GEOSPATIAL WORLD FORUM
18 - 21 January 2011, Hyderabad, India
Theme
Dimensions and Directions of Geospatial Industry

PAPER REFERENCE NO.: PN-250

GIS Based Transit Information System for Metropolitan Cities in India

Pal, Sarvjeet. [a] and Singh, Varun.[b]

[a] M. Tech. (GIS & Remote Sensing); GIS Cell; Motilal Nehru National Institute of Technology, Allahabad- 211004, India (E-mail: sarvjeetpal.it08@gmail.com)

[b] Asstt. Professor, Department of Civil Engineering; MNNIT, Allahabad, India (Tel: +91-532-2271325(O), +91- 9473956924 (R), E-mail: vsingh.ce@gmail.com, varun@mnnit.ac.in)

KEYWORDS: Transit Network, ATIS, CTIDSS

ABSTRACT:

Transition countries with growing traveler infrastructure, lack mechanism to disseminate transit information for general traveler use. The lack of effective and efficient schedule-based information system for transit networks has limited the application of GIS in transit trip planning services. This paper introduces a GIS based information system for transit networks. Transit networks are defined as possible paths that satisfy the acceptable time criterion. Transit data is related to bus schedule and bus route information. This data is used for Information generation and dissemination about:

(i) available buses from different bus stops,
(ii) bus route planning
(iii) bus route information

By availing the powerful GIS functionalities of proposed system a user can query for transit information and allow the interactive system to assist him in the decision-making process regarding trip planning and related information as discussed above.

This paper provides a systematic overview of a GIS system that can be used for structuring, storing and dissemination transit information.

Pre management strategies provide the pretrip and/or en-route information to the travelers about their travel options so as to influence their travel behavior about time of travel, route transit choice etc.

1. INTRODUCTION:

With the speedy improvement in road infrastructure of developing countries, urban traffic is continuously increasing. A country's transportation system represents development stage of country. But at the same time highly developed countries are facing higher problems of

transportation management and spending lots money and effort for solving those problems. Further, due to unavailability of an integrated traveler information dissemination medium in metropolitan cities in developing and transition countries such as India, travelers are not well aware of spatial and temporal variations in traffic and road conditions.

The application of GIS to a diverse range of problems in Transportation engineering is now well established. It is a powerful tool for the analysis of both spatial and non-spatial data and for solving important problems of networking.

Travelers having access to real-time traveler information in advance can avoid traffic congestion and select travel options regarding mode, route, and time of their trip. Developed countries such as the United States, Canada, Japan, U.K., Australia, Germany, etc. have adopted ATIS technologies expeditiously, for example, 511 services in the United States. On the other hand, social conditions in developing countries are quite different from those in developed countries

National and regional state transport authorities in India have been monitoring traffic and collecting traffic data as part of their traffic management strategies for many years, but generally they do not often share the collected information with travelers and when they do, it is provided as is i.e. without processing in order to finally provide value-added service to the public.

Shortest path analysis is an essential precursor to many GIS operations. So far there is not a widely recognized schedule-based routing algorithm for the transit network. With the growing demands for online transit trip planning services, it is imperative to develop an effective and efficient path finding algorithm for transit.

