Mapping urban green open space in Bontang city using QGIS and cloud computing

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Mapping urban green open space in Bontang city using QGIS and cloud computing

F Agus[*1], Ramadiani[1], W Silalahi[1], A Armanda[1] and Kusnandar[2]

[1]GIS and Environment Modeling Research Group, Computer Science Department, Faculty of Computer Science and Information Technology-CSIT, Mulawarman University Samarinda, Kalimantan Timur Province, Indonesia

[2]Informatics Department, STMIK Widya Cipta Dharma Samarinda, Kalimantan Timur Province, Indonesia

[*]Corresponding Author: fahrulagus@unmul.ac.id

Abstract. Digital mapping techniques are available freely and openly so that map-based application development is easier, faster and cheaper. A rapid development of Cloud Computing Geographic Information System makes this system can help the needs of the community for the provision of geospatial information online. The presence of urban Green Open Space (GOS) provide great benefits as an oxygen supplier, carbon-binding agent and can contribute to providing comfort and beauty of city life. This study aims to propose a platform application of GIS Cloud Computing (CC) of Bontang City GOS mapping. The GIS-CC platform uses the basic map available that's free and open source. The research used survey method to collect GOS data obtained from Bontang City Government, while application developing works Quantum GIS-CC. The result section describes the existence of GOS Bontang City and the design of GOS mapping application.

1. Introduction

Geographic Information Systems (GIS) have been developed and applied to various areas of life. The existence of SIG also helps the community to provide various information. In the field of health, GIS can assist and provide useful information such as health information mapping or public health spatial database [1]. GIS functions for crime mapping and geographic crime analysis solution for operational, tactical, investigative, and strategic policing and crime reduction purposes [2]. In elections to the region or president, GIS is linked to the economy and elections can help illustrate the distribution of voters and their choices [3]. There are many more GIS applications that have been developed for various purposes such as mapping of public facilities [4], handicraft industry center [5], or GIS for urban green space management [6-7].

Mapping techniques are also undergoing rapid development. Supported by increasingly sophisticated cartography techniques, making the GIS development process easier. Digital map creation is much different from 5-10 years ago. Implementation of spatial data infrastructure for a government can be done by applying free open source GIS software on the state of on limited financial budget [8]. Outside there has been a lot of digital maps available for free and can be accessed freely with still include the source, such as the surface map of the earth by google maps (https://maps.google.com/), or a digital highway map that is the open street map (OSM: http://www.openstreetmap.org).

There are two approaches to making GIS developed into web-based, proprietary and open source approaches. The proprietary approach means that users are willing to pay for licenses as software used for development. For this section, the available software is ArcGIS (www.arcgis.com) made by ESRI. While the 2nd approach using open source alias free, namely Quantum GIS for desktop versions [9-10] and QGIS Cloud (http://qgiscloud.com) for the development of web GIS.

Green Open Space (GOS) in the city area is at the heart of urban life. Its existence can provide great benefits as an oxygen supply, as a carbon-binding agent, sustains beauty and comfort and reduces the impacts of climate change [11]. The problems that often occur in aspects of GOS management are the low quantity, overlapping of land ownership as the location of GOS and inappropriate location selection and less attention to the public interest.

Bontang City is the second highest city in the Human Development Index in East Kalimantan Province. The city has a rapid development so as to improve the overall human welfare. The area of green space owned by Bontang City has exceeded the target of regulation Public Works Minister at 30 percent of the total area. GOS area of this city reached 33.9 percent of the city area outside the protected forest, which is 9,206.00 hectares. Targets promoted by the Bontang City Government according to Local Regulation RTRW Bontang city that is equal to 38.37 percent or 3,532.34 hectares. As an industrial city, the city also has the same problem in terms of GOS management, which is still targeting many new locations of green open space [12].

This study aims to build a model of geospatial application software for the management of GOS location of Bontang City using Cloud Computing based GIS.

