25].

GIS technology can also be used for scientific investigations, resource management, development planning, cartography and route planning [26]. The final result of the GIS process is manifested in a map or graph. Maps are very effective for storing, visualizing and providing geographic information. This training program consists of two levels.

### B. Mapping

A map is a picture of the earth's surface with a certain scale and depicted on a flat plane with a projection system certain. According to Erwin Raisz (1948), a map is a picture conventional reduced features of the earth's surface like the original appearance when viewed vertically from above, the map is made on a flat plane and is equipped with writings as an explanation [27].

Mapping is a grouping of a collection of areas that related to some geographical location of the area which includes the plains, height, mountains, resources and potential of the influential population towards social and cultural characteristics that have special characteristics in the use of the right scale [28]. A map is a two-dimensional representation on a flat plane all or part of the projected earth's surface with a certain comparison or scale [29].

So, from the two definitions above and adapted to this research then mapping is a process of collecting data to be used as a first step in map-making, by describing spatial distribution of certain natural conditions, moving the actual situation into the base map, which is expressed by use of map scale. Map drawn on a computer application, usually use a Geographic Information System (GIS) [30].

### C. Spatial data

Spatial data is data that refers to on positions, objects and the relationships between them in earth space Spatial data is one of the systems of information which is it contains information about the earth, including the surface earth, below the earth's surface, waters, oceans and below atmosphere [31]. Spatial data sources include is:

1. Satellite Image, this data uses a satellite as a vehicle.
2. Analog Map, actually this type of data is an early version from spatial data, where the difference is only in storage only.
3. Aerial Photographs, is one of the data sources that are widely used to generate data spatial data other than satellite imagery.
4. Tabular data, this data serves as an attribute for the data spatial.
5. Survey data (observations or measurements in the field), data this is generated from the results of surveys or field observations.

### D. Attribute data

Attribute data is data contained in space or a place that describes an information [32]. Attribute data obtained from statistics, censuses, field notes, and tabular (data stored in tabular form) [33]. Attribute data can be in terms of quality, such as the strength of a tree, and can be seen in terms of quantity, such as the number of trees [34].

1. Quantitative data, namely data relating to a numeric assessment. These numbers can then be calculated mathematically and processed in a system. Data It can also be used as statistical information on geographic information system complementary data.
2. Qualitative data, namely subjective data. This data is in the form of quality interpretation data. Spatial data and attribute data are stored in the form of dots (dots), lines (vectors), polygons (areas), and pixels (grids). Data in the form of dots (dot), including altitude, rainfall, location, and topography.

Data in the form of lines (vectors), covering the road network, drinking water pipes, pattern river flow, and contour lines. Data in the form of polygons (areas), includes administrative area, geology, geomorphology, soil type, and use land. Data in the form of pixels (grids), including satellite images and photos air. The basic data included in the GIS were obtained from three sources, namely field data (terrestrial), map data, and sensing data far away [35].

### E. Web GIS Concept

Web GIS can be said is a web mapping which means mapping internet, but not map the internet [36]. Web mapping makes use of the function the interactivity that exists in the GIS application in web form [37]. The web browser on the user sends a request to the web server. Because the web server is not have map processing capabilities, the request is related to map processing will be forwarded by the web server to the application server and Map server. The processing results will be returned again via the web server, wrapped in a PHP file.

The development of GIS applications in the future leads to Web-based applications known as Web GIS [38]. This is

because the development of applications in the network environment has shown great potential in relation to geo information. An example is the existence of an online map of a city where users can easily search for the desired location online via an intranet/internet network without knowing the user's geographic boundaries.

### III. RESEARCH METHODOLOGY

#### A. Research Location

The location which is used as the object of the following research is South Bengkulu Regency. Geographically, Bengkulu Selatan Regency is located between 409°39'- 4033°

34 'South Latitude and 102047° 45'- 103017°18' East Longitude. In the north, it is bordered by Seluma Regency along approximately 23,500 km. South Bengkulu Regency has an area of 118,610 Ha. which administratively consists of 11 Districts and 142 Villages.

