Google Maps Based Travel Planning & Analyzing System (TPAS)

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Abstract- **With the immerging technologies like GPS and Interactive map applications, travel and tourism industries have been accelerated a lot. And also the individual travelers are getting benefited by cloud services like "Google Maps". But still there are some limitations like travel destination sorting and location based travel recommendations to the user. This research proposes an interactive trip organizing service with enhanced travel information services and travel recommendations. This system is capable of proposing a positive or negative score to a specified travel plan by analyzing weather conditions and distances. Initially user can input the starting place and intended travel destinations even the user doesn't know the optimum route of reaching those destinations. The System can analyze user inputs and generate shortest path covering all the travel destinations and generate the travel plan including the route. Then user can check for weather details of all the places as weather conditions, temperature, wind speed and humidity. After, the system gives its suggestion about the suitability of the travel at the specified time.**

Keywords- Google Maps, Weather API, GIS, Distance Sorting, Optimum path

I. INTRODUCTION

Google Map is developed to find, locate and mark places, find directions, durations and many other Geographical Information Systems (GIS) based tasks.

Geographical Information System is a decision support System which has geo spatial data (e.g. maps) to analyze spatial data and relationships between them. [1].

When using Google Maps to find a path, it provides the path according to the user inputs (destinations), but that may not be the optimum path. This research provides a solution to this issue which is a better path for user inputs (destinations). And also this system provides weather details and suitability of the travel at the specific time.

Regarding Geo Spatial data and GIS based systems, there are several geographical systems has been developed. A summary of some of them are mentioned below.

A - location-based services and Google Maps based information master system for tour guiding.

This research proposed an intelligent information master system for tour guiding using multi-agent systems and ontological system databases. This proposed system is more accurate with top experiments so solved traditional issues of travelling guides. The system has been demonstrated with tourism and travel guiding features [2].

B - Visualizing Our Futures: Using Google Earth and Google Maps in an Academic Library Setting

According to the research, most of present academic libraries have been used google maps and google earth for wide variety of purposes. That means, most of users are still take data and geographical details from google maps and google earth to manage GIS based systems. According to the research, google earth and google maps can be used in many subjects even not regarding GIS based purposed. As example, to evaluate students talking "French as a second language" in University of Toronto Mississauga, they used google earth to find French language libraries, restaurants and community centers [3].

C - Web-Based Zoomable Pathway Browser Using KEGG Atlas and Google Maps API

In this research, Pathway is an intuitive browser that has been designed with providing a large-scale metabolic pathway map based on the popular KEGG Atlas layout, with the addition of gene and enzyme nodes. Pathways has a better user friendly interface with integrated search capabilities and exploratory facilities [4].

II. RESEARCH APPROACH

When an user wants to plan the trip with several destinations, Google Maps provides the output according to the user inputs only (Fig. 1). The user has to search for each destination separately to retrieve distance and duration in Google Maps. And also the user has to enter destinations in the correct order according to the distance to get the travelling route.

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When the user enters starting point and destinations, this system (TPAS) creates the travelling route in the correct order (Fig. 2) according to the distance and provides the route in text format. So the user can understand which place to visit first, second, third and so on.