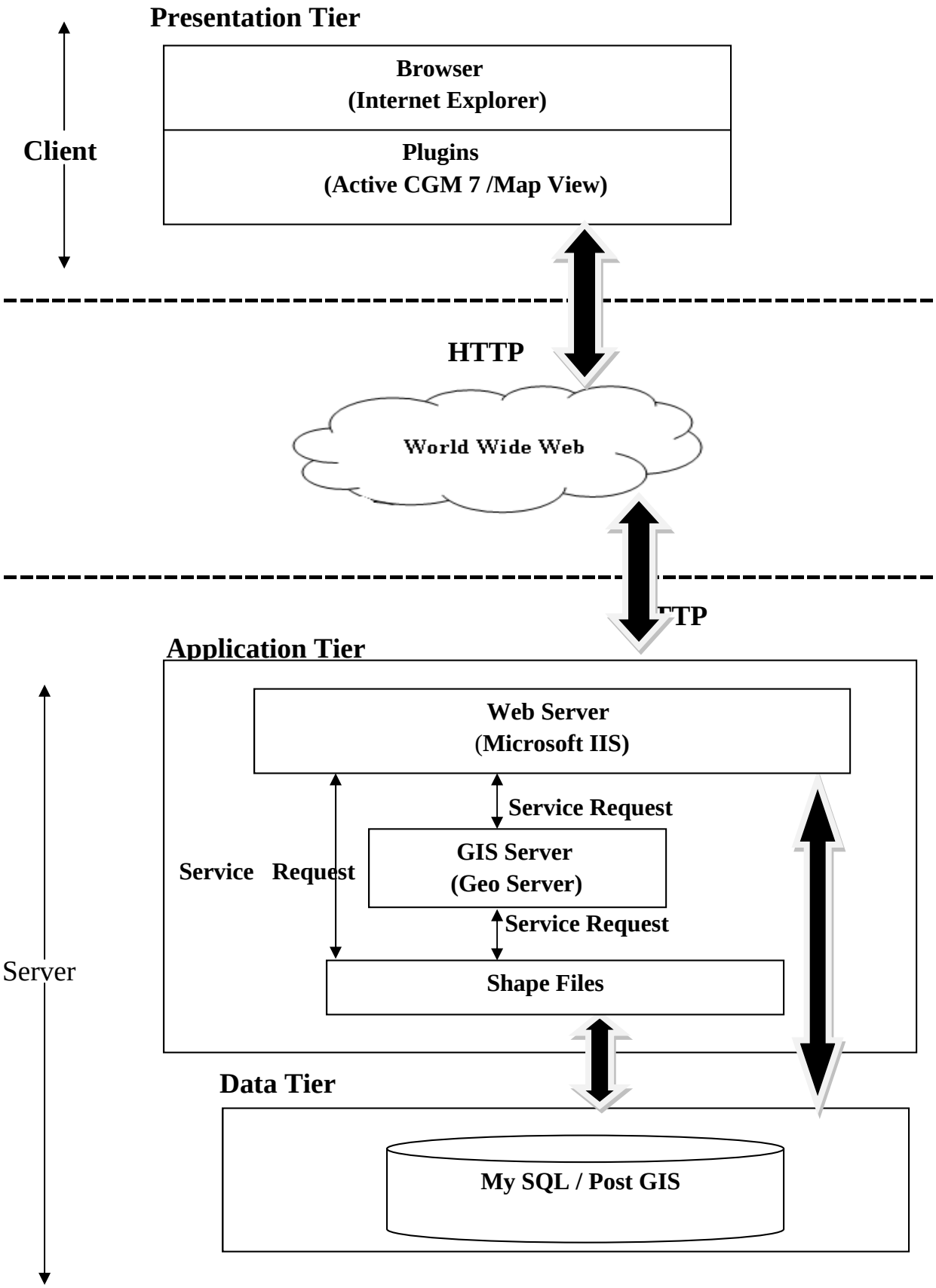
2. DESCRIPTION OF PROPOSED SYSTEM:

We propose a web GIS based system for analyzing and disseminating pretrip traveler information for a typical metropolitan area (in this study in India but with the ambition to provide a rather universal approach), which carries real-time information handling capabilities.

2.1 THREE- TIER ARCHITECTURE:

Three-tier client-server SW architecture has been adopted as a logical architecture for developing the ATIS. This architecture logically partitions major functions into three tiers. These three tiers are: _1_ presentation tier _user interface, _2_ application tier _data processing and information generation rules_, and _3_ data tier _for data storage and management. The Architecture is as shown in Fig.

