A System Model of Travel Route Selection of Urban Transit Network

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ABSTRACT: *Urban public transport throughout the city transportation system is an important part of its development level is a measure of an important symbol of urban modernization, but also the best way to solve the problem of traffic congestion in cities. And to select the optimal route bus network model of urban public transport is an important subsystem, public transport priority guaranteed perfect, Rationalization of its urban land use structure has important significance. Now combine development level and trend of urban public transport system, the paper analyzes the public transportation system model structure, operating characteristics and timetables property, from network connectivity features characteristic transfer bus stops, bus lines and arcs characteristic time several charges aspects elaborate. Passenger bus travel will consider their own preferences, trip purpose a variety of factors, the external environment, the best network analysis based on the least time and obstacles the least time is the best path analysis, this paper expounds the GIS in urban traffic network the important function of the optimal path analysis, in the hope of using GIS network analysis technology to build urban intelligent traffic network system, provide a solid foundation for the development of urban facilities and based on their experience and the limited information on real-time access to comprehensive judgments. Papers from the passenger travel process starting behavioral psychology, analyzed the factors affecting passenger bus travel path selection principles and metrics, and analysis of empirical investigation of Wuhan bus, redefined the optimal path selection bus trip principle.*

Keywords: Urban Transit Network, Electronic System Model, Travel Route Selection

Received: 7 February 2017, Revised 5 March 2017, Accepted 12 March 2017

1. Introduction

Currently, the city's public transportation system of the prevalence of the following questions:

(1) *The number of transfers and more*. Reflect the public transport network in terms of self can not meet the demand of passengers, which is part of the passengers inconvenienced by the main reason [1]. (2) *The site coverage is low*. Causing peopleto take the bus is not convenient, walking distance too long. (3) *Vehicle time-consuming*. The reasons for these problems are many, the public transport network with the site layout is unreasonable, bus network density and density distribution does

not match the demand for travel, it is the decisive factor. In the bus system [2], the optimum path selection bus network model is the basis for operation, therefore, the public transport network model was evaluated to optimize public transport network, and identify the optimal travel route is to improve the public transport system and bus passenger service levels attract rate lies, it is the most economical, most effective means. Reasonable bus network structure [3, 4], to improve the overall efficiency of the system, Shorten travel time residents, Reduce transfer times, Equalization bus passenger flow will have a positive impact [5].

2. Basic data organization of transit network model

Geographic information systems, often the space into something abstract point, Line, Surfaces and other geometric elements. Point, Line builds topology, you can form a network. On the network side by a geometric composition, the endpoint side, Intersection nodes of the network [6].

The figure is an important and complex data structures. Online-shaped table, only a linear relationship between data elements, each data element has only one immediate predecessor and a direct successor; in the tree structure, and there is a clear hierarchical relationship between data elements, and data on each layer possible element and a plurality of elements in the next layer (i.e., its children nodes) associated, but only one element and the upper layer (i.e. its parent node) associated; in the graph structure, the relationship between the nodes can be any in the figure are possible correlation between any two data elements.

Bus Station bus terminal station and in the middle of the site, the site is divided in a general intermediate intermediate station and transfer station. Bus terminal stations are an important part of the public transportation system, it's reasonable to set up and layout can improve the public transport share, rate and extent of convenient bus travel, reducing the amount of traffic on a road vehicle, help to solve urban traffic problems. The bus station in the middle of the urban public transport formed an important support point, the surrounding region has a strong attraction and radiation, the general arrangements for the transfer station three or more public transport links to the hair station, could take different forms, there are usually arranged certain facilities and operations management scheduling the necessary logistic facilities, centralized compact layout requirements, can be multi-layered and three-dimensional convergence transfer, so that people and vehicles, eye-catching signs, reducing the transfer distance as possible, convenient and comfortable. Reasonable arrangement of urban public transport intermediary site in order to create a higher level of public transport network.

The connecting link between the bus station can be unidirectional or bidirectional, according to the nature of the use of points, can be divided into general urban transport lines and special bus lines. Path analysis is a hotspot of research on GIS network analysis, is one of the basic spatial analysis methods of GIS software, is a core function in geographic information system, usually can be understood as the optimal path. On the cross Pass network path analysis, according to the given weights in the network path is different, the shortest path problem can be divided into the distance, time, asked the shortest path [7].

