

G310

Socialization and Visualization of City Transport Using Google Maps API

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Abstract –

Traffic jam is a classic problem that has always faced by big cities. One source of traffic jam is the number of private vehicles used by people in everyday mobility. Therefore, some of the city government initiated the program to encourage people to use public transport, such as in Jakarta and Bandung. The evidence suggests there are still many people, especially certain circles or urban migrants, who are reluctant to use public transportation services because they do not know the complete information of public transportation such as the route and tariff. On the basis of the problems we are trying to build an application to introduce public transportation service and pricing estimates.

This web-based GIS application built using the Google Maps API technology that can display interactive maps and easy to use. This application is equipped with various facilities such as public transportation data entry, visualization routes, calculates distance, public places are impassable, route planning and calculation of the total tariff for two particular points on the map. The application contains information about 39 tracks and 78 routes. The application is expected used by local government to socialize the public transportation, especially city transport.

Keywords: *traffic jam, GIS, Google Maps, route, visualization*

I. INTRODUCTION

Traffic jam and unmanaged public transportation is a common problem in big cities. Some solution has been introduced to serve citizen better, such as building better transportation system, provide more roads and many more. But, there also some constraint in implementing the solution such as limited budget, limited spaces, priority conflict and so on.

The idea of public mass transportation has considered as a suitable solution. But it needs time, space and money to be realized. For some cities in Indonesia, build infrastructure to support public mass transportation is not easy. For example, building a new train route, provide new road, or build new

transportation system such as TransJakarta. The constraint varies from budget, space, local culture and local system that tend to resist new system.

Bandung, famous as Paris van Java, is facing the same problem. Data from the Local Government stated Bandung has a population of 2.4 million. The level of vehicle ownership is high at 146.73 Bandung / 1000. The average vehicle ownership is 101.29 / 1,000 people. 0.8 Mobility vehicles in Bandung trip. While public transport in Bandung there are trains and buses. The use of trains is high at 3 million. For bus itself there are 3 kinds of Small Bus (sort of public transportation), Medium Bus and Large Bus [7].

Bandung has 36 route of small bus to serve the mobility of citizen. The local government has a program to empower and utilize the public transportation by improving the quality of public transportation services and promote them among the resident. The problem is how to promote it better, especially for urban migrant, since they do not familiar with local condition. To resolve this problem, we proposed a system to support people finding information about public transportation in Bandung, using web based application that can present spatial information. The system is expected give the user better information about route, distance and tariff for public transportation so it can help the citizen more familiar with the public transportation.

II. MAPPING USING GOOGLE MAPS API

A. Spatial and Non Spatial Data

Spatial data is geographic data related to the actual appearance of objects on the surface of the earth, such as administrative boundaries, hydrologic boundaries, land use, potential and soil characteristics, and hydrological and building irrigation networks[9]. Spatial data obtained from maps, aerial photographs, satellite imagery, statistical data and other.

Non-spatial data is the data in the form of text or numbers (commonly called attributes), tabular form of the data that is

linked to spatial data. This relationship allows the user to understand the meaning of the spatial object. Information about the attributes of a spatial object is shown as a row of data records in the attribute table. Explain the non-spatial data or spatial data as a basis to describe the spatial data.

B. Google Maps

Google Maps is a web mapping service application and technology provided by Google, powering many map-based services, including the Google Maps website, Google Ride Finder, Google Transit,[12] and maps embedded on third-party websites via the Google Maps API.[12] It offers street maps and a route planner for traveling by foot, car, bike (beta), or with public transportation. It also includes a locator for urban businesses in numerous countries around the world. Google Maps satellite images are not updated in real time, however, Google adds data to their Primary Database on a regular basis, most of the images are no more than 3 years old.