Fig: Three-tier client-server architecture:



2.1.1 Presentation tier:

The Presentation Tier will consist of the end-user application program that travelers will use to interact with CTIDSS (Computerized Traveler Information and Decision Support System). For CTIDSS, the end-user application program will be in the form of an interactive web interface website that will be accessed by the travelers using Internet browsers like Microsoft's Internet Explorer, etc. Browsers will be coupled with web Plugins or add-ons these are the ActiveX controls or Java applets that run on browsers so as to publish map returned by Geo server after geospatial analysis. For more advanced geospatial analysis like shortest path generation, searching features with some spatial and parametric constraint, web interface will pass on request to web server and web server will then pass on the request to a Geo server through server connector. Subsequently map server will carry out processes in a following sequential manner:

1. Processes the client's request by carrying out geo-spatial analysis based on user request and by carrying out computation on data stored in data tier.
2. Generate a map graphic.
3. Convert the graphic to web format.
4. Wrap the image in HTML /XML.
5. Send it back to the web server, which then returns the response to the client as a standard web page.

2.1.2 Application tier:

Application Tier will be sandwiched between the Data Tier and the Presentation Tier and is an important component of the CTIDSS architecture. The components in the Application Tier handle the requests of the user and process these requests on the data in the data tier to give a timely response. It will consist of the Web Server, Server Connectors and the Geo Server. The Web Server will handle and transfer the clients' requests that are subjected to geospatial analysis and processing on Geo server. The Web Server will also forward the response back to the requesting client. The Geo Server will process client requests handed to it by the Web Server. It will access the spatial data, performs geo-spatial analysis and renders web-ready map as vector or raster image.

2.1.3 Data tier:

The Data Tier will be concerned with storage and management of spatial information (along with associated attribute data) of road network topology of area and features of interest. Attributes for road network also include the temporal information that is varying throughout the day. Temporal information is the real-time information pertaining to prevailing traffic conditions (vehicle speed limit, congestion level etc.) and incident conditions like road blockage, construction zone, bad road condition, congested road, accidents etc. and information regarding schedule of operation of public transportation like Buses, Mass Rapid Transportation Systems (MRTS) etc.

2.2 NETWORK TOPOLOGY:

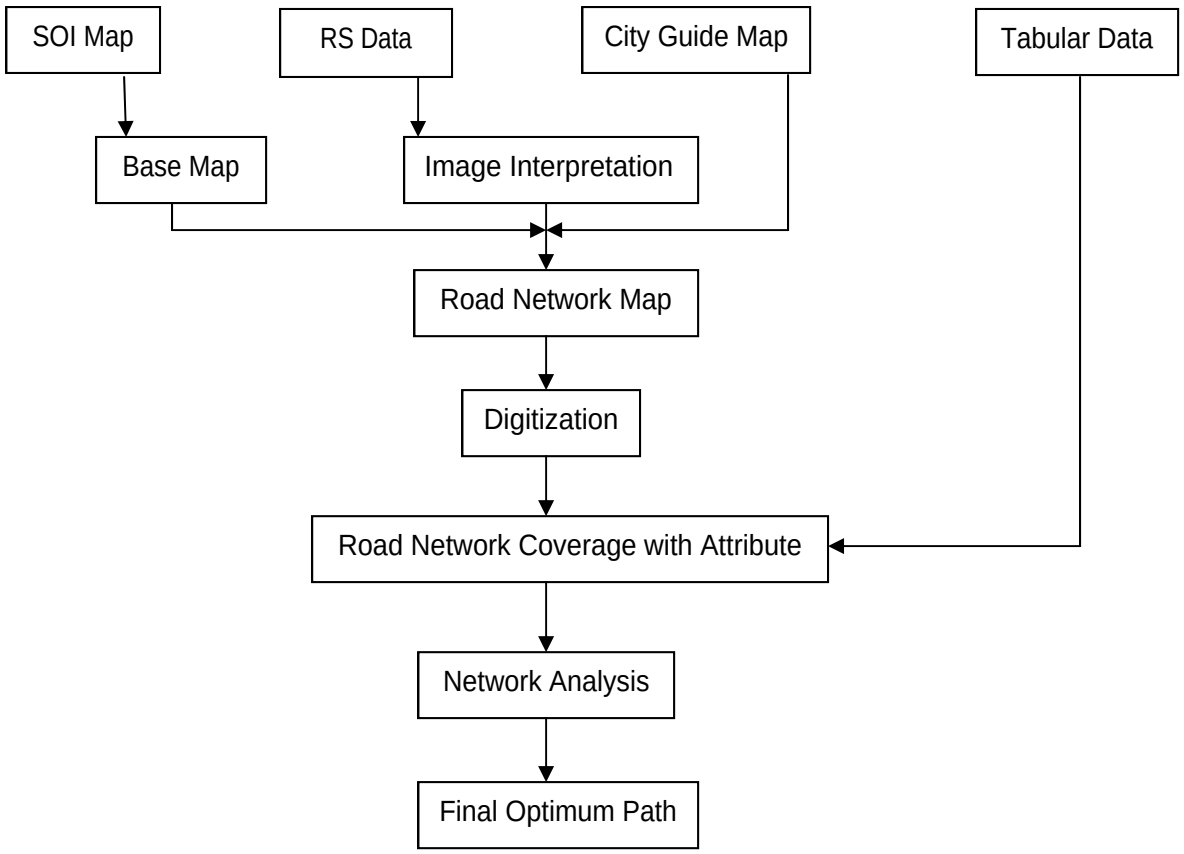
For vehicle routing, in real world, road network is conceptualized as the well-defined arc-node model. Arcs or roads are connected to each other at nodes (intersections). This arc-node model or network topology will form the basis for vehicle routing. Impendence or cost for traversing an edge will be calculated separately for different lanes for each edge and average of them are taken for each direction. Further impedance offered by turning movement for one edge to other is maintained in a separate table.

