Application of OpenStreetMap (OSM) to Support the Mapping Village in Indonesia

Nurin Swasti Kanthi[1] and Taufik Hery Purwanto[2]

[1]Student of Remote Sensing and GIS Program, Universitas Gadjah Mada, Yogyakarta, Indonesia
[2]Heads of Remote Sensing and GIS Program, Universitas Gadjah Mada, Yogyakarta, Indonesia

nurin.sk95@gmail.com, taufik@ugm.ac.id

Abstract. Geospatial Information is a important thing in this era, because the need for location information is needed to know the condition of a region. In 2015 the Indonesian government release detailed mapping in village level and their Parent maps Indonesian state regulatory standards set forth in Rule form Norm Standards, Procedures and Criteria for Mapping Village (NSPK).Over time Web and Mobile GIS was developed with a wide range of applications. The merger between detailed mapping and Web GIS is still rarely performed and not used optimally. OpenStreetMap (OSM) is a WebGIS which can be utilized as Mobile GIS providing sufficient information to the representative levels of the building and can be used for mapping the village.Mapping Village using OSM was conducted using remote sensing approach and Geographical Information Systems (GIS), which's to interpret remote sensing imagery from OSM. The study was conducted to analyzed how far the role of OSM to support the mapping of the village, it's done by entering the house number data, administrative boundaries, public facilities and land use into OSM with reference data and data image Village Plan. The results of the mapping portion villages in OSM as a reference map-making village and analyzed in accordance with NSPK for detailed mapping Rukun Warga (RW) is part of the village mapping. The use of OSM greatly assists the process of mapping the details of the region with data sources in the form of images and can be accessed for Open Source. But still need their care and updating the data source to maintain the validity of the data.

Keywords: Open Street Map (OSM), NSPK, Mapping Village

1. Introduction

Indonesia is a big country with many province and many island. Because of that, in 2015 the Indonesian government has launched unified geospatial information for the entire province of Indonesia with making Indonesian Parent Map [1]. It aims to integrate geospatial information Indonesia, so the location information in Indonesia are no longer different perception or confusing.

Geospatial information displayed to date the most detailed to the limit of the Village Administration. Geospatial Information Agency began planning the administrative boundary mapping to RW (RukunWarga) and RT (RukunTetangga). Detailed mapping of the area aims to present accurate boundary information. This is done in order to avoid conflicts over land boundaries. However, more detailed mapping such as building limit has not been done by the government, where as the mapping building is very important for the manufacture of a detailed plan of an area.

Over time, the mapping is not only done by manual survey, but there have been new digital technologies, namely with Web GIS and Mobile GIS. It is influenced by the developing knowledge about Information and technology. Both in terms of the Internet network that is easily accessible and increasing smartphone users in the world as well as in Indonesia. The increasing use of these technologies can be a bonus e-Commerce and e-Technology. But it would be a loss if it is not utilized properly.

Web GIS is one of geography technology which use the Web to display map information, so it can be accessed anytime, anywhere and by anyone. OpenStreetMap (OSM) is a Web GIS product. OpenStreetMap with base Websites can be applied to the smartphone so that it can also be classified in the category MobileGIS. Use of Mobile GIS mapping process is very helpful because it can be taken to any area. Open source systems make anyone can edit, download it and upload the real map, certainly the results shown will be based on the consent Admin.

The merger between detailed mapping and Web GIS is still rarely performed and are fully utilized. In fact, it can really help search spatial information of a region or place in a rapid, precise and accurate. Even now public knowledge of Web GIS and Mobile GIS is a free (Open Source) is still not too many, the most widely known today is Google Maps. In fact, in addition to Google Maps there is a wide range of Web and Mobile GIS such as one featuring the OSM building data in detail.

1.1. Aim of the research

This research was conducted with the aim of:
1. Knowing the concept of using OpenStreetMap mapping.
2. Apply OpenStreetMap for mapping village based on NSPK.

