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SURVEY ARTICLE

A Survey on Route Planning Algorithm for Real World Transportation

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Abstract— In real time traffic situation, the RPA, which is constructed based on historical data may differ from that data and may change over time. Lots of researches are made on developing a prediction technique to improve route navigation, route planning, etc. Traversing from source to destination faces various types of congestions. In order to predict the optimal route, prefer a transient route between source & destination. The Route Planning algorithm aims in predicting the routes available between various source and destination based on the live circumstances captured using Geographical Information System (GIS). The Route Planning Algorithm(RPA) achieves route prediction from source to destination by including transient nodes i.e., in between nodes for multimodal criteria combinations such as Bus (B), Train (T), Flight (F) and Distance (D), Time (T), Cost (C) along with traffic. A Route Planning Algorithm, find a route between the two available Public Transportation. The source and destination may be specified as geospatial coordinates. A Route_Planner is a journey planner specialized for public transportation. The cities are characterized by a large number of nodes and edges which may typically be used at any time. The Route planner has covered the Routes, showing a path which is possible to travel between two points at any time. Different weightings such as distance, cost, time associated with each edge.

Keywords— Real time traffic; Geographical Information System (GIS); Route Prediction Algorithm (RPA); Optimal Route; Route Planning.

1. INTRODUCTION

Geospatial is the data or information that identifies the geographic location of features and boundaries on Earth, such as natural or constructed features, oceans, and more. Geospatial analysis is an approach to applying statistical analysis and other informational techniques to data which has a geographical or geospatial aspect. Such analysis would typically employ software capable of geospatial representation and processing, and apply analytical methods to terrestrial or geographic datasets, including the use of geographic information systems and geomatics.

Spatial data is also known as geospatial data or geographic information. Spatial data is usually stored as coordinates and topology, and is data that can be mapped. A spatial database, or geodatabase is a database that is optimized to store and query data that represents objects defined in a geometric space. Most spatial databases allow representing simple geometric objects such as points, lines and polygons. Some spatial databases handle more complex structures such as 3D objects, topological coverages, linear networks, and TINs.

A geographic information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data GIS can relate unrelated information by using location as the key index variable. Locations or extents in the Earth space–time may be recorded as dates/times of occurrence, and x, y, and z coordinates representing, longitude, latitude, and elevation, respectively.

Geomatics, also known as geospatial technology, geomatics engineering, or geomatic engineering, in French géomatique, is the discipline of gathering, storing, processing, and delivering geographic information, or spatially referenced information. In other words, it "consists of products, services and tools involved in the collection, integration and management of geographic data".

