# Information Visualization for Tourist and Travelling in Indonesia

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**Abstract.** These days, many developing countries, especially island nations such as Indonesia would try to increase productivity in tourism by trying to improve facilities and services to the tourists and travelers. With so many beauty and diversity in Indonesia, we should see this potential and create a container that can help the people in the world to see the natural beauty found in this country. If this can be realized it will cause a positive impact for both parties, especially governments in the tourist attraction region. However, it is still cannot be realized until today due to the absence of a facility-based of information visualization that can assist travelers in obtaining information about tourist attractions in Indonesia. This paper tries to display a web-based concept of tourism services that can help the tourists in getting the information, location and also the shortest path to reach a tourist destination.

**Keywords:** Dijkstra Algorithm, GIS, InfoVis, Tourism.

## 1 Introduction

By looking at the many tourist attractions in Indonesia based on the diversity of cultures, it obvious will attract many tourists both from domestic and abroad to take vacation and travel in Indonesia. Indonesian tourism department is always trying to increase the number of tourists, especially from abroad. But the problem often faced by Indonesia is when the tourists come, they are having a hard time finding a tourist attraction if it does not have guidelines such as tourist maps or other information sources. In 2009, the number of international tourists arriving in Indonesia climbed 3.6Many solutions have been sought by local governments such as the creation and improvement of the guide book that comes with the latest maps. An increasing number of vehicles and imprecise controls of traffic in Jakarta have become major issues that create congestion. The traffic congestion causes loss in productivity, consumes a lot of gasoline, diminishes air quality, creates a variety of safety hazards, often discourages tourism,

and reduces business information [1]. All of these problems are required to be solved so that the traffic congestion can be reduced There are several different types of solution that have been taken to reduce traffic congestion in Jakarta, such as employs traffic policemen in important traffic points, attempt to lay more pavements to avoid congestion, etc. But with the advent of technology and increment of traffic flow, several approaches with less involvement of human have been taken. Contemporary approaches emphasize better information and control to use the existing infrastructure more efficiently [2]. In contemporary approaches, image processing, computer vision or robot vision, etc are highly recommended. In these types of solutions, involvement of computers provide many promising approaches because information feed through mobile applications or web networks can simply provided. Because of this, we are proposing an innovative method in detecting traffic congestion using mobile application. In Indonesia, we can get the online information of traffic flow on certain location through some websites. One of the websites is http://lewatmana.com. In this website, the information of traffic flow will be obtained through cameras that are placed in important traffic points. This information will be updated every two hours. Therefore, the people who are connected to the internet network can use this application and choose an appropriate road to avoid congestion. In this paper, we want to describe mobile-based interaction as a new generation of traffic jam detection system that has tremendous potential to improve decision support system. This application will support real-time maps that can be viewed or accessed and provide the information of the current situation on specific roads in Jakarta. It also presents a better management decision making to the user or the traveler. So, the user not only can avoid traffic congestion but also can choose the appropriate road with a mobile phone. This new and improved application is necessary to develop an innovative traffic jam detection system. This paper is structured as follows. The second section presents the path (graph theory) and the algorithm, Dijkstra's shortest path algorithm, that we used to establish the mobile application. The third section discusses the modeling of mobile-based interaction for detecting traffic congestion. The fourth section shows the final comments and conclusions.

## 2   Related Works

Nowadays, E-Tourism in the other countries is no longer a new topic. There has been much research and papers discussed about E-Tourism and shortest path algorithm. In this section, we will give a few related paper that has a similarity problem.

Chow proposed a GIS application framework to utilize the Maps Application Programming Interfaces (API) in visualizing and presenting geographic information [3]. This paper produced a web prototype that proved to be effective in providing the users with a dynamic interface for data exploration. With the openness of the Maps API source code and flexibility in adopting open-specification data standards will indicate some of the potential of the Maps APIs in developing new Internet GIS applications.

Dijkstra's algorithm for finding the shortest route tourist attractions in Bali using GIS web form, introduce with the script PHP and MySQL as a database manager [4]. This paper also used the format SVG (Scalable Vector Graphics) to create the map, The advantage of using SVG file format is the quality of images or maps that been generated which will not be diminished or destroyed when the image is enlarged or reduced (scalable).

A method to speed up shortest path computations using graph proposed by Wagner and Wilhalm [5]. This paper describes three geometric speeds up techniques for Dijkstra's algorithm. There are goal-directed searches, geometric shortest path containers, and reach based routing. All the three graph-drawing methods that proposed in this paper produce equally good layouts concerning the geometric speed-up techniques. Generating a new force directed and spectral layouts relies non-trivially on parameters that are sometimes hard to optimize.

## 3     Methodology

Basically, the term Geographic Information System (GIS) is a combination of three main elements: system, information, and geography. Geographic Information System is a computer system that is used to input (capturing), storing, checking, integrating, manipulating, analyzing, and displaying data related to positions on the surface of the earth. Geography Information System can integrate information between the graphics data (spatial) with text data (attributes) that are connected on earth [6].

