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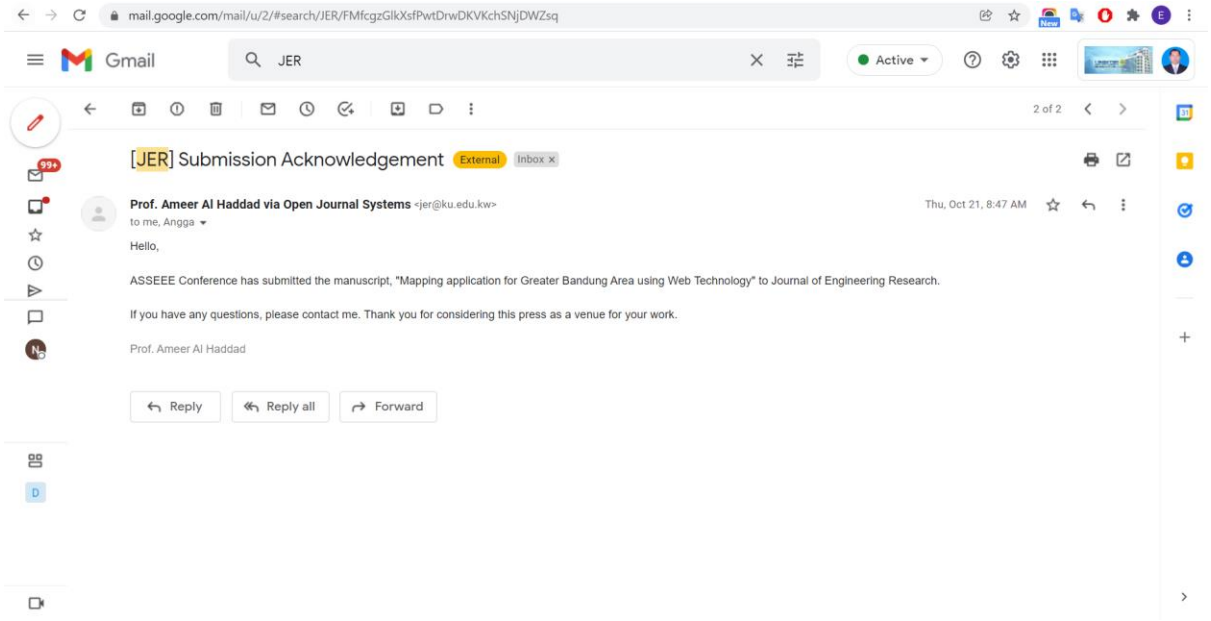

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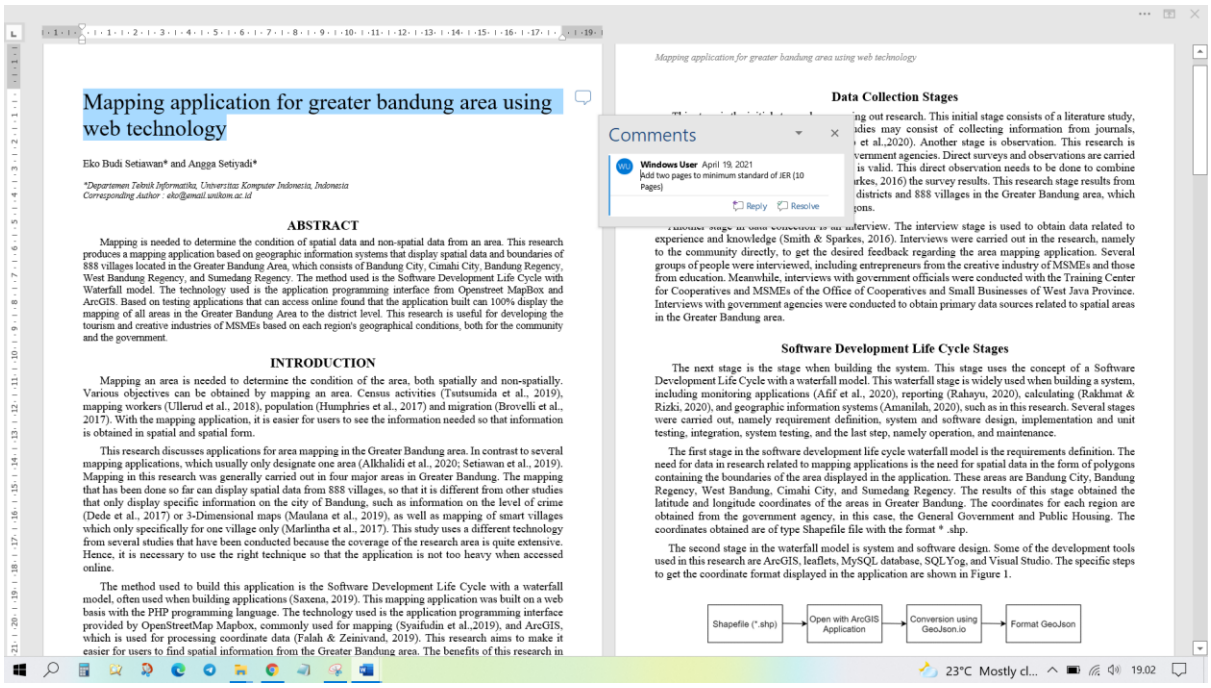