3. OBJECTIVES OF PRESENT WORK:

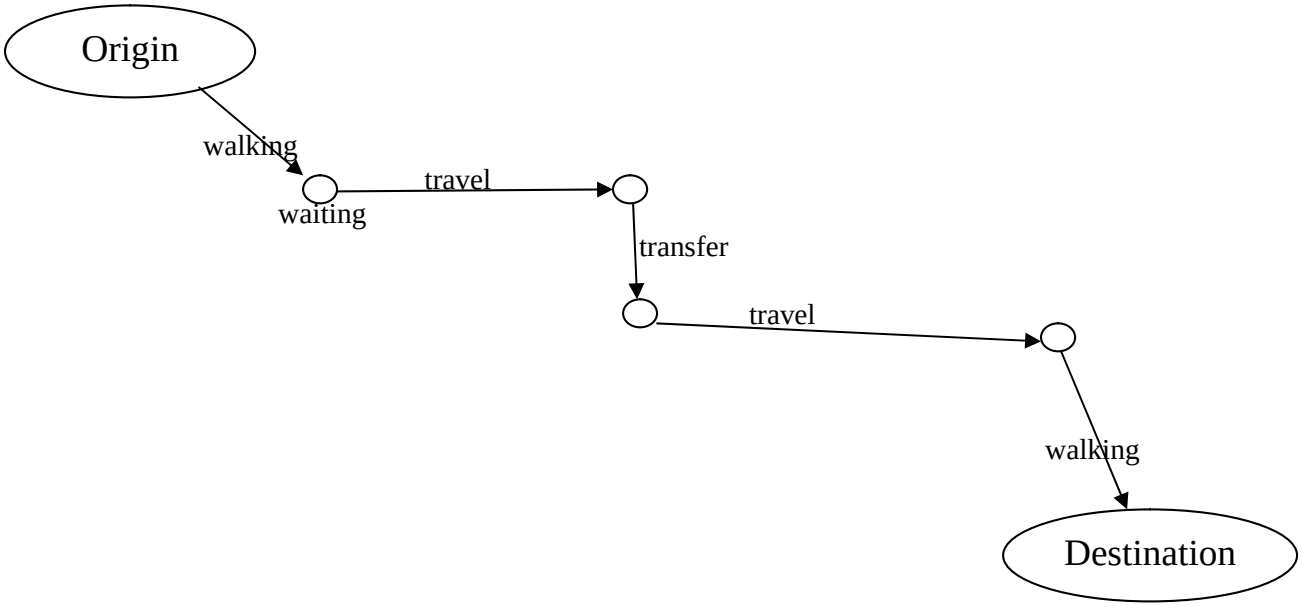
The prime objective is to determine the optimization of transport service using GIS network analysis techniques for the area. An ATIS (Advanced traveler information system) has been developed based on proposed architecture for structurally storing and analyzing the spatial, including associated attribute data and disseminating the value-added traveler information. This approach allows the developers to take advantage of knowledge gained from both the previous development in terms of consistency, content, and usefulness of traveler information to be used and improved upon in current iteration of development. Key steps in the process were to start with a simple implementation of a subset of the SW requirements and iteratively enhance the evolving sequence of versions until the full system is implemented.

