Detection of Reliable Route in Transportation Network Using GIS: A Review

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***Abstract*—With the advent technology of Remote Sensing and GIS, a network transportation (Route) analysis is become a common practice in many application areas. In this paper effort is made to find the route between any two given points subject to some constraints. The constraints utilized in this study were associated with the reliability of travel time. The reliability of period was supported on the basis of variation of speed on that route or link. This reliability was attributed as a cost of the link with alternative costs like average period of the link and length of the link. The optimum route was found by minimizing the cost of travel and period. Network analyst extension in ArcGIS was used to realize the optimal route.**

Keywords*— Optimal Router, Reliable Route, ArcGIS, Network Analyst.*

I. INTRODUCTION

Traditional route selection involves finding the shortest or the quickest route between any two given points. The shortest route is obtained by minimizing the gap between the origin and the destination purpose. Whereas the quickest route is obtained by minimizing the time period between those points. The time period between any two given points A & B is random in nature. It may depend on several variables like traffic on route, congestion, traffic incidents, weather, etc. Hence, the quickest route throughout off-season hours might not be the quickest route throughout the peak hours; in short, it should not be a reliable route for travel. For locating a reliable route (route with less travel time variation) it needs to own data on the time periods and their variation on all possible routes connecting the given points.

GIS are used as an economical tool for a large varies of applications over the past decade. It is used for applications like emergency response and transportation planning and management. GIS has evolved on the far side the initial stages of information management and mapping, and have advanced into spheres like modelling and analysis therefore facilitating decision creating. Many attempts are created to integrate totally different models into GIS and combine GIS with the event of Intelligent Transport System (ITS) [1] ITS has an objective of finding a reliable route between any two given points in a transportation network.

The rest of the paper is organized as follows. Sections 2 discuss the related work. The frame work is presented in section 3 and at last section 4 contains conclusion and summary technique.

II. LITERATURE SURVEY

A. Bi – Level Genetic Algorithm

Route designing has been an energetic analysis space in transportation and supply. Bi-level Genetic rule (GA) and Geographic data System (GIS) used in [2] to derive a route in a very given transportation network that satisfy multiple objectives like, minimal cost, minimum period of time, etc. The authors applied the mentioned methodology to a tour operator problem, where the tour planner must plan a tour that must cover a particular variety of visiting points such that it has the minimum cost, minimum travel time, have most scenic beauty on the route, have least vehicle operational cost and most safety compared to alternative attainable routes. The calculated values for each link were then coded to a GIS map. With the coded data and using the analytical capabilities of GIS the importance of a link with relation to any given criterion was found. This information is used to get a generalized cist of every link that is important variable for locating the simplest possible route. For every link, each of the variables was given a weight then; GA was used to obtain the simplest attainable combination of weights. Once weights are known GA was used to obtain the simplest sequence to cover the given visiting points.

B. Advance Traveller Information System

In ATIS, it presents information on real time traffic which might be used to predict traffic congestion, allowing travellers to create higher choices on the basis of their preference of shortest or fastest route [3]. The methodology presented in this paper involves a quest for associate best route between any two given points among the transportation network. Di-jkstra algorithmic is used to find the best (shortest or fastest) route. Di-jkstra algorithmic

program needs weights for every link in the transportation network to search out the best route. The weights for links were calculated as a function of its time period and phase length. The time period was calculated supported the information on each real time traffic data and historic data on every link. The weights were created available within the attribute table of GIS and were updated each five minutes. A typical ESRI ArcGIS Server Network extension was setup that permits to perform best route calculation tasks. Data on real time traffic collected by sensors on the road were transmitted to the server and updated within the GIS information. An online primarily based data systems application was created to be used by travellers. The web application permits users to input their trip data and additionally permits them to incorporate restrictions on their trip (e.g. travelling from A to B with stop at point B) when submitted it shows the best route (both quickest and shortest) on a GIS map and it additionally gives transport as another choice for the trip.

C. Value of Time, Delay and Reliability

Travel time, delay and reliability are an important research area which is gaining importance these days. According to [4], in presence of substantial road congestion, the travel time variability is valued more than travel time savings. Value of reliability (VOR) indicates the value travellers place on the reliability of travel time. There have been several studies in the past trying to estimate the VOR. VOR is the travellers' willingness to pay to reduce the variability of travel time by one unit. This variability in travel time is defined differently by different researchers.

III. METHODOLOGY

Standard ESRI ArcGIS Server Network Analyst extension allows performing best route calculation tasks. This extension is used to detect the best route. The best route was defined as the route that minimizes the period between any two given point and maximizes the value related to the travel. The cost for travel was outlined alone on the basis of reliability of the links. As mentioned before the quality deviation of the speed data was used to outline the un-reliability of the link. The greater variance in speed implies that the link is unreliable, hence, the greater cost for travel. Similarly, a lower variance of speed data implies that the link is a more reliable, or, the period is a lot of inevitable, hence, a lower value for travel through the link. Figure 1 show the methodology followed during this process.

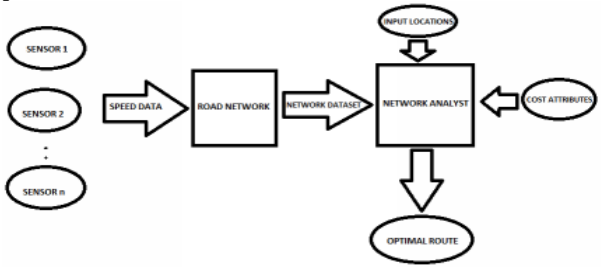

Figure 1: Methodology For Finding Optimal Route.

Experimental Setup:

Sensors are used to locate on all major highways in the city. Average vehicle speed data is collected by the sensors for every thirty seconds period of interval. Applied mathematics Analysis package (SAS) was then used to get the most, minimum, average, and variance of the speeds of every sensing element. During off peak hours most of the roads have traffic flowing at several speed limits therefore the period is predictable. Whereas, throughout peak hours most of the Freeways and roads close to the downtown area are largely blown up and therefore the period on those roads varies significantly. Therefore finding a reliable route that contains a predictable travel time is extremely useful throughout peak hours.

The speed data from the sensing elements is combined to the sensor location data by using the join technique. The sensing element data was then assign to the average speed and cost to any or all the Freeways in the network using spatial join function of ArcGIS. Then the average speed is set up for the peak hours and some appropriate standard deviation of speed is also set up. The road network data was then adapted to produce a new network dataset. With the access of the network analyst extension the shortest route between two points will found. Time taken and reliability of the roads were used to determine the respective cost factors.

IV. CONCLUSIONS

The optimal route calculation technique is used in this method is based on the reliability of travel time of the network links. The reliability of a link was outlined on the standard deviation of the speeds. The upper the standard deviation, the lower reliability and was given the higher cost for travel through the link for the network calculations. On the opposite hand lower standard deviation of speed implies that travel times are additional predictable so is additional reliable and was given a lower cost for travel through the link for network calculations. Network analyst extension was used to find the optimum route between any two points.

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