Mapping application for greater bandung area using web technology

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*Departemen Teknik Informatika, Universitas Komputer Indonesia, Indonesia
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ABSTRACT

Mapping is needed to determine the condition of spatial data and non-spatial data from an area. This research produces a mapping application based on geographic information systems that display spatial data and boundaries of 888 villages located in the Greater Bandung Area, which consists of Bandung City, Cimahi City, Bandung Regency, West Bandung Regency, and Sumedang Regency. The method used is the Software Development Life Cycle with Waterfall model. The technology used is the application programming interface from Openstreet MapBox and ArcGIS. Based on testing applications that can access online found that the application built can 100% display the mapping of all areas in the Greater Bandung Area to the district level. This research is useful for developing the tourism and creative industries of MSMEs based on each region's geographical conditions, both for the community and the government.

INTRODUCTION

Mapping an area is needed to determine the condition of the area, both spatially and non-spatially. Various objectives can be obtained by mapping an area. Census activities (Tsutsumida et al., 2019), mapping workers (Ullerud et al., 2018), population (Humphries et al., 2017) and migration (Brovelli et al., 2017). With the mapping application, it is easier for users to see the information needed so that information is obtained in spatial and spatial form.

This research discusses applications for area mapping in the Greater Bandung area. In contrast to several mapping applications, which usually only designate one area (Alkhalidi et al., 2020; Setiawan et al., 2019). Mapping in this research was generally carried out in four major areas in Greater Bandung. The mapping that has been done so far can display spatial data from 888 villages, so that it is different from other studies that only display specific information on the city of Bandung, such as information on the level of crime (Dede et al., 2017) or 3-Dimensional maps (Maulana et al., 2019), as well as mapping of smart villages which only specifically for one village only (Marlintha et al., 2017). This study uses a different technology from several studies that have been conducted because the coverage of the research area is quite extensive. Hence, it is necessary to use the right technique so that the application is not too heavy when accessed online.

The method used to build this application is the Software Development Life Cycle with a waterfall model, often used when building applications (Saxena, 2019). This mapping application was built on a web basis with the PHP programming language. The technology used is the application programming interface provided by OpenStreetMap Mapbox, commonly used for mapping (Syaifudin et al.,2019), and ArcGIS, which is used for processing coordinate data (Falah & Zeinvand, 2019). This research aims to make it easier for users to find spatial information from the Greater Bandung area. The benefits of this research in

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Add two pages to minimum standard of JER (10 Pages)

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Mapping application for greater bandung area using web technology

Data Collection Stages

ng out research. This initial stage consists of a literature study, idies may consist of collecting information from journals, et al.,2020). Another stage is observation. This research is vernment agencies. Direct surveys and observations are carried is valid. This direct observation needs to be done to combine rkes, 2016) the survey results. This research stage results from districts and 888 villages in the Greater Bandung area, which ons.

nterview. The interview stage is used to obtain data related to experience and knowledge (Smith & Sparkes, 2016). Interviews were carried out in the research, namely to the community directly, to get the desired feedback regarding the area mapping application. Several groups of people were interviewed, including entrepreneurs from the creative industry of MSMEs and those from education. Meanwhile, interviews with government officials were conducted with the Training Center for Cooperatives and MSMEs of the Office of Cooperatives and Small Businesses of West Java Province. Interviews with government agencies were conducted to obtain primary data sources related to spatial areas in the Greater Bandung area.