Like many other Google web applications, Google Maps uses JavaScript extensively.[13] As the user drags the map, the grid squares are downloaded from the server and inserted into the page. When a user searches for a business, the results are downloaded in the background for insertion into the side panel and map; the page is not reloaded. Locations are drawn dynamically by positioning a red pin (composed of several partially transparent PNGs) on top of the map images. A hidden *iFrame* with form submission is used because it preserves browser history. The site also uses JSON for data transfer rather than XML, for performance reasons. These techniques both fall under the broad Ajax umbrella. The result is termed a slippy map[13] and is implemented elsewhere in projects like OpenLayers.

C. Google Maps API

After the success of reverse-engineered mashups such as *chicagocrime.org* and *housingmaps.com*, Google launched the Google Maps API in June 2005[12] to allow developers to integrate Google Maps into their websites. It is a free service, and currently does not contain ads, but Google states in their terms of use that they reserve the right to display ads in the future.

By using the Google Maps API, it is possible to embed Google Maps site into an external website, on to which site specific data can be overlaid. Although initially only a JavaScript API, the Maps API was expanded to include an API for Adobe Flash applications (but this has been deprecated), a service for retrieving static map images, and web services for performing geocoding, generating driving directions, and obtaining elevation profiles. Over 1,000,000[12] web sites use the Google Maps API, making it the most heavily used web application development API.

There are four types of maps available within the Google Maps API. In addition to the familiar "painted" road map tiles, the Google Maps API also supports other maps types. The following map types are available in the Google Maps API:

- ROADMAP displays the default road map view. This is the default map type.

- SATELLITE displays Google Earth satellite images
- HYBRID displays a mixture of normal and satellite views
- TERRAIN displays a physical map based on terrain information.

The main requirement to be able to use the Google Maps API is to get the API Key. API key is a code which is the interface between the web applications that we created with the function performed. The steps to get the API Key is as follows:

1. Having a Google account.
2. Log in to the Google APIs Console page: <https://code.google.com/apis/console>.
3. Start a new project by selecting the Create Project menu.
4. Selecting the menu "Services", select one of the services that will be used, such as "Google Maps API v3" and change the status to "On"
5. Select the "API Access", Google will include the API key is ready for use, for example:

```
ABQIAAAA8tt4eKTuBZMVnLJfP2BZrBT2yXp_ZAY8_ufC3CFXhHIE1NvwkxS4Rz1LFzG0odNPtk8VLkdrQF5grA
```

6. API key is then inserted at the script file that will access the web page functions available on google maps service is *maps.google.com*, as the following example:

```
<script type="text/javascript"
src="http://maps.google.com/maps/api/js?sens
or=true&key=ABQIAAAA8tt4eKTuBZMVnLJfP2BZ
rBT2yXp_ZAY8_ufC3CFXhHIE1NvwkxS4Rz1LFzG0odNP
tk8VLkdrQF5grA"></script>
```

Furthermore, earlier key can be used to insert a map from Google Maps on the web application as follows:

1. Incorporating Maps API Javascript into our HTML (Javascript snippet like the above example).
2. Creating a div element with the name *map_canvas* to display the map, example:

```
<div id="map_canvas" style="width:600px;
height:600px"></div>
```

3. Create some literal objects to save the properties on the map, example:

```
var map = new
google.maps.Map(document.getElementById("map
_canvas"), myOptions);
```

4. Write a Javascript function to create map object, such as:

```
function initialize() {
var latlng = new google.maps.LatLng(-6.4,
106.8186111);
var myOptions = {
zoom: 13,
center: latlng,
mapTypeId: google.maps.MapTypeId.ROADMAP
```

```
};
```

Setting the map is determined by the position you want to appear as in step 4 above, namely by entering longitude and latitude (map coordinates).

Parameter determines the zoom level you want. The smaller the value, the farther you are from the ground. A value of 0 will show a map of the whole world. The maximum value is 19.

MapTypeId parameter determines the type of map to be displayed, and there are four options, such as ROADMAP, SATELLITE, TERRAIN, and HYBRID.