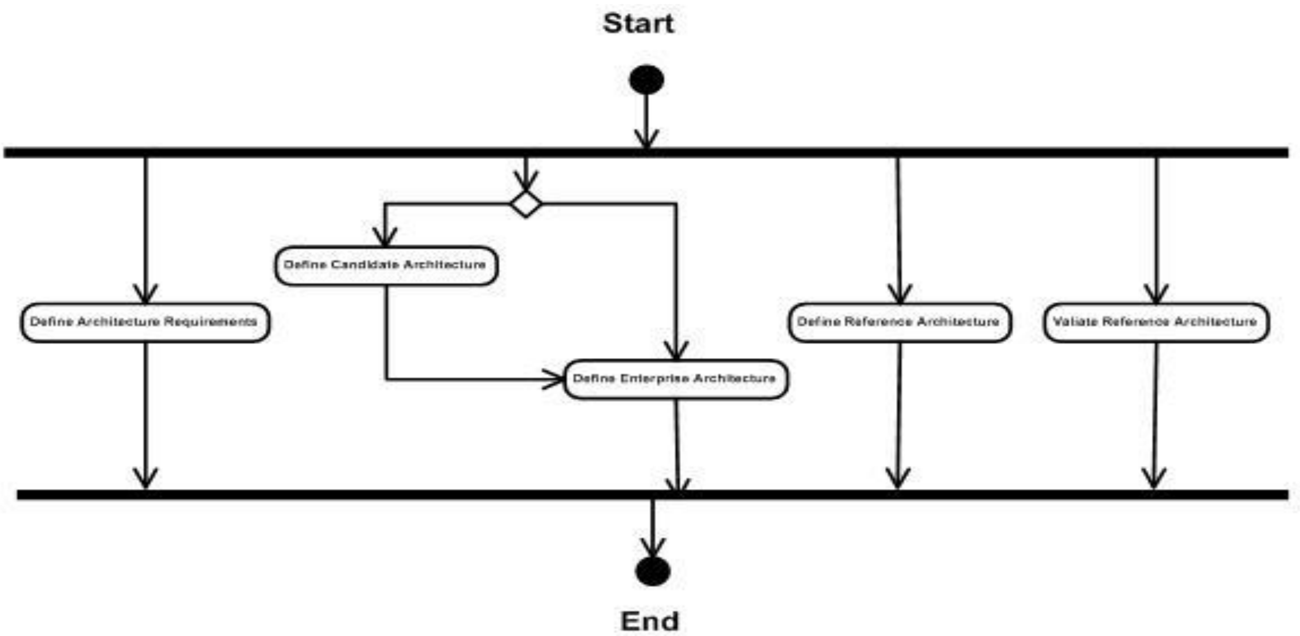

Fig 1.1 Work flow of Geospatial Architecture

Route planning is an important problem for a number of diverse applications including intelligent transportation systems, space applications, autonomous robotics, and military guidance and navigation systems. The main issue which is important in our society is Mobility. Peoples used to travel from one location to another, in effect increasing the use of public transportation. Travellers aims in determining the best route to reach destination from source. Traversing from source to destination faces various types of congestions. The three major travel modes are only by Road, Rail and Air. According to the geographical position of the world, the distance, time and cost varies in this three modes between the same source and destination.

The basic route planning models the problem as a graph. The nodes of the graph represent geographic locations, such as nodes, and edges. A valid connection, from a source node to a destination node, is a sequence of edges connecting source and destination. Each edge is assigned a non-negative weight, for example the length of the road or an estimation of the travel time required to reach from one end to the other. The optimization problem is to find a shortest path between a source node and a destination node.

The Route Planning Algorithm may tackle with standard search algorithms. Public transportation systems exhibit a computing travel plans. Planning can be carried out at the stop level where the algorithms find the best next stop, starting from the origin of the trip. Computing the shortest paths becoming the challenging task in predicting the route between two locations. The random incidents, change in weather, traffic congestions may affect the efficiency of the algorithms. Hence, the algorithms should get extended to take in account these parameters.

The users requirements in travel is limited upto the existing software solution version. The requirements is fulfilled in all aspects in this algorithm. The predicted route informs all required data in all combinations of Modes and Criteria. The user can immediately get the transient route and available Modes and Criteria information. They can book the travel from source and destination (transient route in that mode) early comparing the traditional version. So, the traveller /passengers confirm their journey initially. Suppose any failure occurs at any node, the user can execute the software from that node by assigning that node as a source. The whole process simplifies the decision making in travel.

2. LITERATURE REVIEW

2.1 Utilizing Real-World Transportation Data for Accurate Traffic Prediction

Transportation networks of major cities have the availability of real-time high-fidelity spatiotemporal data. The data's are collected by placing sensors on road networks. The accuracy of traffic prediction is enhanced by incorporating the intrinsic behavior of data into time-series mining technique based on the data collected from the real world county transportation network. The traditional approach fail to forecast the peak hour traffic and events such as accidents and constructions. This traffic prediction algorithm helps in improving the prediction accuracy by incorporating the historical data by correlating the event attributes along with traffic congestion. But it can predict for each sensor individually. It helps in improving the accuracy of Predicting the traffic. It uses the average of previous data to forecast the future data. Utilize the historical data to predict the traffic even in the occurrence of infrequent events. Short term and long term average speed can be predicted accurately.

A traffic prediction technique that uses real-world spatio temporal traffic sensor data on road networks. The proposed system incorporating the historical traffic data into the prediction model by correlating with traffic congestion. It fails to forecast traffic during traffic peak hours and in cases such as accidents road constructions. It cannot predict the speed changes in traffic. It only can predict traffic for each sensor individually. It is not possible to predict for distributed entities. It can be applicable only to predict road traffic.

2.2 Mining Traffic Incidents to Forecast Impact

The traffic incidents occurred are captured using sensor data from highway traffic detectors. Classification models trained on sensor data and report built an understanding for prediction and impact of high way incidents. The expected state of traffic at different times of are built on understanding the spatial and temporal data. With high accuracy, this model can predict false reports of incidents measured as a function of vehicles delayed, the spatial and temporal extent of the incident. Structured data from sensor networks on highways as well as semi-structured text collected at different points in time builts the featured vector.