2. Materials and Method

The study area. The study was conducted in the administrative area of Bontang City. The city is geographically located $0^0$01' North Latitude - $0^0$12' North Latitude and $117^0$23' East Longitude - 117^0 38' East Longitude, with an area of 14,780 Hectares or 497.57 Km^2. Bontang City administration area consisting of 3 (three) districts:

a. North Bontang District;
b. Bontang Selatan District; and
c. District Bontang Barat.

The boundaries of the planning area of RTRW Kota Bontang include:

a. Regency of East Kutai in the north;
b. East bordering Makassar Strait;
c. Regency of Kutai Kartanegara in the south; and
d. Regency of East Kutai in the west.

Residents of Bontang City currently number 118,000 souls with the potential of natural resources include seaweed, fishery and plantation and natural gas. Tourism potential developed by the city government include Pupuk Kaltim Lake, Wetland Beach and Kaba Bay. Administrative Map of Bontang City as described in Figure 1 (Source: http://www.bpkp.go.id/kaltim/konten/1174/Profil-Pemkot-Bontang).

RTRW Planning Bontang City divides the area into 3 Sections of City Region (BWK), namely BWK I consists of 8 (eight) urban villages include: Bontang Kuala Village, Village of Gunung Elai, Bontang Baru Village, Api-Api Sub-District, Central Berbas Village, Tanjung Laut Sub-District, Tanjung Laut Indah Sub-District; BWK II consists of 6 (six) villages covering: Satimpo Village, Gunung Telihan Village, Canaan Village, Belimbing Village, Loktuan Village, Guntung Village and BWK III covering 1 (one) urban village of Bontang Lestari. Planning of RTRW Bontang City 2012-2032 is described with the map as in Figure 2 (Source: Bontang City RTRW Regulation No. 11 The year 2012.