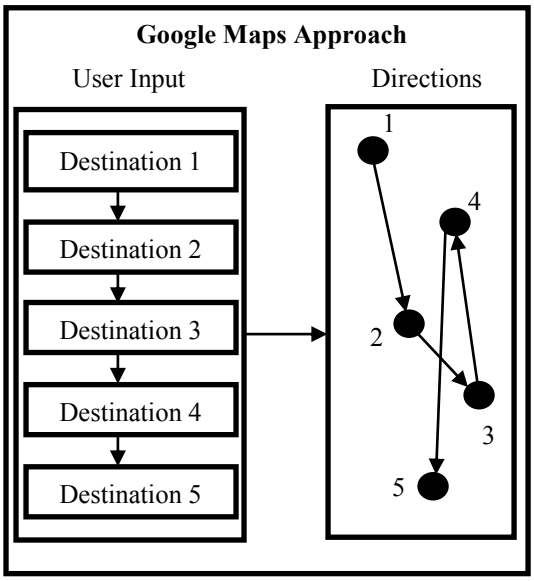

Fig. 1 - Google Maps Approach

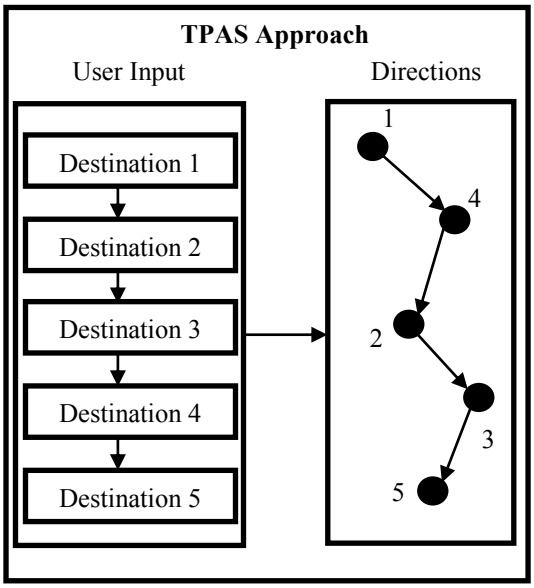

Fig. 2 - TPAS Approach

In this system, it first access to Google Maps through the Google Maps API. The system has two google AJAX [5] based search boxes to find locations. First one is for the starting point and other one is for destinations. The user can enter the starting point and each destination with locating the point and user can add locations where planned to visit.

Then the system takes the starting point and all the destinations to a 2D array and sort the array according to the distance between starting point and each destination.

The distance sorting technique is a simple quarter circle technique. Which means, if the destinations distribution is a spread one like a mesh (Fig. 3), there is no any problem to understand which the closest location is, next closest location is and so on.

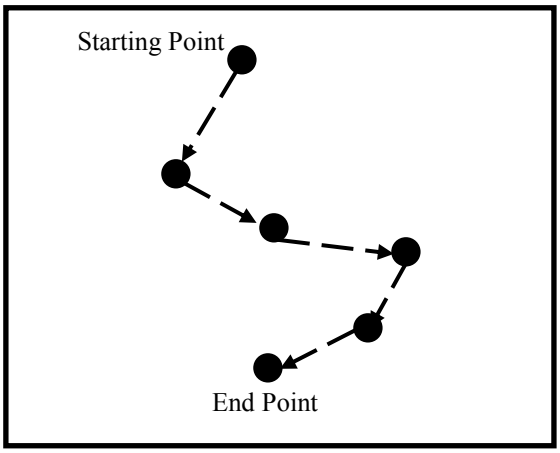

Fig. 3 – Example for a mesh spread destination distribution

But if the destination distribution is a circle spread distribution (Fig. 4), there will be a problem which is the end point may be the closest point to the starting point.

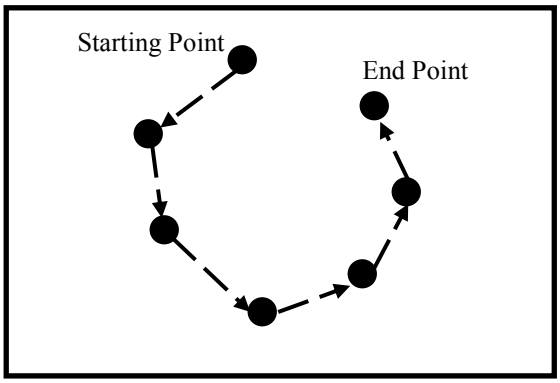

Fig. 4 – Example for a circle spread destination distribution

If the end point is closer to the starting point, the result map will be an incorrect one because the system will decide to go to the end point at the beginning. To solve this problem, the quarter circle technique can be used.

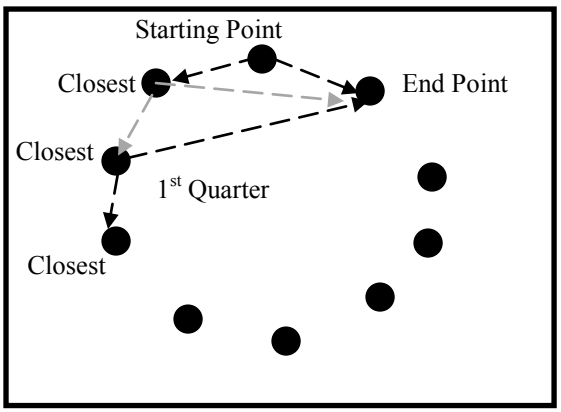

Fig. 5 – The Quarter Circle Technique

In the quarter circle technique, the circled destination distribution will be divided into four equal parts (quarters). Then find the closest destination from the starting point and take that quarter which that closest destination belongs as the first quarter. And set the path from starting point to that destination. Then that destination sets as the starting point and performs the same principle within the quarter. After finishing the quarter, the path will be set within the quarter. Then there is no any circle distribution anymore and it can find which one is closest, and next closet is from the rest (Fig. 5).

According to the above example, within the first quarter, always skip the end point as not closest because when each destination becomes the starting point, there is another closest destination to them than the end point. After the quarter, the next closest destination will become the last starting point and the end point will be the longest destination to it.