Software Development Life Cycle Stages

The next stage is the stage when building the system. This stage uses the concept of a Software Development Life Cycle with a waterfall model. This waterfall stage is widely used when building a system, including monitoring applications (Afif et al., 2020), reporting (Rahayu, 2020), calculating (Rakhmat & Rizki, 2020), and geographic information systems (Amanilah, 2020), such as in this research. Several stages were carried out, namely requirement definition, system and software design, implementation and unit testing, integration, system testing, and the last step, namely operation, and maintenance.

The first stage in the software development life cycle waterfall model is the requirements definition. The need for data in research related to mapping applications is the need for spatial data in the form of polygons containing the boundaries of the area displayed in the application. These areas are Bandung City, Bandung Regency, West Bandung, Cimahi City, and Sumedang Regency. The results of this stage obtained the latitude and longitude coordinates of the areas in Greater Bandung. The coordinates for each region are obtained from the government agency, in this case, the General Government and Public Housing. The coordinates obtained are of type Shapefile file with the format * .shp.

The second stage in the waterfall model is system and software design. Some of the development tools used in this research are ArcGIS, leaflets, MySQL database, SQLYog, and Visual Studio. The specific steps to get the coordinate format displayed in the application are shown in Figure 1.

Shapefile (*.shp) → Open with ArcGIS Application → Conversion using GeoJson.io → Format GeoJson

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Figure 5. Information on name of the village.

There are a total of 888 villages in 80 sub-districts spread across the Greater Bandung area. Bandung Regency has 280 villages, Bandung City has 151 sub-districts, West Bandung Regency has 165 villages, Cimahi City has 15 villages, and Sumedang Regency has a total of 277 villages.

The hardware and software specifications used to implement the mapping application for the Greater Bandung area can see in Table 1.

Table 1. Hardware and Software specification.

Hardware Type	Specification
Processor	Shared Hosting
Space Hardisk	1,5 GB
RAM	1 GB
Browser	Google Chrome
XAMPP	Version 3.2.4
Webserver	Apache
PHP Version	7.3
Apache version	2.4.46
Sever Name	Lato
PHP Version	7.2.33
MySQL Version	10.3.27-MariaDB
Operating System	Linux

The web server used in this application is Apache because the apache web server has superior performance in data transfer (Setiawan et al., 2019). Application testing is carried out by functional testing, which displays the five regions in the Greater Bandung area and testing to display 888 villages. Based on BlackBox functional testing, 100% of the area can display information as expected. The results obtained from the tests carried out show that each area can be displayed on the map well, including 888 villages. It can display area name information when the user selects a polygon area.

Applications in this research have been able to display spatial information from five regions in Greater Bandung. Further research is planned so that this application can display non-spatial data as needed. It

This lag is because it takes time for the system to load all the information in GeoJson. Besides, the information displayed does not take too long. It is hoped that the implementation of applications related to the spatial use of better server and network specifications. It is recommended to use a Virtual Private Server to get better performance (Balen et al., 2020), not using the concept of a shared hosting server.

CONCLUSION

Based on the results of the research that has been carried out, it is concluded that the mapping application can be useful for knowing the spatial data of each region which, if developed with non-spatial data, can be known the distribution of potentials contained in each region.

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Colvero, D.A., Gomes, A., da Cruz Tarelho, L., de Matos, M., and dos Santos, K. 2018. Use of a geographic information system to find areas for locating of municipal solid waste management facilities *Waste Management*, 77: 500-515.

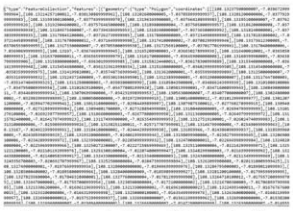

Figure 2. Stages of getting coordinates from shapefile.

So that the resulting coordinates can be used in the system, the next step is to convert them into GeoJson format so that they can be used to display spatial data (Horbiński & Lorek, 2020; Zhu & Tan, 2018). GeoJson also has good encoding and decoding performance when used in geographic information (Tong, 2018). This conversion process uses the tools from geojson.io, as shown in Figure 3.

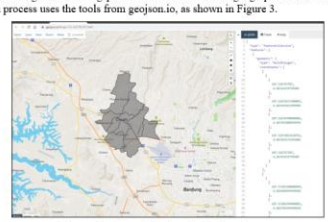

Figure 3. Stages of getting the Geojson format.