The main goal of the utilization of Geographic Information System is to facilitate in getting information that has been processed and stored as attributes of a location or object. The data that processed in Geographic Information System is basically composed of spatial data and attribute data in digital form, so analysis can be used is spatial analysis and attribute analysis. Spatial data is data related to the spatial location of the general shape of the map. While attribute data is a data table that serves to explain the existence of various objects as spatial data.

### 3.1     Collecting and Conversion Data

**Collect Data.** The first thing we must do is collect the data that needed to make this tourist applications. This application need a tourist map of tourist attractions to be located. Map of the tourist area is taken from a map owned by Google (Google Maps). After that, we need the data from police department about traffic jams or other information related to the traffic, the data from department of transportation about public transportation routes and the latest data needed is from department of tourism [7]. The illustration of the data collecting can be seen in Fig.1.

**Convert Maps into Graph.** we created an undirect weighted graph based on google maps (see in Fig 2.(A)). The graph uses to find the shortest route for tourists to arrive at their destination place. We use Dijkstra's algorithm to

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**Fig. 2.**
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**Fig. 1.** Collecting Data

search the shortest path from the graph. To create a good graph for this tourist application, a method of drawing graphs that can accelerate the search for the shortest route is required. A high-dimensional embedding method to describe the graph and using a goal-directed search to accelerate the computation of the Dijkstra's algorithm is used[8]. Edge is a path in the graph representation. The value of each edge is determined from the distance, traffic conditions, and transportation used by tourists. While the vertex is a representation of each tourist places and crossroads that described in Fig.2.(B).
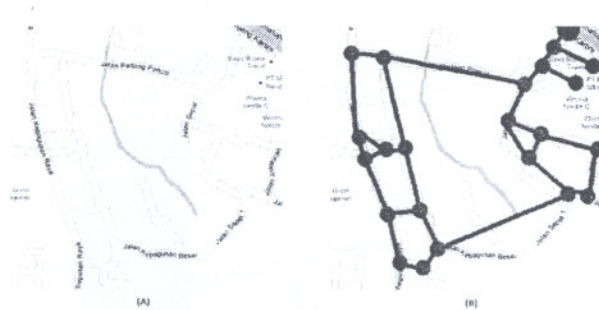


**Fig. 2.** (A) The map from google.maps.com , (B) The graph from result of conversion map

The key idea of high-dimensional embedding is to draw the graph in a very high dimensional space (usually d = 50) and then project the graph to 2D using principal component analysis. As our graphs are weighted, the shortest paths were calculated using these edge weights.

## 3.2   Find the Shortest Path

After obtaining the graph from the two methods, Dijkstra's algorithm to get the shortest path from the place which the tourist are in to tourist destination place is be used [9]. Dijkstra's algorithm is called the single-source shortest path. Dijkstra's algorithm is one variant of a popular form of algorithms in solving problems that related to the problem of finding a shortest path (a path that has minimum length) from vertex a to vertex z on a weighted graph, where weights are positive numbers.

This algorithm uses a tree diagram to determine the shortest path route. Using a greedy strategy, at each step is taken from the side of the minimum weight that connects a node that has been selected with an other node that has not been selected. The path from initial node to a new node must be the shortest path between all the tracks into nodes that have not been selected.

Dijkstra's algorithm using a time of O $(V * \log V + E)$ where V and E is the number of vertices and edges. The complexity of Dijkstra algorithm is

$$O(n^2)$$

So to find all pairs shortest vertex, the total asymptotic computation time is

$$T(n) = O(n^2) = O(n^3) \tag{1}$$

in other words Dijkstra's algorithm is more beneficial in terms of running time. This is a pseudocode of the Dijkstra's algorithm [9].

```
Procedure Dijsktra (V  set of vertices 1   n (Vertex 1 is the source)
        Adj[1..n] of adjacency lists;
        EdgeCost(u. w) edge - cost functions;)

Var  sDist[1..n] of path costs from source (vertex 1); (sDist[1] will be equal to
     the length of the shortest path to j)
Begin:
Initialize
(Create a virtual set Frontier to store i where sDist[i] is already fully solved)
        Create empty Priority Queue New Frontier;
        sDist[1]=0; (The distance to the source is zero)

        forall vertices w in V - (1) do (no edges have been explored yet)
        sDist[w]=∞
        end for;

        Fill New Frontier with vertices w in V organized by priorities sDist[w];
endInitialize;

repeat
        v=DeleteMin(New Frontier); (v is the new closest; sDist[v] is already correct)
        forall of the neighbors w in Adj[v] do
            if sDist[w]>sDist[v] +EdgeCost(v,w) then
                sDist[w]=sDist[v] +EdgeCost(v,w)
                update w in New Frontier (with new priority sDist[w])
            endif
        endfor
until New Frontier is empty
|
endDijkstra;
```