2. Methodology

Village Mapping need a 2 general methods, that is by remote sensing and GIS approach. OpenStreetMap have the source for remote sensing approach like image satellite from bing map, and have many progam to do GIS analyze. For mapping the village we choose Kwarasan RW 05, Nogotirto, Gamping, Sleman. The choice of location is based on several reasons. The first reason is Nogotirto located on the border village of Sleman and Yogyakarta are expected to conflict areas in the region. The second reason is that the village had their plans RW 05 which can be used as a reference. Plan options include local street names and numbers eraser existing homes in the area. The second reason is a detailed mapping requires good local knowledge, so that the local elections are based also by researchers in the area residence Kwarasan RW 05, Nogotirto, Gamping, Sleman.

The implementation stage is a stage core research in the study. Stages of implementation include:

2.1. Input a Village Map to OSM

The process input and editing OSM data must go through the account creation first. Making do with @nurinsk name. OpenStreetMap provide flexibility for the owner of the account to edit and input data. The results of each editing OSM user need not wait for the approval of the central admin. Data will be instantly displayed in the OSM website. Input data to OpenStreetMap can generally be done in two ways : directly through the window *OpenStreetMap.org* (in-browser editor) and using the application JOSM (Java OSM). The difference lies in the use of the input method application or not.

Input data RW 05 Kwarasan done with directly through the window *OpenStreetMap.org*, choose "Edit with ID", that because the map data plans that exist in the form of .pdf and no form of data shp, and Edit with ID is very simple and easy to understand in its application. Input data were digitized point line and area suitable appearance OSM imagery available. Graphical data input point, line and area accompanied with a description of the attribute is a general facility name and house number. In addition to editing data input data is also performed on existing data, but requires justification form or description (ID). The process after the data input is editing the attributes, which include giving the name or number on the object, depending on the type of object.

2.2. Mapping using OSM Administrative Boundary
Administrative boundary mapping is an important element in the village because it shows the boundaries of the zone administration smallest RT. Limit Administrative Mapping involves the role of related people such as village heads or a native who has local knowledge of the area of study. Administrative boundary can be either natural objects such as rivers or artificial objects such as roads and boundaries of the house. Object identification administrative boundaries performed using the image of the OSM.

After input and edit all object and mapping the administrative boundary in OSM save the results by choose the save icon on OSM, so the results of digitization stored on OSM and may appear on the main page of the website.

2.3. Survey / Field Test
The survey was conducted to validate the existing data in the OSM and the condition of the object in the field. The survey was conducted on a wide range of objects that exist, the equipment used when the field survey covering Smartphone Sony Experia U is already integrated with GPS so it can use the geo-tagging to determine the coordinates of the location.

2.4. Completion Phase
The completion stage or the final stage of research includes the presentation of the data export results data from the website OpenStreetMap. Completion phase of the study as follows:

2.4.1. Map Village on OSM's proven conflict. OpenStreetMap data validation process performed by the OSM validator. Validation is done to avoid the perception of conflict due to differences in study areas. This is because their freedom to enter and change the data, then it is necessary validator to investigate different data in the same area and choose a more precise data. OpenStreetMap also has a variety of topology requirements that must be met when performing digitization. The topology requirement will cause the error and warning if it is not met. Terms include overlaying digitized, naming, polygon boundaries, etc.

2.4.2. An analysis of the data on OSM with NSPK. Results of entering data into OSM to have various objects types that can be displayed in a map that came out of the website. NSPK contains various details of the content and requirements that must be included on a map of the village, and then there is need for adjustment of writing, visualization and the benefits of OSM maps with existing NSPK.