The next stage is system and software design. This stage is carried out the design from the procedure, functional, database, model to display design. After the design is complete, the next step is to implement it

RESULTS AND DISCUSSION

Data Analysis for New Business Actors

The application in this research can be accessed via the internet at the address http://wirausaha.web.id/view.php?menu=gis&act=frm_gis as shown in Figure 4.

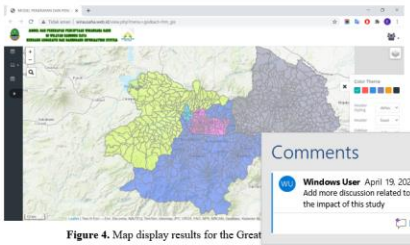

Figure 4. Map display results for the Great

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There are five regions shown in the application. The five regions are Bandung City with a pink map, Bandung Regency with a blue map, Cimahi City with a cyan map, West Bandung Regency with a green map, and the Sumedang Regency area with a gray map. To display the map in Figure 5, use a script like the following.

```
var layer_ADMINISTRASI = new L.GeoJSON.AJAX("assets_gis/layer/request_maps_layer.php",{ //
sekarang perintahnya diawali dengan variabel
            style: function(feature){
            var fillColor, // ini style yang akan digunakan
                kode = feature.properties.KOT_KAB; // perwarnaan objek polygon berdasarkan kode
kabupaten di dalam file geojson
                if ( kode == "kota_cimahi" ) fillColor = "#00ccff";
              else if ( kode == "kota_bandung" ) fillColor = "#ff4dff";
              else if ( kode == "KBB" ) fillColor = "#d2ff4d";
              else if ( kode == "kabupaten_bandung" ) fillColor = "#3366ff";
              else if ( kode == "sumedang" ) fillColor = "#8585ad";
              else if ( kode > 5104 ) fillColor = "#3ab7e9";
              else if ( kode > 5103 ) fillColor = "#c8cf06";
```

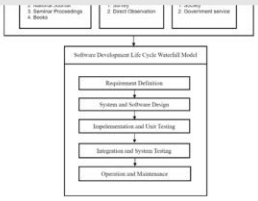

Figure 1 Stages of the research carried out

Data Collection Stages

This stage was the initial stage when carrying out research. This initial stage consists of a literature study, observation, and interviews. Literature studies consist of collecting information from journals, proceedings, and reference books (Orlando et al.,2020). Another stage was observed. This research is intended for use by the general public and government agencies. Direct surveys and observations are carried out to ensure that other sources' spatial data is valid. This direct observation needs to be done to combine the available data sources with (Smith & Sparkes, 2016) the survey results. This research stage results from the latitude and longitude coordinates of 80 districts and 888 villages in the Greater Bandung area, which are implemented as regional boundary polygons.

Another stage in data collection was an interview. The interview stage was used to obtain data related to experience and knowledge (Smith & Sparkes, 2016). Interviews were carried out in the research, namely to the community directly, to get the desired feedback regarding the area the Office of Cooperatives and Small Businesses of West Java Province. Interviews with government agencies were conducted to obtain primary data sources related to spatial areas in the Greater Bandung area.

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See comments.