5. Initiate map in on-load event at body tag of HTML, example:
`<body onload="initialize()">`

III. VISUALIZATION OF CITY TRANSPORT

A. The Problem in Public Transportation

Transportation system is a conjunction of some components or related object to move people or goods using vehicle accordance with the advancement of technology[5]. The system consists of the transports and the management that manage the transports.

Mode of transport (or means of transport or transport mode or transport modality or form of transport) is a term used to distinguish substantially different ways to perform transport. The most dominant modes of transport are aviation, land transport, which includes rail, road and off-road transport, and ship transport. Each mode has its own infrastructure, vehicles, and operations, and often has unique regulations. Each mode also has separate subsystems. On this paper we only discuss about road transportation.

The management of transportation falls into two categories which are marketing management and selling of transportation services, and management of traffic.

Public transportation, in this paper, limited to road transportation, is a transportation system using in the city, or a regency using automobile or bus that has fixed and specific route and destination, both scheduled or unscheduled.

Each destination is distinguished by color or number. The tariff usually is defined by local government, but short-distance passenger or students usually pay in lower tariff. The route or trajectory for public transportation is set by local government.

Formally, the public transportation can stop only in specific point such as a bus stop, but actually, especially in Bandung, the drivers will stopped their vehicle anywhere to pick or drop the passenger. The violation of rules is common happen such as pick the passenger or good over capacity, the door is not closed properly and many more. The violations are ignored by the officer because of weakness in applicable laws.

The problems in public transportation have strong related with the people and rules. Some of problem such as: the inconvenience environment in the vehicle, undisciplined drivers and passenger, and criminality problem[11].

Bandung, the capital of West Java, is facing the problems of public transport as well as other cities in Indonesia. The existence of public transportation is not properly empowered and some problem arise such as undisciplined driver and passenger, unbalanced distribution on public transportation to serve certain area and others, are often blamed to be the cause of traffic jam problem. The other problem of traffic jam also caused by unbalanced of amount of road users compare to roads space. It leads to an initiative to empower the public transportation to reduce the amount of vehicles in the road, especially in peak time. The initiatives include improvement of transportation system, make public transportation more comfortable and socialize the system to the citizen. It involved some stakeholders such as Transportation authority department, local government, transportation management, and the citizen.

Mosca and Zito has built the application for mapping public transport in Adelaide [10] using ArcGIS. The system can display the bus route and coordinate of bus position. But in Indonesia, recently we did not find the GIS-based system which can display the route of public transportation in the city.

B. Socialization and Visualization Transportation System

Based on problem according to public transportation as described previous, we try to provide a system to support the promotion program of using public transportation among the citizen. The system will provide visualization of public transportation route and give some information such as the tariff, public place on the route and total cost for certain route. The system should provide some functional requirement such as:

1. The system can display information about the route, tariff and distance for each route.
2. User can use the system to make a travel plan, by simulate some alternative route and calculate the distance and tariff for each alternative. It can be done interactively.
3. The system can display public place which are famous or relative important for the citizen such as mall, government office, hospital, and so on.
4. Administrator system can manage the master data such as route, tariff, road name, category, and public place.

The reference data using in this system is based on Bandung Government Decree according to public transportation, route and tariff, which consist of 36 routes. The public places describe in this application are classified into some categories such as: restaurant or café, entertainment, education, tourism, health services, government office, transportation, and public services.

The system functionality can describe as Figure 1 below. The system will manage by an administrator who will maintain the

data and tagging the map. User, anybody who can access the web, can view the map that will display the route and public places. User also can search certain route and make a travel plan. The system will display the route, distance and total tariff that is accumulated from transportation passes the route.

The identified data modeled by conceptual data model as displayed in Figure 2. The main entities are trayek, route, public place, street, and tariff. Each trayek has a route, which can differ from incoming and outgoing route. Each trayek has a tariff which is defined by government rules. Each route will consists some streets and based on the street route we can calculate the distance.