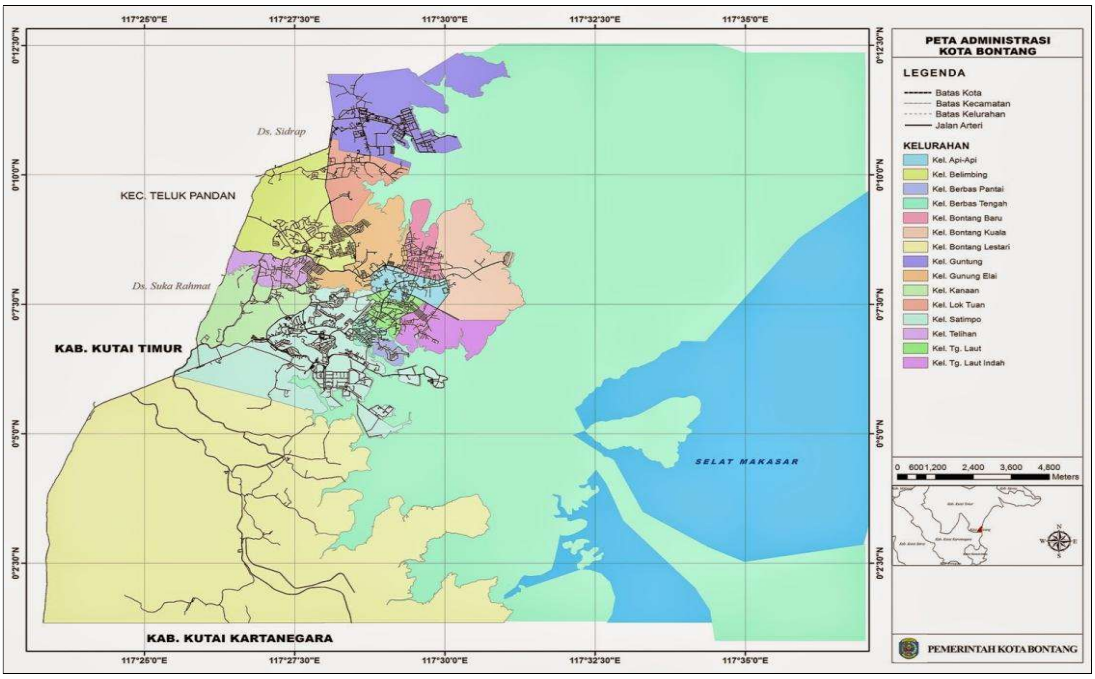

Figure 1. Administrative Map of Bontang City by Sub-District

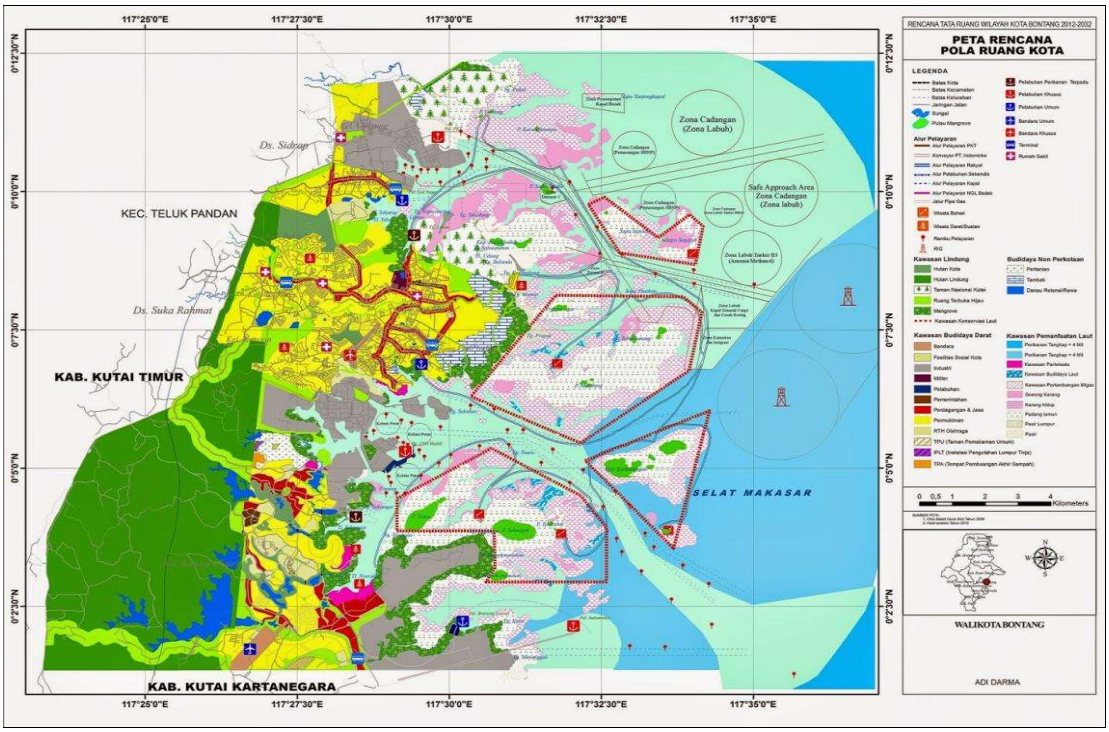

Figure 2. Map of Planning RTRW Bontang City 2012-2032

2.1. Field data collection

This stage is to collect data and materials in the form of an in-depth survey on the policy and implementation of GOS management of Bontang City. Data collection was conducted by two institutions directly related to the management of Green Open Space in Bontang City, namely the Office of Spatial Planning and City and the Office of the Environment.

2.2. Data analysis

At this stage data analysis has been collected in the previous stage. Primary data were obtained from interviews for the design of software products, as well as secondary data and other supporting data collected and used as complementary research data.

This stage performed the process of analyzing spatial data and attributes. It used Quantum GIS Desktop 2.0 Dufour software with Ubuntu 14.04 LTS 32 Bit operating system (Figure 3a). Minimum hardware requirements for processing this spatial data as described in Figure 3b.