Experiencing with the real data, the work supports a decision- response to a high way incident. But traditional system relies on human expertise. Impact of an incident can be characterized in multiple ways. Supports a decision-response to a high way incident. Machine learning technique can predict the impact on incident. Propose a practical system for predicting the cost and impact of highway incidents using classification models trained on sensor data and police reports. The feature vector is built from structured data from sensor networks on highways as well as semi-structured text collected at different points in time. It delay on each segment of road per unit time may be calculated as driving hour. Need to place sensor at different points to know the impact of an incident. Predict false reports of incidents that are made.

2.3 A Methodological Approach for Estimating Temporal and Spatial Extent of Delays Caused by Freeway Accidents

The non recurrent congestions by accidents cause defects in prediction remain elusive. Identifying and quantifying the congestions help in the development of accident management strategies. Binary integer programming (BIP) is applied in estimating the temporal and spatial extent of delay caused by freeway accidents, based solely on commonly available inductance loop detector data. The basic idea behind the method is to estimate the most likely temporal and spatial extent of the region of congestion caused by an accident by solving a BIP problem that is consistent with the topology of the spatio-temporal region that defines candidate speed differences between normal flow conditions and accident conditions. It quantifying accident congestion in terms of the total delay to evaluate the benefit of accident management systems accrued from efficient traffic operations.

Defines candidate speed difference between normal flow condition and accident condition. Applied to any freeway system for which accident data are collected. Investigate the variation of non recurrent total delay relative to a set of potential causal factors. The method can be applied to any freeway system for which accident data are collected and that is instrumented with common inductance loop detectors. Using the procedures developed here, it is possible to develop a performance measure to evaluate transportation policies and planning level analyses associated with the design. It fails in Need to investigate the variation of total delay each time. Need to monitor the congested area using cameras, is expensive & difficult. Cannot directly distinguish secondary accident impact from primary accident impact.

2.4 Path-Planning Algorithms for Public Transportation Systems

In public Transportation systems, finding shortest path is not as same as planning a trip. The Path planning must consider the constraints in routes before planning the trip. Capturing the route constraints helps in designing the efficient algorithm with explicit representation. The strategies connectivity matrices and hubs employ in applying the special properties for identifying the constraints and computing travel plans concentrate on service routes. Connectivity matrices capture the route constraint by encoding the possibilities of transferring among routes. Categorizing stops into regular-stop and hub classes allows us to tackle more complex queries efficiently.

This hierarchical structure is similar to the hierarchical encoded map views technique used for finding shortest paths in large areas. This information may help travellers to select buses when there are multiple choices. Improves the accuracy of Predicting the traffic. Provides alternative travel plans. Uses the average of previous data to forecast the future data. Help travellers to select buses when there are multiple choices. Help travellers to select buses when there are multiple choices. It fails in Need to prioritize travel plans each time , when multiple ways for desired trip. Different stops having same name needs extra geographic information. The management system may also relay real-time bus locations. It only returns the viable intermediate stops to the standard shortest-path algorithm.

2.5 Route planning algorithms: Planific@Project

Its main aim is to develop an intelligence system capable of routing people from one place in the city to any other using the public transport. In order to do this, it is necessary to take into account such things as: time, traffic, user preferences, etc. Before beginning to design the project is necessary to make a comprehensive study of the variety of main known route planning algorithms suitable to be used in this project. The main problem in this Project is how to calculate the optimal route between two locations within a city, taking into account all potential bus and subways routes. To resolve this problem we must create an algorithm that takes into account all the possibilities offered by public transport in the city of Madrid. This involves planning routes that may include several stages in different modes of transport.

After searching all possible solutions to resolve this problem we could say that HTN-PDDL and JSHOP2 is apparently the best way to reach the objective proposed based on the studied algorithms. So we started to design the PDDL domain that represented the proposed problem and it was seemingly easy and powerful. Moreover the language is not flexible when it necessary to instantiate the predicates and functions describing the initial state of a problem, which is quite tedious and impractical, especially when defining the problems as our case in which initialization involves a large number of nodes.

2.6 Robust Algorithm for Real-Time Route Planning

Standard route planning algorithms usually generate a minimum cost route based on a predetermined cost function. Unfortunately, such a solution may not represent a desirable route for various mission scenarios. The routes are computed in real-time and are able to take into account various mission constraints including: minimum route leg length, maximum turning angle, route distance constraint, and fixed approach vector to goal position.

Standard route (in this paper the terms “route” and “path” are used interchangeably) planning algorithms usually generate a minimum cost solution based on a predetermined cost function (relating factors such as terrain features, threat locations, mission requirements, etc.). Unfortunately, such a solution may not represent a “desirable” route for many mission scenarios.