**Fig. 3.** Pseudocode of Dijkstra's Algorithm

### 3.3  Designing an Interactive Map

To get an interactive interface to the tourist application, an easier new map for tourist to find places information is created. First, Google maps were used as the basis of the interactive map, and then we add the data from the department of tourism to the maps. Rebuild the maps using open source software such as Quantum GIS. All the data from the department of tourism were added to the new map on Quantum GIS, automatically the data will be saved on Postgre SQL. So now, the interactive digital maps for the tourist application interface were made. MapServer will make these new digital map to be used in the web server layer. MapServer also provides API (Application Programming Interface) called MapScript, which make the programmer, can modify the map as their want. Chameleon as a product of Open Source that is built with PHP programming language, provides simple access to some features that can only be accessed in MapScript. The function of the Chameleon is a liaison between MapServer and the web server (see fig x). By using the PHP language and with some help of php functions on Chameleon, digital map into a web-based tourist application can be display easily. The next step is to create a web design for tourist applications. The application can help the tourist to search and find the shortest route to their destination (tourist places). For example, when the tourist want to find location of Sea World at Ancol, they only input on search box and then the application will automatically save the position of tourist as beginning node and the destination place as end node. The application can give the information about their destination place and route as described in Fig.4 and Fig.5.



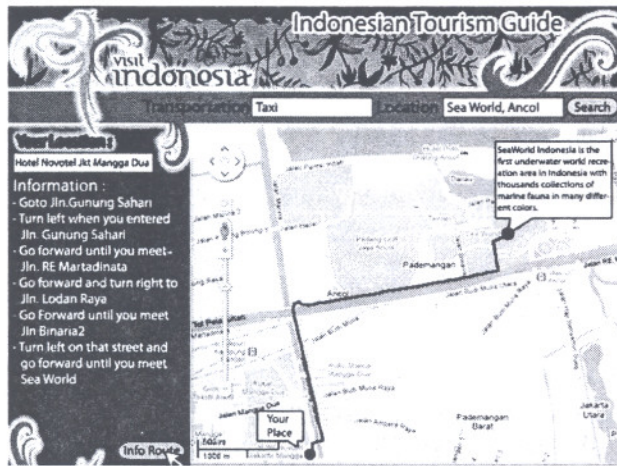**Fig. 4.** Web Interface with information of tourist place

**Fig. 5.** Web Interface with route information

## 4    Conclusion

Based on the methodology, the using of information visualization can make the tourist easier for searching the tourist attractions in Indonesia. Dijkstra's algorithm is good enough to search the shortest route of a tourist attraction in Indonesia. It is more beneficial in terms of running time. Dijkstra's algorithm combined with the result graph from conversion of maps (high-dimensional embedding and Goal-Directed Search) proved can be useful to find the shortest route for tourists to arrive at their destination place. This GIS application based on web, it will make the tourist easier to get the alternative route (shortest path) to arrive at their destination place.

This paper refers only with web-based applications. For the future this application will be try to implement in other media, such as mobile applications and etc. Online Reservation also will be the next target of this application. This application expects to avoid tourist trouble when they want to buy tickets or lodging around a tourist attraction. So, the tourists cannot just only search or find a way to the tourism object, but they also can make a ticket reservations and lodging for a hotel just by through our application.

## References

1. Wikipedia. Tourism in Indonesia (February 2011),
   http://en.wikipedia.org/wiki/Tourism-in-Indonesia
2. Singapore Tourist Guide.Welcome to the Singapore Tourist Guide,
   http://www.singaporetouristguide.net/
3. Edwin Chow, T.: The Potential of Maps APIs for Internet GIS Applications, p. 13. University of Michigan, Department of Earth and Resource Science (2005)
4. Joni, L., D
   gunakan A
   (SNATI 2
5. Wagner,
   p. 9
6. Venia Rac
   Tourism b
7. Prakoso E
   tion (DM
   Informasi
8. David Ha
   Graph Al
9. Puthupar

4. Joni, L., Dewi, E.: Pencarian Rute Terpendek Tempat Wisata Di Bali Dengan Menggunakan Algoritma Dijkstra. In: Seminar Nasional Aplikasi Teknologi Informasi 2010 (SNATI 2010), June 19, p. 4 (2010)
5. Wagner, T.W.D.: Drawing Graphs to Speed Up Shortest-Path Computations. p. 9
6. Venia Rachmawati, S.,Wirawan, S.: Web Application Of History- cal And Cultural Tourism Information Mappin. In: Jakarta. pp. 13 (2010)
7. Prakoso Bhairawa Putera, S. R., Mulatsih, S.: Destinaiton Manage- ment Organization (DMO): Parafigma Baru Pengelolaan Pari- wisata Daerah Berbasis Teknologi Informasi, June 20, pp. 4 (2009)
8. David Harel, Y.K.: Graph Drawing by High-Dimensional Embedding. Journal of Graph Algorithms and Applications 8, 20 (2004)
9. Puthuparampil, M.: Report Dijkstra's Algorithm, 15 (2005)