Figure 3. Main Panel for User

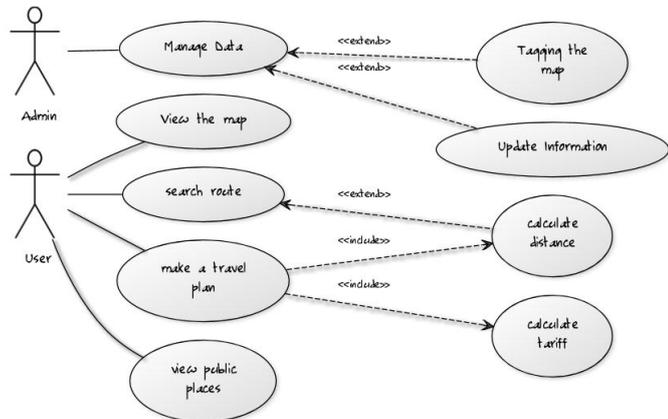


Figure 1. Use Case Diagram

After user chosen a specific trayek, application will display the route of chosen trayek with different color between incoming and outgoing route (Figure 4), because some of them have different route. It can helps the user to decide the right trayek if they want to visit certain places. The system also display a photo and information about the trayek, and tariff in flat condition (not depends on distance).

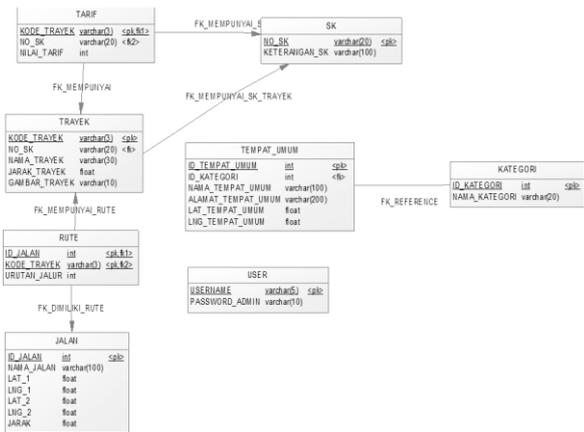


Figure 2. Conceptual Data Model



Figure 4. Panel for display the route

User can access the application through main panel which consist 2 options. User can choose between display the route or display the public places.

The main panel displays the map and user can choose the available trayek in dropdown text.

Figure 5 display the panel for all public places. User can chose to display specific categories such as education, health services, or government office by clicking the menu above. The map also combined with trayek and route so the user can choose the right trayek to reach their destination places. Map also show different icon for different category of public places.



Figure 5. Public Places

The system is not implemented yet and also need some improvement such as integrated with other transportation mode (train or busses). The difficulties on this system is for administration when entering the street path data, because they have to divide the street path into some section and input each section to present the complete route. But, since it need to be done only once, the administrator can do it step by step until we can present the data completely. Another constraint of this system is the system will works well if there is internet connection available, in other words, the performance of this system depends on quality of internet connection.

The system was built without intelligent features such as shortest path and intelligent search because of lack of data on city traffic jam and other statistic data according to city transport problem.

CONCLUSION

Based on analysis and development of system which can display the map of city transport above we can conclude some point as bellow:

1. Google Maps can help us to present spatial information easily and it give us lots of opportunity to build some system and present the information spatially so it more informative than before.
2. The feature of Google Maps, through API facility, has implemented as a tools to build the system which can display the route of public transportation in Bandung. This system is expected to help the government promote the public transportation uses between the resident as a solution in reducing traffic jam and transportation problems.
3. The system is developed to display public transportation which has some features such as display the route, calculate the tariff and distance between two places, display public places and help user to make a simple travel plan.
4. The system was designed to display only small bus type of public transportation since it is a main transportation mode in Bandung.

5. The system need internet connection to operate well so the system performance is also depends on the quality of internet connection.

In the future, we expect can improve the system by adding some extended feature such as improving the search alternative so user can using vary search option, integrated the system into public transportation mode such as big Bus or train mode.

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