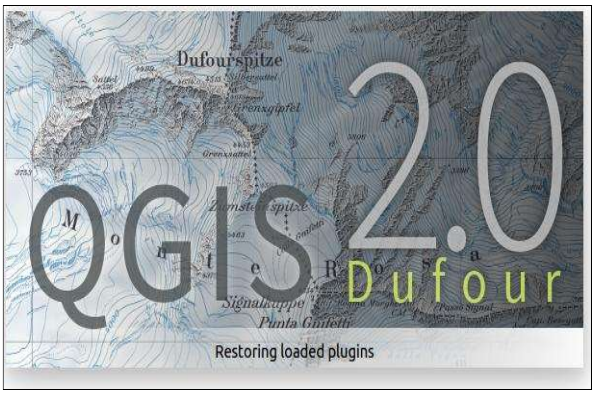

Figure 3a. Quantum GIS Desktop 2.0 Dufour Version

Figure 3b. Minimal System Requirement QGIS Desktop Processing

2.3. Process Integration using Cloud-Computing GIS

At this stage, processed of integration between Quantum GIS Desktop applications with Cloud Computing applications such as QGIS-Cloud or GIS-Cloud and embedded coding process with WebGIS platform development script or Mobile GIS platform will be developed. This study is limited to the scope of application of Cloud Computing GIS to generate WebGIS platforms.

3. Result and Discussion

3.1. Distribution of GOS Bontang City

The result of the in-depth survey on the existence of GOS Bontang City resulted in 14 locations of green space spread in the three sub-districts. South Bontang region is the area that has the widest GOS, followed by North Bontang and last Bontang Barat. The distribution of GOS locations is described in the following table.

Table 1. Distribution of GOS Bontang City

No.	GOS Name	GOS Address	Wide(m^2)	Ownership Status
1.	Bontang Lestari	Mohammad Roem Street, Bontang Lestari, South Bontang	80,000.00	Government
2.	Guntung	Tari Jepen Street, Guntung, Nort Bontang	31,000.00	Government
3.	Taman Tanjung Laut	Jl. Jendral Soedirman, Tanjung Laut, South Bontang	12,083.00	Government
4..	Hutan Kota Wana Khatulistiwa	Urip Sumoharjo Street, Bontang Lestari, South Bontang	12,083.00	Privat
5.	Belimbing	Arief Rahman Hakim Street, Belimbing, West Bontang	12,000.00	Government
6.	Loktuan	Kapal Selam 3 Street, Loktuan, Nort Bontang	9,019.00	Government
7.	Hutan Kota DSM	Bontang Lestari, South Bontang	-	Privat
8.	Taman Basket HOP VI	Ternate Street, Gn Elai, Nort Bontang	-	Privat

No.	GOS Name	GOS Address	Wide(m^2)	Ownership Status
9.	Taman Nasional Kutai	RA Kartini Street, Gn Elai, Nort Bontang	-	Government
10.	Taman Wisata Graha Mangrove	Cut Nyak Dien Street, Bontang Baru, Nort Bontang	-	Privat
11.	Taman Cibodas	Kembang Sepatu Street, Belimbing, West Bontang	-	Privat
12.	Taman Palembang	Palembang Street, Telihan, West Bontang	-	Government
13.	Taman Adipura	Basalt Street, Bontang Kuala, Nort Bontang	-	Government
14	Lapangan Lang-Lang	Aip II KS Tubun Street, Api-api, Nort Bontang		Government

Based on the data in the table, done pointing to create GOS Location layer on Quantum GIS application.

3.2. Data Layer Processing

Data processing GOS location Bontang City has 4 main layers, namely the Administration Boundaries layer, Boundaries of Protected Forest layer, Coastal Area layer and GOS Location layer. In addition to the four layers, data processing also uses maps from openstreetmap.org in the form of OpenCycleMap (OCM) Landscape layer and OpenStreetMap layer and Google Maps of Google Satellite Layer. All of these maps are spatial data developed free and open source by mentioning the original source.

After the Dufour QGIS application loads successfully on the computer, open all the shapefiles containing pre-prepared data layers. Next, do the process of installing the plugin for the open layer map. After the install process is successful, do the loading process for each open layer as the background screen. Do not forget that the background screen is placed on the first screen. The map visualization results in Quantum GIS with the background of each layer as described in Figures 4a, 4b, and 4c. Each data layer can be done editing process. The editing process is done to give the map more exclusive, elegant and dynamic. Such as giving a coloring style in accordance with the color of the map object displayed or setting the transparency value of each layer.