The topic, the fuel consumption minimum path problem, minimum cost path problem, which is safe comfortable. The optimal path problem and so on. In general, the shortest path is big.

Most people are of particular concern, therefore the best route for the shortest time analysis has become GLS focuses on one of the problems. By far the most common application path analysis model based on network traffic model is generally sections of actual abstraction for an edge of the network, to the edge of the weights to represent the cost of connectivity between two points for travel time, speed, road length, etc., to find out a point on the transportation network to the other as the sum of the cost of connecting the smallest path as the best path. In a sense, the optimal path is actually solving conditional, the weight of the shortest path.

In many of the shortest path algorithm, Dijkstra algorithm because of its can adapt to the change of network topology, and stable performance, so the most short circuit in GIS.

Path analysis to get a more extensive application Dijkstra algorithm the basic idea is to start a soup as a root node, iterate through all the shortest distance from ‰ or adjacent node with the shortest time traverse gradually, gradually, adjacent to traverse all the nodes it again, until the target, so that each node) (I) the smallest distance or least time path.

Is looking for such a path, the shortest distance between two points or

The least time, i.e., *D*/*st* = rain Topology analysis of geographic information system is in the description of the spatial location relationship between geographical elements, and the spatial location relationship between geographical elements.

Abstract for the spot, the line (or arc), the surface (polygons) geometry of space between each other.

Relationships, including point and point, point and line and point and plane, line and.

line, line and plane and The relationship between surface and surface and so on 6 kinds of The main function is to topology analysis.

The 6 kinds of spatial relations organically integrated, of spatial entities such as point,

Line, face adjacency between, containing, coverage, phase and phase space position relations is described. To create a topological relationship can be truly said of geographical elements, to better describe the geographical phenomenon in the real world, topology relationship can clearly reflect the logical structure of the relationship between geographical entity, it than just empty.

Between data have greater stability, not change along with the change of map projection. In an ArcGIS topology analysis of spatial data, must pay attention to participate in the topology created elements are to be in the same data set, and the need to define the topological rules, topology hierarchy and a topology tolerance Geographic entity [8].

In the traffic network topology analysis plays a decisive role in the optimal path analysis, is the foundation of network analysis, topological relation of vector data is the necessary data source network analysis. Before the network analysis, therefore, must to transport vector.

According to the topology analysis, topology analysis in ArcGIS tool. Traffic network topology analysis is mainly the relationship between nodes and sections.

Build, specific performance of the node and the relationship of the road and road sections and asked.

3. Public transport network optimal path selection

Public Transport Network Optimal Path Selection is the key technology of urban public transport inquiry system. Urban public transport inquiry system is the most important function is in the passenger is given from the endpoint to automatically generate the optimal travel route program for passengers, with a theoretical model to generate the optimal travel route search is to find the passengers traveling in the bus network selection or distribution of road network, research and build more realistic models, in favor of a more rational allocation of bus passenger results [9].

For the average shortest path, as long as there is an edge between two vertices, it can be searched, without regard to the cost of the transfer path, and if so calculated in the public transportation network, it is possible to obtain search result the shortest path to transfer to several bus. So for bus travel are concerned, the shortest path to universal significance, for travelers, but not the best choice. For travelers, in the travel route change is a very sensitive element, if the shortest path distance value, but must be transferred several cars to get; and the other from a long path, but as long as the route to fewer transfers You can reach the passenger is bound to time and money it takes to transfer the process into account. This article focuses on the transfer factors to consider in a public transport network in some of the shortest path problem.