A desirable route can be considered a route that does not: 1) exceed the physical limitations of an aircraft, 2) exceed the threshold comfort level and/or workload of a pilot, or 3) violate mission scenario parameters. Our SAS route planner is an accurate, efficient, and robust algorithm that advances the state of the art for real-time route planning applications. The ability to introduce various route constraints during the planning process, as well as varying these parameters over the duration of a mission, makes the algorithm valuable for almost all types of intelligent guidance/navigation systems, including, but certainly not limited to air, land, and sea military craft. The uniqueness of our route planner is the combination of functionality and efficiency that it affords.

2.7 Route Planning in Transportation Networks

A variety of techniques provide different trade-offs between preprocessing effort, space requirements, and query time. Some algorithms can answer queries in a fraction of a microsecond, while others can deal efficiently with real-time traffic. Journey planning on public transportation systems, although conceptually similar, is a significantly harder problem due to its inherent time-dependent and multicriteria nature. The multimodal route planning problem, which seeks journeys combining schedule-based transportation (buses, trains) with unrestricted modes (walking, driving), is even harder, relying on approximate solutions even for metropolitan inputs.

For routing in road networks, in particular, modern algorithms can be up to seven orders of magnitude faster than standard solutions. Successful approaches exploit different properties of road networks that make them easier to deal with than general graphs, such as goal direction, a strong hierarchical structure, and the existence of small separators. These recent successes do not mean that all problems in this area are solved. The ultimate goal, a worldwide multimodal journey planner, has not yet been reached. Systems like Rome2Rio provide a simplified first step, but a more useful system would take into account real-time traffic and transit information, historic patterns, schedule constraints, and monetary costs.

TITLE	YEAR	AUTHOR	METHODS	ADVANTAGES	DISADVANTAGES
Utilizing real-world transportation data for accurate traffic prediction	2012	B.Pan U.Demiryurek C.Shahabi	ARIMA H-ARIMA HAM	Improves the accuracy of Predicting the traffic. Uses the average of previous data to forecast the future data.	Fail to forecast traffic during traffic peak hours and in cases such as accidents & road constructions. Cannot predict the speed changes in traffic
Path-Planning Algorithms for Public Transportation Systems	2001	Chao-Lin Liu Tun-Wen Pai Chun-Tien Chang Chang-Ming Hsieh	Path Planning Algorithm	Provides alternative travel plans.	Need to prioritize travel plans each time , when multiple ways for desired trip. Different stops having same name needs extra geographic information.
Mining traffic incidents to forecast impact	2012	M. Miller C. Gupta	k-NN classifier C4.5 tree	Defines candidate speed difference between normal flow condition and accident condition.	Need to investigate the variation of total delay each time. Need to monitor the congested area using cameras, is expensive & difficult.
A methodological approach for estimating temporal and spatial extent of delays caused by freeway accidents	2012	Y. Chung W. Recker	Log-rank test KM	Defines candidate speed difference between normal flow condition and accident condition.	Need to investigate the variation of total delay each time. Need to monitor the congested area using cameras, is expensive & difficult.
Route planning algorithms: Planific@Project	2009	Carlos Martín García Gonzalo Martín Ortega	SHOP JSHOP2 Dijikstra's	It was easy and powerful, when compared to the traditional one. Robust to model behavior.	No planner use it directly. It is quite difficult to solve some complexity.
Robust Algorithm for Real-Time Route Planning	2000	R J. Szczerba Peggy Galkowski Ira S. Glickstein Noah Ternullo	SAS	It is an accurate & efficient algorithm.	It supports only lower dimensional environments. Works on taking only cost as input.

TAB 2.1 LITERATURE REVIEW

3. CONCLUSIONS

The Route Prediction algorithm aims in predicting the routes available between various source and destination based on the live circumstances. The Route Prediction Algorithm achieves route prediction from source to destination by including transient nodes i.e., in between nodes for various multimode criteria combinations. The system provides optimal result for all user required Multimode & criteria combinations between the source and destinations. Provides real time traffic analysis between transient routes. Predict all possible routes for source & destination. Predict traffic for all possible distributed areas. Predicts routes along with traffic in global. Efficiently predicts traffic for all transient routes. Analyze real time traffic based on statistical data. It provides the transient routes between the source & destination including traffic for all possible user required multimode & criteria combinations. Achieve global traffic prediction by coordinating distributed entities.

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