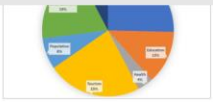

Figure 9 Percentage of community willingness to know more information

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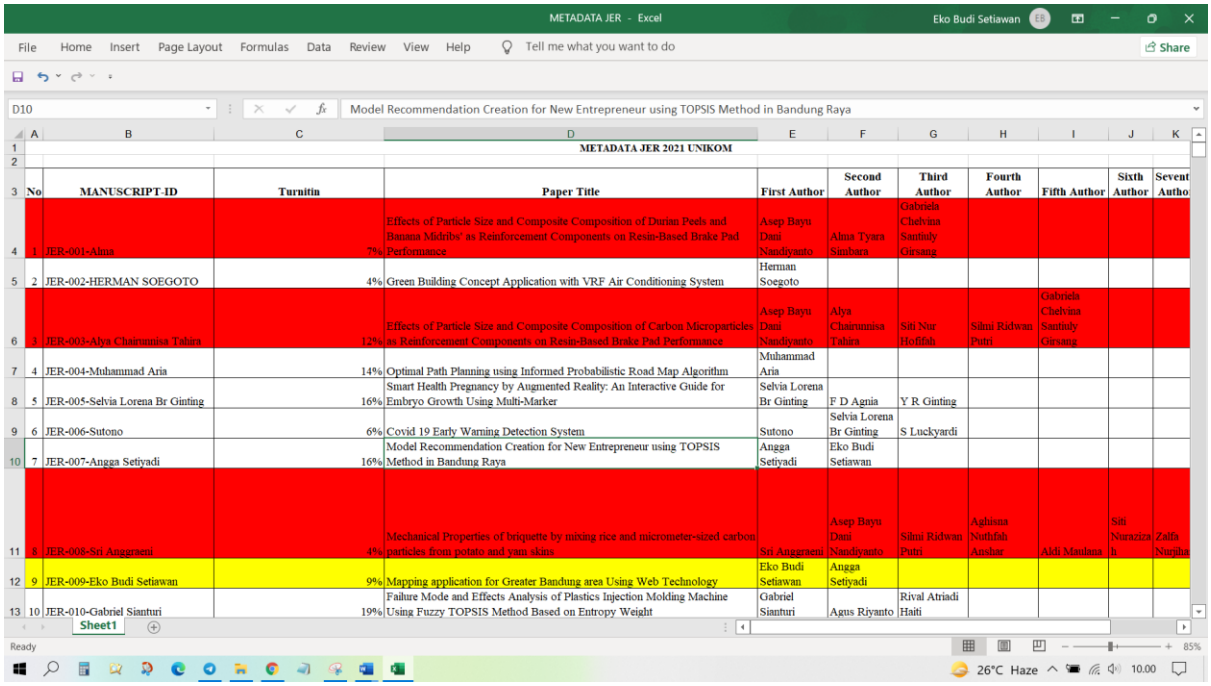

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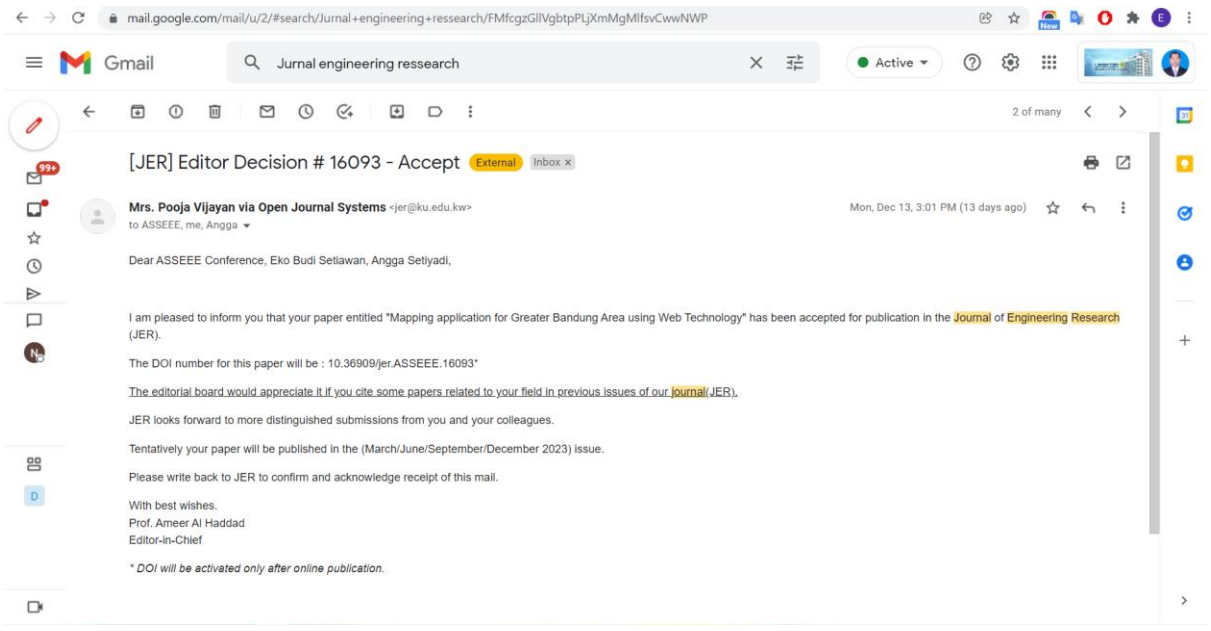

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With best wishes.
Prof. Ameer Al Haddad
Editor-in-Chief

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