In order to facilitate the large-scale applied to the actual transit network, the paper by means of relational algebra operation simple, fast database technology to achieve the advantages of using TransactOSQL language programming ideas and databases running on the server side and can improve operational performance, efficient storage process technology, the design is simple, efficient computer algorithm algorithm main ideas: the travel decision model to achieve two goals hierarchical computing, which is to use TransactOSQL language stored procedures in relational algebra relevant operation direct to arrive, transfer 1, 2 transfers travel program and direct travel options, 1 transfer travel options and travel decisions 2nd transfers program sequentially stored in a database table zhida_fangan_trip, trans-fer_one_time_trip and transfer_two_time_trip table, and then write a stored procedure with parameters sequentially solving the optimal travel program table zhida_fangan_trip, transfer_one_time_trip data structure as shown in tables 3 and 4, table transfer_two_time_trip data structure (See figure 1).

Figure 1. Travel site analysis diagram

Specific step algorithm is as follows:

Step 1: Create departure site and destination site with a stored procedure parameter;

Step 2: identify all sites after the initial starting line set # line_set_1, to find the route to your destination through all the sites from the table set # line_set_2 line_stop from the table line_stop;

Step 3: to set # line_set_1 and # line_set_2 intersected get set # line_set_3;

Step 4: # line_set_3 determine whether the collection is empty, that the temporary table # line_set_3 whether a record, if not empty, then the existence of the program starting from the travel destination site directly to the site of departure, and the program stored in the database table for reaching program zhida_fangan_trip in turn step13 if it is empty, turn step5.;

Step 5: # line_set_3 empty indicates there is no direct line of travel to identify the presence of line set collection # transfer_stop_set_1 # line_set_1 all sites, find the line set collection # # line_set_2 all sites transfer_stop_set_2.;

Step 6: The site collection # transfer_stop_set_1 and # transfer_stop_set_2 intersected was set # transfer_stop_set_3;

Step 7: determine whether transfer_stop_set_3 # set is empty if it is not empty, then the collection is transfer_stop_set_3 # 1 transfer site collection, transfer step8;. If empty, the transfer can not be represented by a single destination, turn step10;

Step 8: Get 1 transfer travel plan: Find out after 1 transfer site collection # transfer_stop_set_3 all line set line_set_4 (specific implementation database table in which only stop_name a site name field);

Step 9: identify and set # line_set_1 intersection line_set_5 set line_set_4 (the specific implementation of the database table in which only line_name a line name field) is the 1st line set by car; identify and set line_set_4 # line_set_2 intersection line_set_6 (concrete realization database table in which only line_name a line name field) is the 1st set of transfer line; in accordance with / start site a) 1st car line R1 (set)) 1st transfer station B0 transfer mode and site a and site B in the line R1 serial number size is determined whether the line is feasible (for example, 3-way (eastbound) line may then 3 Road (westbound) lines may not) to obtain 1 transfer scheme program before the half, the second half of the program and so on, and finally the trip feasible 1 transfer program stored in the database 1 transfer trip scheme table transfer_one_time_trip in .

Step 10: find 2nd trip transfers program: find out through the site collection # transfer_stop_set_1 All lines either site collection # transfer_line_1, find out through the site collection # trans-fer_stop_set_2 any one of these sites all line set # transfer_line_1; identify and set # transfer_line_1 # transfer_line_1 intersection #transfer_line_one, is the 1st transfer line set;

Step 11: If the collection #transfer_line_one is empty, turn Step15, otherwise, turn Step12;

Step 12: find the 2nd transfer program transfers the 1st set #transfer_line_one all site collections #temp_transfer_stop; identify and set #temp_transfer_stop # transfer_stop_set_1 intersection # transfer_stop_11, is the second transfer trip scheme 1 secondary transfer site collection; identify and set #temp_transfer_stop # transfer_stop_set_2 intersection # transfer_stop_21, is the second transfer trip scheme 2nd Ride site collection; after collection # transfer_stop_21 identify all the lines set # line_set_12; identify and set # line_set_12 # line_set_2 intersection #transfer_line_two, is the second transfer line second

transfer trip scheme set; find out after 1 transfer station set # transfer_stop_11 all line set # line_set_10, find out set # line_set_10 and # line_set_1 intersection was secondary transfer trip scheme 1st bus line set # line_set_11, is determined in accordance with step9 reasonable travel route (or link) to find a way to travel twice to change the program stored in the database take mobility options in the table transfer_two_time_trip.