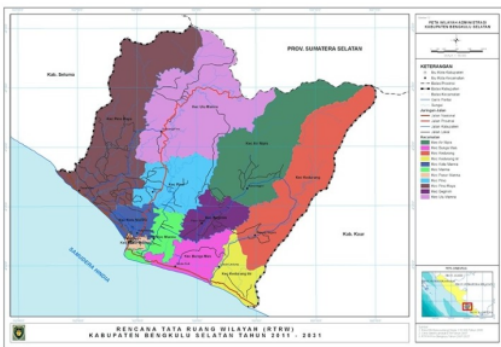


Fig. 1. Map of South Bengkulu Regency; Spatial Plans South Bengkulu District

#### B. Data and Equipment

##### 1) Materials used

###### a) Spatial data:

1. Village Boundary Map shapefile format
2. District boundary map shapefile format
3. South Bengkulu Regency Road Network Map in shapefile format
4. Digitizing the shapefile format fish pond

###### b) Non-spatial data:

1. Village Boundary Data.
2. District Boundary Data.
3. Road Network Data
4. Fish Pond Data

##### 2) Hardware :

1. Unit of Macbook laptop
2. Unit of printer unit for printing reports
3. Handheld GPS for taking coordinates
4. Mirrorless camera for documentation

##### 3) Software:

1. CSS
2. XAMPP
3. Notepad ++
4. Arcgis 10.1
5. Google Fusion Tables

6. MySQL
7. phpMyAdmin

#### C. Research Flowchart

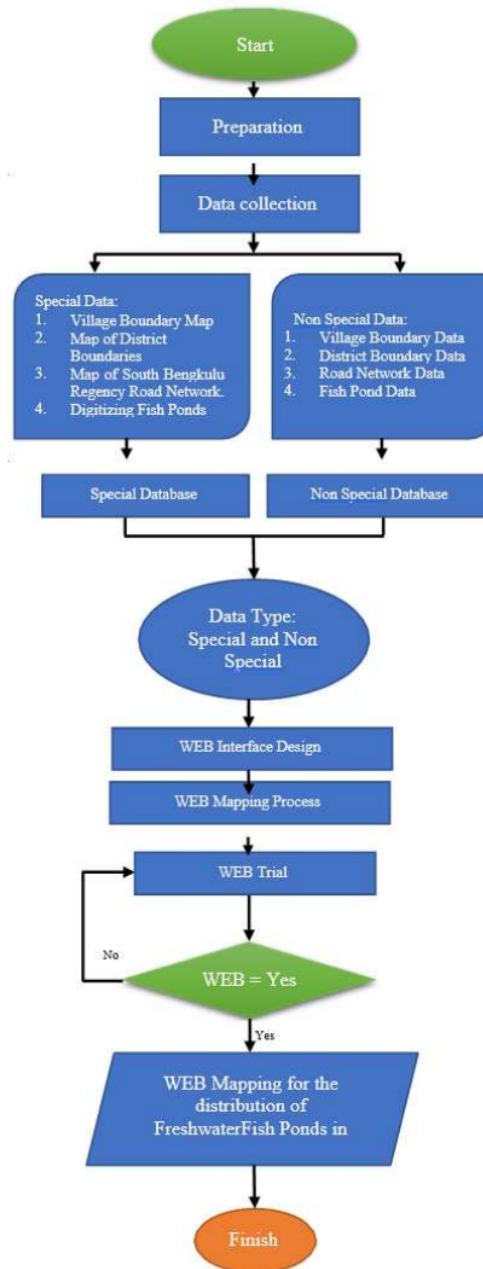


Fig. 2. Research Flowchart

### IV. RESULTS AND DISCUSSION

From the results of the research with the theme "Distribution Map of Freshwater Fish Ponds in South



Bengkulu Regency", a map can be generated in the form of a web-based geographic information system. After the creation of a web-based information system for the distribution of freshwater fish ponds in South Bengkulu Regency. It can be seen the number of harvests of several types of fish in each village from year to year starting from 2017-2020. The following is the data on the results of the distribution of freshwater fish ponds in South Bengkulu for each district in 4 villages.