3.3. Processing with Cloud Computing

The next is GIS data processing using Cloud Computing (CC) system. The CC system is a popular terminology of the present era. CC has explained the leap of products and technology services that are very powerful in the field of information technology. CC can be applied to be a solution to the challenges of GIS applications in the future [12]. GIS-CC can also be applied to build spatial data on local government [13]. such as policy and implementation of one data one map of East Kalimantan Provincial Government (http://onedataonemap.kaltimprov.go.id/geoportal/).

The QGIS-Cloud operation is very easy and fast. First, the user must register an account at https://qgiscloud.com/en/account/sign_in. Next, do the install process plugin on Quantum GIS desktop. If the install is successful then QGIS-CLoud will appear on the left side of QGIS desktop, as shown in Figure 4a-c. Next, do the login process user. The last step of this process is uploading local data layer. If the upload process is successful then the entire map layer on the desktop will be converted into a web platform.

In this case, GOS processing of Bontang City uses GIS-Cloud (giscloud.com) as GIS Cloud Computing platform. This platform is a proprietary application, but the researchers used trial versions for the purposes of this study. The results of the GIS-Cloud processing as described in Figure 5a, as well as the downloaded maps on GIS Cloud Computing, are shown in Figure 5b.

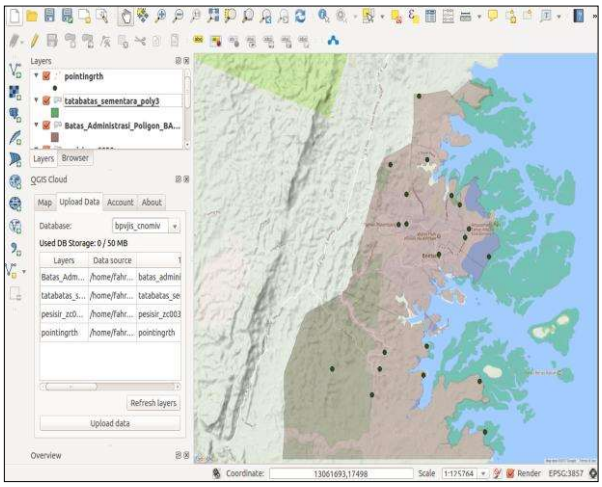

Figure 4a. Data layer processing on Quantum GIS Desktop and QGIS-Cloud with OpenCycleMap layer as background

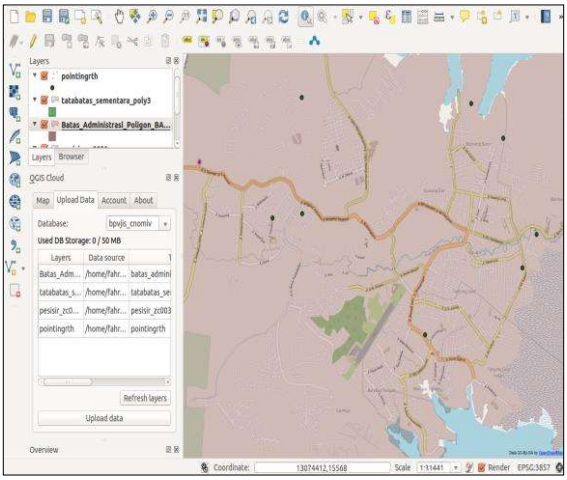

Figure 4b. Data layer processing on Quantum GIS Desktop and QGIS-Cloud with OpenStreetMap (OSM) layer as background

