Web GIS University for Planning Infrastructure

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Abstract: The purpose of this study is to present Web GIS-based infrastructure resources at the State University of Manado. This study uses the waterfall method or often called the classic life cycle, this approach is a systematic approach. Software development begins with the user requirements specifications and then went through the stages of planning, modeling, construction, and deployment, then topped with complete software support generated. The research methodology used is the waterfall method has several stages: requirements, system design, coding and testing, program implementation, and maintenance. The data source in this research is to conduct a field survey to collect the object of study is all the infrastructure is located on the campus of the State University of Manado. Mapping in the field using the Global Positioning System (GPS) in which all the buildings on campus Unima at coordinates, the latitude, and longitude. Furthermore, to make polygons from each building identified with aerial photographs available in the OpenStreetMap software then analyze using other software namely QGIS 3.02 Girona Version. The design of the infrastructure on campus WebGIS using data flow diagrams serve to demonstrate the scope and limitations of a system being modeled, as well as demonstrate their interaction with the system outside entities. In the data flow diagram shows that outside entities directly associated with Geographical Information Systems are the location of the building, then the design has been formed with the geodatabase already arranged later in the design Web GIS Manado State University. The results showed that there were two main locations from the campus of Manado State University. The main campus is located in the administrative area of Minahasa Regency precisely in the district of South Tondano, known as Tataaran Campus and other campuses located in the administrative area of Tomohon City which is better known as the Faculty of Education. The campus layout area covering an area of approximately 300 hectares resulted in the spread of lecture buildings spread randomly by following the contour pattern formed on the land of the University of Manado campus. From the results of the identification, there are 86 objects in the form of coordinates, forming separate clusters for faculties, head office, institutions, and dormitories. The exposure of this location shows that it needs to be supported by other infrastructure such as clean water, electricity, internet and roads that require high costs if not properly managed. Therefore, it can be concluded from this research that it will help provide information through the design of campus infrastructure so that it is easier to plan and make decisions towards Unima as a smart campus.

1 INTRODUCTION

This study focused on the development of a web-based geographic information system with the object of research is the campus infrastructure. WebGIS application development, facilitate campus planning decisions in the future (Geoda, Suprayogi, and Hani'ah 2015). The WebGIS application is a system that can answer the planning needs in organizing lectures such as the amount of space that students will use so that planners can find a comparison between the number of students and the size of the lecture room used (Ajwaliya, Patel, and Sharma 2017). Additionally, WebGIS can visualize and describe the appropriate location within the campus facilities planning (Bi, Yang, and Ren 2017). WebGIS already developed in several countries such as China (Qi et al. 2011), India (Abhilash and Lajish n.d.), Taiwan

(Niu 2012); The Czech Republic (Herman and Řezník 2015) and some other country.

Manado State University (Unima) is a university located in Tondano, North Sulawesi. The campus region of around 300 Ha is one of the campuses in Indonesia which has a very large property capacity so that careful planning is needed if infrastructure management is to be carried out. Unima has two campuses, campus Tataaran is administratively located in the district of Minahasa and Campus Kaaten in Tomohon City.

The building infrastructure is far apart in Unima and the area is wide on campus, so it is difficult to find out the location of the inter-lecture buildings. Often found where the students are still looking for a location where they are studying or guests visiting the campus Unima, so the need for information about the location of buildings in Unima requires the availability of a good information system as well, can provide ease of finding the location of buildings on the campus of Unima.

Geographic Information System (GIS) based web can be used to solve the above problems in the search for the location of Building Unima layout and map displays as a source of information providers. The purpose of this study is to present Web GIS-based infrastructure resources at the State University of Manado.

2 METHODOLOGY

The system development methodology has evolved over the years and has adapted to changes in software project requirements, where each methodology has strengths and weaknesses that tend to make it profitable for certain types of projects (Fanon 2016). Similarly, the evolution in the complexity and the need for a web application (Fanon 2016), new methodology specifically for web systems have also been developed (Herman and Řezník 2015), but the technology and the web have changed the system needs to quickly generate new project-specific methodologies are being developed and documented (Bi et al. 2017).

The new technology has provided a framework methodology that can be adapted to future web projects (Fanon 2016). Web GIS is a system that shows the characteristics of GIS and Web (Ajwaliya et al. 2017). More specifically, Web GIS mapping and visualization of geographic information to the web platform. The method used is using the Waterfall method (Fanon 2016). The Waterfall method is often called the classic life cycle, where it describes a systematic and sequential approach to software development, starting with the specifications of user needs and then going through the stages of planning, modeling, construction, and deployment, and ending with support for software complete produced (Ananta and Winiarti 2013);(Nakayama et al. 2017).

This study uses two main data, the data used consist of primary data (field observations) and secondary data (literature) (Suharsimi 2010):

1. Primary data that field surveys in several locations Manado State University building with the installation of coordinate points of each building.
2. Secondary data consists of a basic map of the location of the Manado State University building (QGIS Bing Maps plugin), building and road data using OpenStreetMap (OSM).