#### A. Seginim District

In four years, we saw the development of Freshwater Fish Pond Data in South Bengkulu Regency especially in Seginim District, there are many Freshwater Ponds as shown in Figure 3.

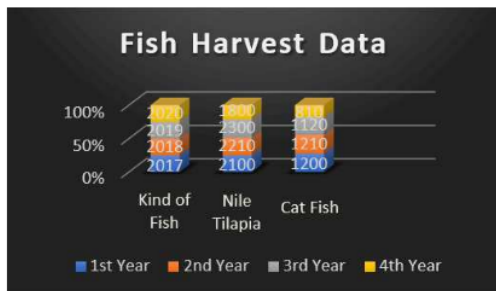


Fig. 3. Graph of Fish Harvest in the Village of Seginim District

#### B. Air Nipis District

Likewise, in Air Nipis sub-district, in four years, the development of Freshwater Fish Pond Data in South Bengkulu Regency, especially in Air Nipis District, there are many Freshwater Ponds as shown in Figure 4.

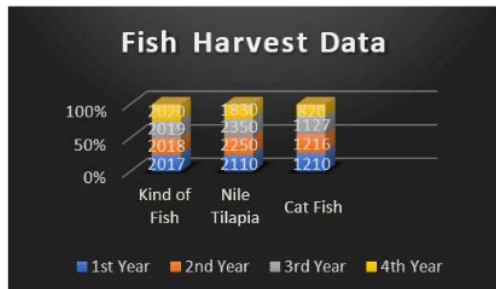


Fig. 4. Graph of Fish Harvest in the Village of Air Nipis District.

On the Web GIS system. The application is on the client side which communicates with the server as a data provider via web protocols such as HTTP (Hyper Text Transfer Protocol). The application uses a web browser (Mozilla Firefox). To display and interact with GIS data, a browser requires a Plug-In such as a Java Applet. The Web Server is responsible for processing requests from clients and sending responses to these responses. In web architecture, a web server also manages communication with GIS server side.

GIS Server side is responsible for connecting to the spatial database such as translating queries into SQL (Structure Query Language) and creating representations that are passed to the server. In fact, GIS Server side Components

are software libraries that offer special services for spatial analysis of data. In addition to components, another thing that is also very important is the functional aspect that is located on the client side or on the server.

Geographical data management requires a DBMS (Database Management System). Object-oriented modeling is needed because relational database modeling is not capable of storing spatial data. Flowchart diagrams provide overview of all system elements. There are two external entities, namely: the user, as the user of the system and can see the map info of freshwater fish. On user there are several data streams, namely: location data and data on the development of freshwater fish from year to year. Admin as system processor.

Availability of a large GIS database containing: information on the proportion of geological catchments, land use, climate, etc., covers a complete area the river network gives us a unique opportunity to produce the suitability of the map fish habitat. The geospatial predictor data we use are prepared as part of another project to determine fish harvest data. We use raw data for our models to ensure we use the best data scale available.

#### V. CONCLUSION

From the results of this study, a Web Mapping application for the Distribution of Freshwater Fish Ponds in South Bengkulu Regency was produced for the distribution of freshwater fish ponds which have the following capabilities:

- Presenting a map of the distribution of the location of freshwater fish ponds in South Bengkulu Regency with adequate supporting information.
- Presenting information related to the location of the city where the research was held, namely in South Bengkulu Regency
- Performing a graphical presentation of the fish harvest each year from each District in the Village and as a whole for 4 years.
- Helping people who want to invest in South Bengkulu Regency.

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