3. Result and Discussion

3.1. Input Map Village in Browser OpenStreetMap
Results can be viewed in a browser input OpenStreetMap (*http://OpenStreetMap.org*)
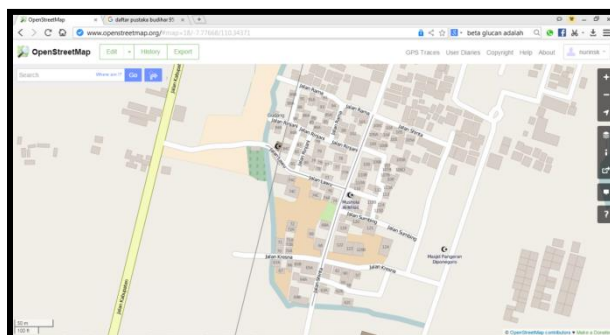

Figure 1. Input Results in Website OSM [2]

Results digitized and input the data in OSM generates village map can be used by anyone at any time. In addition there is the OSM map that can be edited in accordance with the data and knowledge of the user. Results digitized main distinguishing Mobile OSM with other GIS is on the building, the number of buildings digitized in the study area village Kwarasan RW 05 reached 124 houses and one barn and industry. Map results have an accuracy of a shift of 1.01 meters. OpenStreetMap also provide data attributes that can be directly processed after export to .shp. Kwarasan RW 05 village mapping including roads, points, land use and building area. Attribute data from OSM on landuse show objects such as land use graveyard (Cemetary), paddy (Farmland) etc. While in the building area include home (house) and industry.

3.2. Errors and Warnings solve from OSM
Justification errors and warnings made by reference tutorial spatial data handling intermediate and advanced editing techniques of Humanitarian OpenStreetMap Team Indonesia. Data that have been through the process of justification is valid and can be used according to the rules of the OSM.
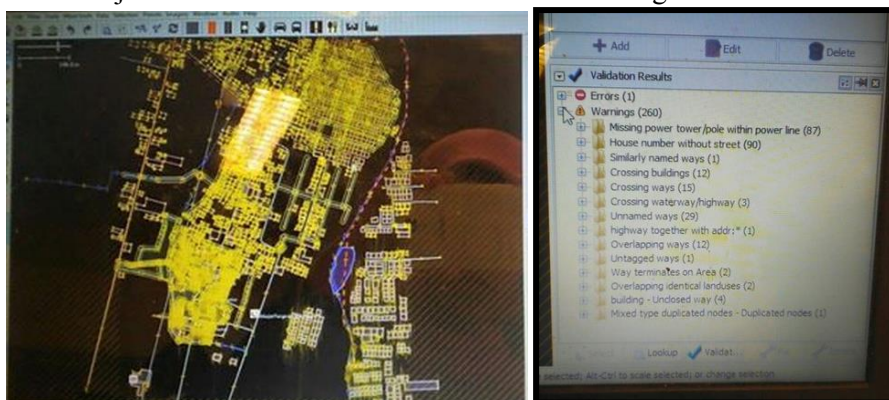

Figure 2. Errors and warnings of data

Inspection is done checking for conflicts and validation of geometry and attributes. Map of RW 05 Kwarasan avoid conflict because no editing of the same area in the same time. Preliminary examination of the geometry and attributes shows there is one error and 260 warnings. Errors occur due to incorrect administration of attribute types. Warning that there is caused by incomplete data and confusion data. Warning majority (90 warnings) occurs in the naming of house number without attribution road. In addition to the warning there is also caused by overlapping land use, roads and buildings that cuts another building, etc.

3.3. Role of OSM to Support Mapping Village According NSPK
RukunWarga mapping is one part of village mapping. Mapping of reference of the village in Indonesia spiked on NSPK standards (Norms, Standards, Procedures and Criteria for Mapping Village). The use OSM is one application that can be used to facilitate the mapping of the village. Mapping can be performed in more detail than the OSM mapping villages, reaching mapping the buildings house. Mapping is done only until RW coverage, but this research can be developed later into wider area coverage.

Analysis of image interpretation is done on a high-resolution image OSM who have true color composite. OpenStreetMap image interpretation results in the hamlet Kwarasan RW 05, Nogotirto, Gamping, Sleman, Yogyakarta includes objects points, lines and areas. The object point consists of a mosque, a line object includes Roads, Rivers and administrative boundaries, the object area, including houses, cemeteries, courts, gardens and fields.