The stages in data collection techniques consist of, The first step to do is make a field and then collecting data on observations made that observation directly. Direct observation is the direct observation of the location of Manado State University building, as well as by using a list of records for the adjustment of secondary data and then determining the coordinates with a Global Position System (GPS) on every building in Manado State University; the second stage is to carry out documentation, where the documentation data is carried out in this study with the image/photographers of the building at Manado State University, whereas the latter stages carried out literature studies. At this stage, the authors studied the theories related to the research to be conducted. In this case, learn things related to WebGIS.

Data sources in this study are subjects from which data can be obtained (Suharsimi 2010). In this study, the data sources are the following: the name and coordinates of the point of building in Manado State University by using the Global Positioning System (GPS), the software used is QGIS 3.02 Girona Version with basic map support from OpenStreetMap (Jafari et al. 2014).

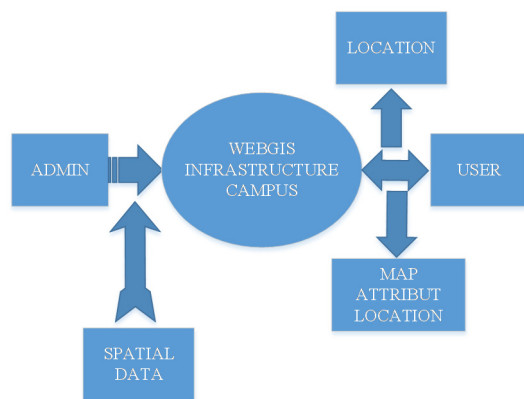Design layout WebGIS Building location in Manado State University is:

Figure 1: Diagram Context.

Diagram Context, also known as DFD (Data Flow Diagram) is used to indicate the scope and limitations of a system being modeled, as well as demonstrate their interaction with the system outside entities (Kulkarni et al. 2014). In the DFD of these entities indicated that beyond that relate directly to the system is the location of the location of the Geographic Information Systems Building at the State University of Manado, the User and Admin.

From the diagram above it (Figure 1) can be illustrated that the admin includes spatial data and attributes map the location of the building located in Manado State University then the system provides information on spatial data and attribute data to the admin, while the user can interact with GIS location of the building in Manado State University with input is a choice of locations available on the system. Furthermore, the location of the GIS of the building in Manado State University will provide output in the form of map display and area attributes and location of the building located at Manado State University to User.
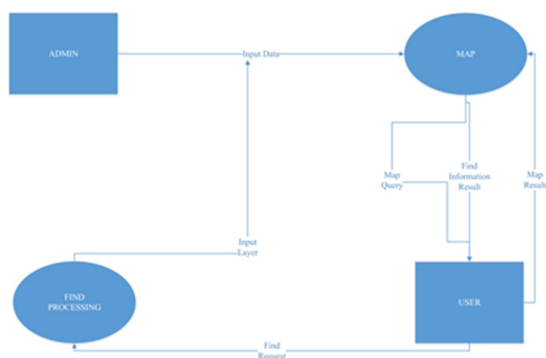

Figure 2: Data Flow Diagram.

DFD in Figure 2 above, describes the process of data in the system, where there are two external entities,

namely Administrators and Users (Agus et al. 2018); in this DFD, there are two processes are taking place, that the map data input process and their attributes and location of the search process at the building site Manado State University in accordance with the inputted data.

The last stage is that all the attributes that have been arranged into a map are then visualized into the Qgis Cloud (Landa et al. 2017).

3 RESULTS AND DISCUSSION

3.1 Field Data Collection Process

The process of data collection in this research field that uses the Global Positioning System (GPS). There are 86 points in the decision and all the data scattered Manado State University study site. From Figure 3 below shows, the observation points are:
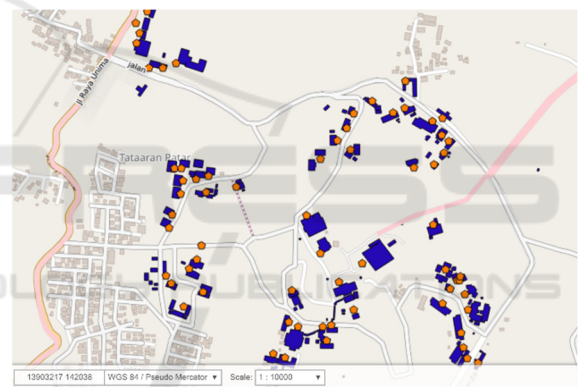

Figure 3: GPS Points Unima Campus distribution infrastructure Tataaran.