When it comes to a common scenario,

If x = No. of total points to be become a starting point,

$$x = upper\ integer\ \left(\frac{total\ no.of\ points}{4} + 1\right)$$

Next part will be described an example with 6 locations (points), how the array will be filled by the quarter circle technique.

There are 6 locations in the example, so the number of points will be become a starting point is 3 (6/4+1=2.5 and the upper integer of 2.5 is 3). This +1 is for the last starting point which is out of the quarter. So there are three parts to sort the destinations.

First part, get the distance between starting point and the nearest destination to the starting point by calculating and sorting every distance between the starting point and each destination.

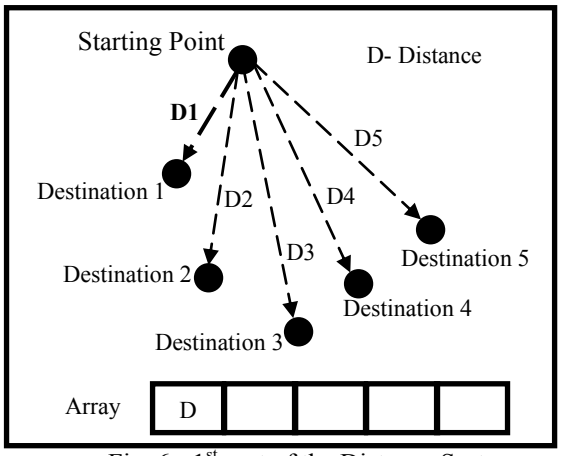

Fig. 6 - 1st part of the Distance Sort

In the first part, array takes only the nearest destination distance to the starting point. If took all the distances and sort them out, the second destination will be the Destination 5 (Fig. 6) because after D1, D5 is the shortest distance from the starting point. But actually the second destination should be the Destination 2.

In the second part, the starting point is the previous 1st Destination. Then get the other distances between the 1st destination and each other destination (Fig. 7).

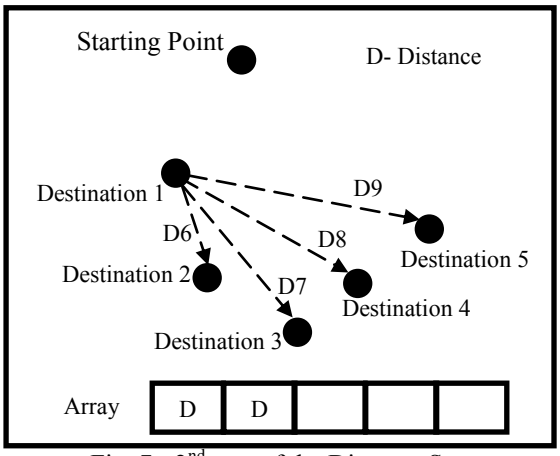

Fig. 7 - 2nd part of the Distance Sort

In the third part, the starting point will be the closest destination to the previous destination which is out of the quarter (3rd point), so it can be taken distances directly from it to each destination left (Fig. 8), and then sort all the distances in ascending order in a 2D array which has both distance and the city name. After that, it provides city names (destinations) in the order. Then the user will have an accurate route with the lowest total distance and duration.

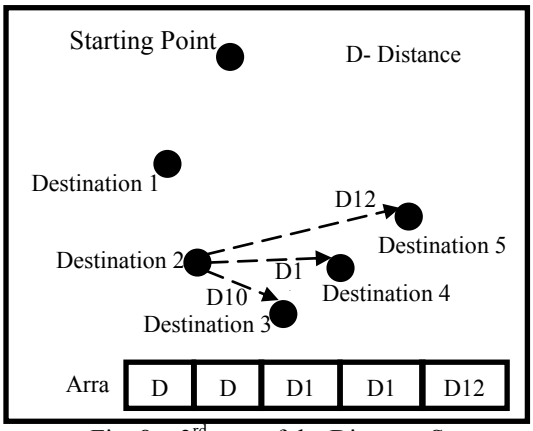

Fig. 8 – 3rd part of the Distance Sort

After getting the accurate route, user can see the path map with each waypoint. The description panel shows distance between each destination, duration and the total distance, duration. After getting the path map, user can check for weather details. The system checks for weather condition, temperature, wind force, humidity and weather description of each destination and show them.

A function will count the number of destinations with bad weather (Lightening, Thunderstorm, Shower rain, light rain, rain and heavy rain) and check whether that number is greater than to 50% of total number of destination. If so; the system will say that this is not a suitable time to travel there due to bad weather. In that situation, system will check for weather forecast for another 7 days for each destination. Then perform the same function mentioned above and tell whether the upcoming week is suitable for the travel or not.