Step 13: created with input and output parameters for each stored procedure required travel distance travel programs;

Step 14: find the best travel route calculated according to the travel distance, the algorithm terminates [10].

Step 15: no bus travel scheme 2nd transfers within recommended to choose other modes of transportation to travel, the algorithm terminates above steps set operations in a computer algorithm implementation process have said before the corresponding database table (table), the table name plus a # symbol indicates a temporary table in the database, otherwise database permanent table (or object), algorithm steps set operations are only a single SQL statement can achieve set operations, such as Step2 and Step3 concrete realization statement is as follows :

SELECT line _ name INTO # line _ set _ 1FROM line_stop WHERE stop_name = @ begin_stop_nameSELECT line _ name INTO # line _ set _ 2FROM line_stop WHERE stop_name = @ end_stop_nameSELECT line _ name INTO # line _ set _ 3FROM # line_set_1 WHERE line_name IN (SE -LECT line_name FROM # line_set_2).

With SQL Server in TransactOSQL language to write a stored procedure in a program running on the server, stored procedures, data processing will be moved to the more recent data from the place, which will effectively ensure the efficiency of a computer algorithm.In recent years there have been some new method to research of urban space development, in view of the urban space of street network topology analysis is one of them. This method will, therefore, this article also draws on the study of taiyuan urban spatial expansion into the study of taiyuan urban street network, and indirectly, the analysis of taiyuan city spatial expansion. In this part of the study, this paper mainly through the downtown streets, in taiyuan in 1985 and 2004 figure on the spatial analysis, considering the urban main road and secondary trunk road of urban space expand the influence of different, therefore, first of all, according to the latest developed street classification method to classify taiyuan branch or more of the city's downtown streets, with different properties and use computer to deal with figure, and then to deal with a good figure partition directional analysis, through the study of the change of urban street in taiyuan city in recent 20 years of urban spatial expansion. Urban spatial expansion refers to the city of the three dimensional space occupied by the city built and showed a trend of increasing, which includes both urban internal spatial structure reorganization, including the external expansion of the city proper. A city's spatial expansion has its inevitability and objectivity, factors affecting urban spatial expansion is also many, including the city's own natural factors, social economic factors, political and policy factors, urban outer region, and many other aspects. Road intersection, port, etc., its state properties include resistance and demand. The Node has the following several kinds of the common types: (1) Ban flow point in the network chain, such as traffic barrier. (2) *The corner points*. Appeared on the division of all nodes in the network chain state resistance properties, such as the turning time limit and traffic rules limit (e.g., are not allowed to turn left, etc.). (3) *Center*. It is accepted or the location of the allocation of resources, such as business center, power stations, etc., its state is 7 including resources, resistance to limit the source (such as logistics, business center, etc.). (4) Site. Point increase or decrease in the transport chain resources, such as warehouse, car *site* (5), etc. After collecting data traffic roads and nodes, build an Attribute structure of spatial data, see table 2. The number of spatial data and attribute the requirement of transportation network construction level is a big difference.With the improvement of the level of urbanization in our country, gradually expanding scope of city proper, population and industries are concentrated gradually in the city, people in the city of activity frequency increasing, this gives the urban traffic in China has brought an unprecedented pressure. At present, our country's various medium cities are faced with larger.

The traffic pressure, directly affect the development of urban economy and people's travel. So, optimize the urban traffic structure, construction of the urban traffic network model, analyses the best route traffic network, select the optimal travel route and parties.

Model fit and unfit quality directly related to the success of subsequent analysis, it is the key to the whole work can be normal.

4. Conclusion

Public transport system is an important part of the urban transport system, the implementation of bus priority help alleviate the increasingly serious road traffic tension. Select the optimal route bus network model based on urban public transport system is

an important part of establishing high-quality public transport network, to meet the actual needs of the passengers optimumtravel route choice is to improve the efficiency of the urban transport system, reduce travel time and space consumption, identify effective ways of public transport dominance, its research and more attention of domestic and foreign experts. After analyzing the current situation Optimal path algorithm based transit network model on the basis of domestic and foreign, for evaluation of urban transit network model and its optimal path selection algorithm explored.

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