The maps have provisions that cover the content of the information the village level. According to the detailed NSPK content must be present on the map village include toponymy, administrative

boundaries, infrastructure, network hydrographic and land use. Below is the ability to display content OSM mapping the village:

3.3.1. Toponym. OpenStreetMap provide completeness toponymy to provide information in the form of street names, village names, etc. OpenStreetMap can display the names.

Figure 3. Toponym [2]

3.3.2. Limit Region Administration. Administration limit shown on mapping the village of dusun Kwarasan include RW 05 and RT/RW limits. Limits valid administration needed to show administratively appropriate area. Limit the administration is in the village Kwarasan RW 05 includes roads, rivers and borders the house. Input data using OSM administration limit sign in the form of lines and the selected type is a special line and named "Limits and Boundaries RT RW". Type of line used to map the administrative boundaries of the interpreter because the significantly OSM types are not available in administrative boundary line only Special Point.

Figure 4. Administrative Boundaries [2]

3.3.3. Infrastructure (Lines, Points). Infrastructure includes roads, public facilities / social and rural assets. On the Map RW 05 Infrastructure includes roads and public facilities. General facilities in RW 05 include mosque, substations and warehouses. Symbols that can be raised on OSM just mosque, substations and warehouses are not on OSM symbol.

Figure 5. Infrastructure [2]

3.3.4. Hydrographic Network. Hydrographical network an irrigation canal and river network include rivers, irrigation, and drainage. Hydrographical network in RW 05 is the river.
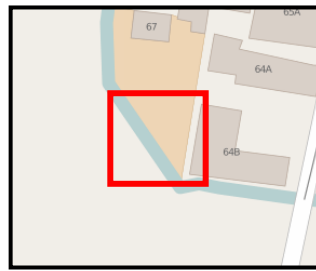
Figure 6. River [2]

3.3.5. Land Use. Land use is any area or place used for the purpose and benefit of man. There are several types of land use were recorded which is building houses, fields, gardens, cemeteries and fields.
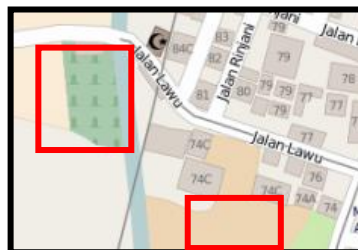

Figure 7. Land Use [2]

3.4. Concept Mapping on OSM

Mapping study of regional differences would affect existing land use types. For instance mapping in urban areas is certainly packed with buildings and industry, and in remote areas in Indonesia is dominated by forest. This makes the OSM can be used for various types of mapping, but the imagery available in the different regions have different renewal. Remote areas tend not to have many significant changes in contrast to cities that rampant development.

Mapping Village with OSM relied on imagery from bing. Most image quality when used OSM mapping is quite good, but the resolution is lower than that of Google Earth imagery. When the results of OSM maps digitized image overlaid with bing it was right and appropriate, but when overlap to Google Earth imagery there is a slight shift, but the image is more noticeable.

Input data to the OSM Open Source, so pul in the export process, OSM provides a variety of ways to download the data to the OSM. Disclosure of data on the causes OSM mapping can be done very easily and can perform mapping an area by adjusting the local knowledge interpreter. The digitized map data to OSM is currently exported to shp shapefile that there are eight types of waterways, roads, points, railroad, places, nature, land use and field. The exported map from OSM can be process to detailed map based on NSPK or many more thematic map.

Figure 8. Detailed Map Building Kwarasan RW 05, Nogotirto, Gamping, Sleman.

4. Conclusion

OpenStreetMap is one GIS application integrated with GPS, Web and Mobile, is open source in terms of input, editing and export data, so the user can input and process data map detail easy to level the building. OpenStreetMap can be a good alternative for mapping the village, because OSM provides a data source in the form of images, the level of detail of the building and export data in various formats such as shapefiles, and the result map on OSM already based on NSPK village mapping role.

References

[1]   Badan Informasi Geospasial2016*NSPK Pemetaan Desa*(Yogyakarta: BIG) pp 1-53
[2]   OSM, H 2016*Training OpenStreetMap*(Yogyakarta: Tim OSM) pp 1-10