This is a system where several APIs bringing together and analyze travelling details. Users can enter destinations and check maps through google maps API and check for weather details using weather API. So the entire system can be modeled as follows (Fig. 9).

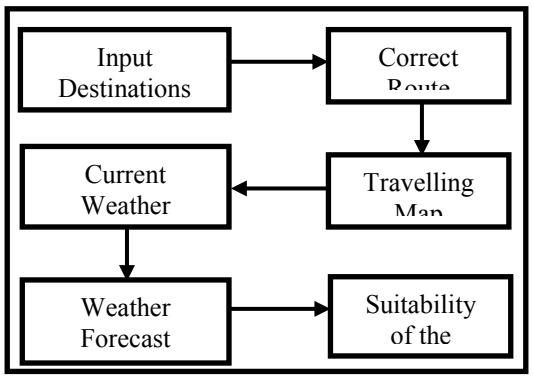

Fig. 9 – Flow Diagram of TPAS

III. SYSTEM DESIGN

The proposed System (TPAS) is running with two APIs and two internal modules. With these APIs and modules, the entire system design diagram can be modeled as follows (Fig. 10).

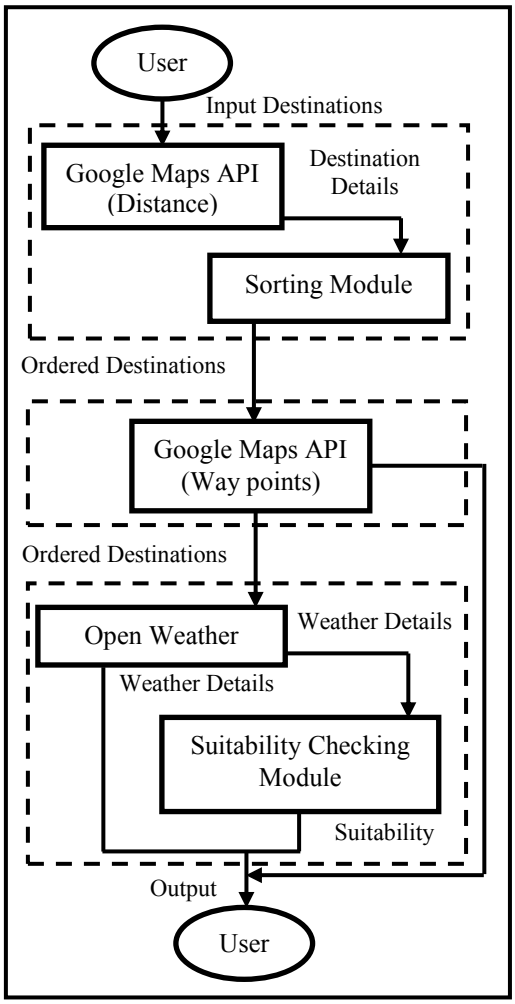

Fig. 10 – Context Diagram of TPAS

IV. IMPLEMENTATION

The system is based on JavaScript and HTML since this is a web system. To develop the system, JQuery, CSS and AJAX have been used. This is a completely front end system so login to the system is not required. HTTP GET method is used to pass data between pages.

First, user enters the starting point and destinations in the system interface. The system consumes Google Maps API to get map data, directions and destinations [6]. Then the Sorting Module (Fig. 10) sort destinations in ascending order and keeps the sorted data set in a text box. Then an AJAX call sends the sorted data set to the direction map page through HTTP GET method with one parameter which is the sorted data set.

In the direction map page, JavaScript, "location.search" method catches the GET parameter and build an array. Then the user can view the ordered path with descriptions provided by Google Maps API. After that, an AJAX call sends the sorted data set using the same (previous) method to Weather details page.

In the Weather details page, "location.search" method catches the data and use them to get weather details. The system uses Open weather API [7] to get weather details and weather forecast. Finally, the system provides the suitability of the trip using the Suitability Checking Module (Fig. 10).

V. CONCLUSION

As the largest GIS in the web, Google Maps has various services and this research is focusing on a different approach to find a path which the google maps has not.

This proposed system carried out an innovative way to generate optimum path to the user by analyzing distances. And also it delivers travel recommendations based on weather information.

Then the system provide details about the suitability of the travel and suggest suitable days if available when there are bad weather conditions at the specific time.

The system currently uses Quarter Circle Technique but this can be further improved by analyzing some other dependencies like traffic data, road conditions, travel recommendations/feedback, historical data and integrating with cutting edge technologies like Machine learning and Artificial Intelligence support to the system.

Google Maps has approximately 64.5 million unique users in the world [8] which is 0.85% of the world population [9] and still those users have not above feature in Google Maps. So the proposed system will help those users to find the optimum route and weather details.

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