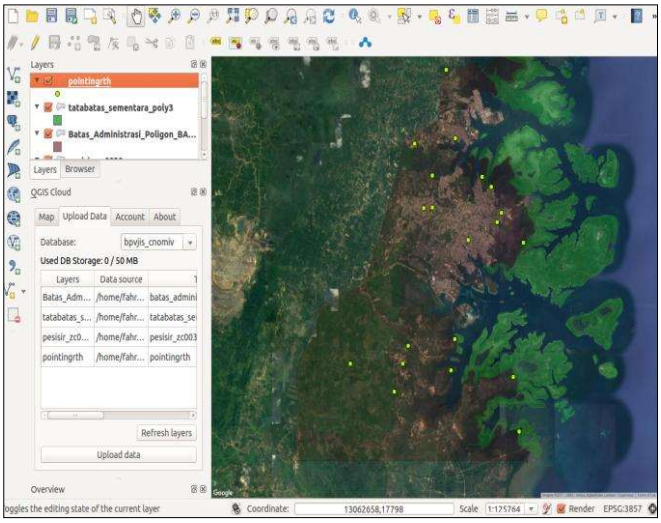

Figure 4c. Data layer processing on Quantum GIS Desktop and QGIS-Cloud with Google Satellite layer from Google Maps as background

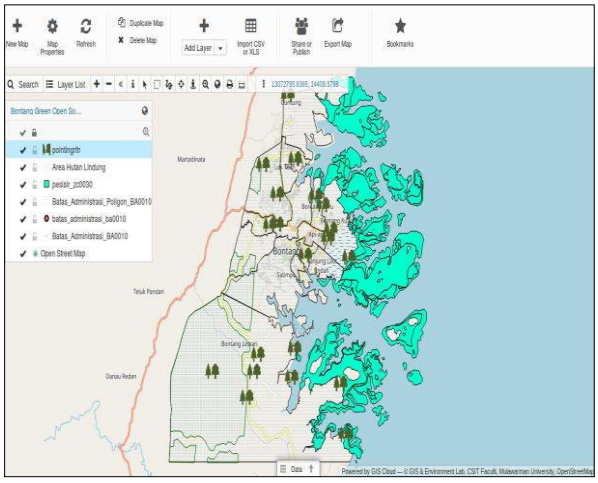

Figure 5a. Processing data layer on GIS Cloud Computing using GIS-Cloud

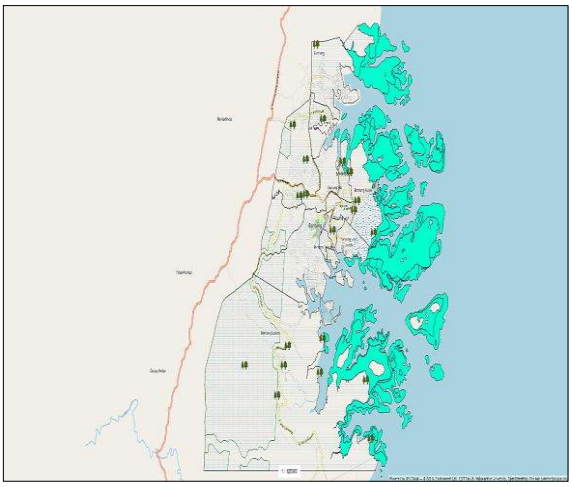

Figure 5b. Downloaded maps from Cloud Computing using GIS -Cloud

The GIS-Cloud result is a web-platform application with the address http://viewer.giscloud.com/map/783971/bontang-green-open-source-giscloud. The results of this map can be shared and accessed openly with the terms and conditions that the user has registered on the web giscloud.com. It can be seen in Figure 5a locations that are GOS areas in Bontang City. There are as many as 14 GOS locations scattered in the Bontang City area which is marked with a picture of a green tree.

The successful implementation of the architecture 14 GOS locations scattered in the Bontang City area can be provided through the determination of successful implementation factors. Factors that determine the success of the implementation of this system, among others: 1. Involvement, support, and management commitment. Strong and consistent management commitment and direct involvement will greatly help accelerate implementation; 2. Must be assigned the implementing person in charge so that he/she can act fully in implementing the architectural plan with the responsibility and authority given. 3. The quality of available human resources competent with information technology. 4. Develop SOP (Standard Operations Procedure) 5. The existence of special training on Architecture Planning. So that each unit can master the concept and how to use it. 6. Ability to evaluate the need for new technology [15].

4. Conclusion

This research has successfully implemented Cloud Computing GIS platform to build a web-based application of GOS location of Bontang City. The CC-based GIS platform makes the WebGIS application development process much easier and faster without the need to set up a domain name and hosting server.

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