From the results of identification, there are 67 points of buildings that are used as educational facilities on the campus of Unima Tataaran. While the other 19 points are located on the Unima Kaaten campus.
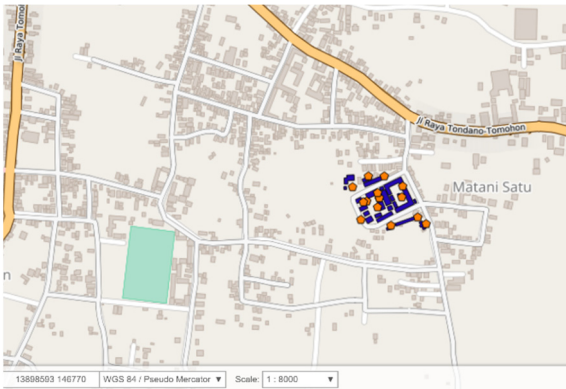
Figure 4. GPS point of infrastructure distribution of Unima Kaaten Campus.

The main campus Unima has an area of about 300 ha (Figure 4), the distribution of each faculty which involves a series of courses and majors have a flocking pattern as found in the Faculty of Science, Faculty of Engineering, Faculty of Languages and Literature and the Faculty of Economics. Whereas for the Faculty of Social Sciences and the Faculty of Sports Sciences several study programs are far apart from their parent faculties, making it difficult to supervise lecture activities as well as in administering student administration. Likewise, the Unima campus in Kaaten which consists of the Faculty of Education and Postgraduate Programs needs tighter supervision due to the distance from the main campus in Tataaran. As for the settlement of the problem conducted by the rector is the addition of the Internet network and control all academic activities through rigorous academic information systems. For that campus network system planning will be more concerned to make Unima as a smart and environmentally whole campus.

3.2 The Design of WebGIS

The design of the WebGis Unima infrastructure is an important part, where this activity focuses on visualization of the campus so that it is easier in planning.
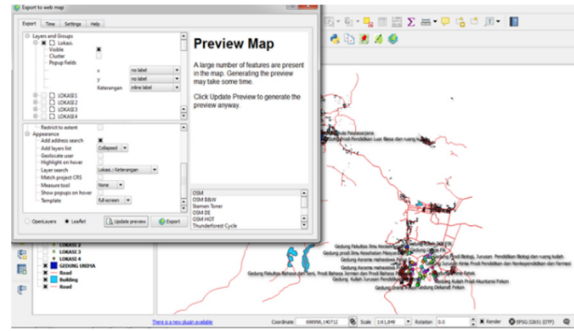

Figure 5: Export to Web Map

Utilizing the facilities provided by the QGIS software, with the plugin web map data attributes such as polygon the buildings on Unima campus are exported to the web map (Figure 5).
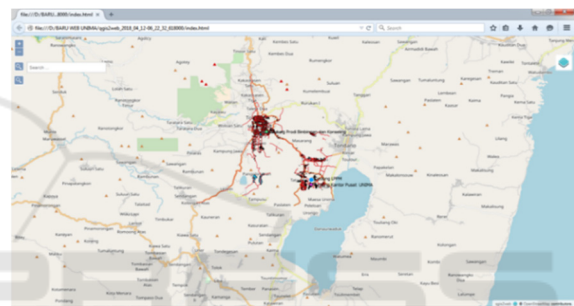

Figure 6: Result Export to WebMap

In Figure 6 above shows, the results of a map created by QGIS has been successfully exported to the web browser.

3.3 Web Mapping Testing

Web mapping testing is done using the Mozilla Firefox and Google Chrome web browser with the Windows operating system on desktop computers and Android operating systems on mobile devices, in order to run properly must be provided connection internet network. Web map testing can be accessed using the web address https://qgiscloud.com/orbin/webgis/. Tests carried out using its web address is accessible then, the map view is as follows (Figure 7):
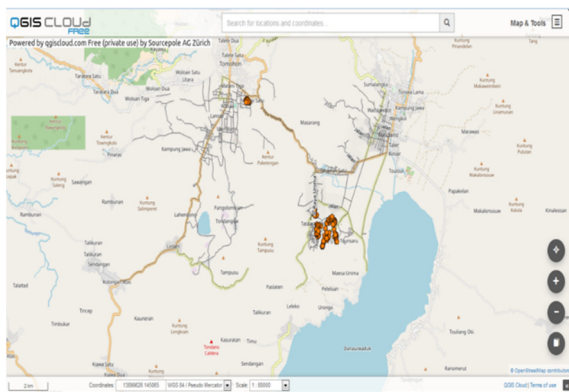
Figure 7. WebGis Campus with QGIS Cloud

4 CONCLUSIONS

This research can be summed up as follows, that the use of the software in the design of WebGIS is using Quantum GIS Girona where the software provides features to support the design QGIS CLOUD Geographic information system based on Web.

WebGIS-based Geographic Information System web at UNIMA will provide information about the building located at the State University of Manado as The location of the building, the point coordinates, names of buildings and map information that can be accessed by users on the web address https://qgiscloud.com/orbin / webgis /.

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