4. METHODOLOGY ADOPTED:

To develop a methodology for route optimization in GIS environment and to determine the optimal routes between various origins destination points. The schematic flow chart of the ATIS is shown in Fig.



4.1 Components of a trip:



5. CONCLUSION:

In this paper, we proposed a conceptual architecture of a traveler information system for a metropolitan city in India. This web GIS based system, namely Computerized Traveler Information and Decision Support System, or CTIDSS will not only assist travelers in route but also prevail roadway and traffic condition and schedule of operation of public transportation in real time. The three-tier conceptual architecture independent of actual implementation offers easy scalability and low maintenance costs and exploits rich functionalities of Geographic Information System (GIS) Private and public sector can collaborate effectively and beneficially so as to provide traveler information to travelers.

The web-based transit information system design that uses Internet Geographic Information Systems (GIS) technologies to integrate Web serving, GIS processing, network analysis and database management. A path finding algorithm for transit network is proposed to handle the special characteristics of transit networks, e.g., time-dependent services, common bus lines on the same street, and no symmetric routing with respect to an origin/destination pair.

The resulted path is a schedule coordinated fastest path for given constraints including origin and destination with a planned departure time or an expected arrival time.

6. FUTURE SCOPE:

ATIS can be provided with several Routing systems to allow users to select from one of several travel objectives used to direct the path search. Typical options include minimizing travel time, minimizing travel distance, and maximizing use of freeways links. In the future, when the integration of highway systems with real-time traffic surveillance and control strategies will take place in India, this ATIS can be modified to provide route choices based on actual or predicted traffic conditions with the help of real-time data acquisition from equipped road networks.

7. REFRENCES:

PAPERS:

- Zhong-Ren Peng, Comp. Environ. and Urban Systems. Vol. 21, A Methology for design of GIS- based ATIS.
- Ruihong Huang, A schedule-based path finding algorithm for transit network using pattern first search. Geoinformatica (2007)
- Varun Singh, Praveen Kumar, web based ATIS for developing countries. JOURNAL OF TRANSPORTATION ENGINEERING © ASCE / SEPTEMBER 2010 / 845.
- Praveen Kumar, Varun Singh, Dhanunjaya Reddy ATIS for Hyderabad city. IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS, VOL. 6, NO. 1, MARCH 2005.
- Mukti Advani, B.Srirama, Improvement in transit service using GIS-Case study of Bhavnagar State Transport Depot.
- Chuanjiu, W., and Zhaosheng, Y. _1999_. “Development of an internet based trip guidance system,” Proc. Int. Conf. on Vehicle Electronics, IEEE, Changchun, China, 278–281.
- www.sciencedirect.com.

Full Details about the Author for Map India 2010

Paper Reference No.: PN-250.

Title of the paper: GIS based Transit Information System for Metropolitan Cities in India.

Name of the Presenter: Sarvjeet Pal.

Author's Affiliation: M. Tech. (GIS & Remote Sensing) Final Year Student from Motilal Nehru National Institute of Technology, Allahabad (U.P), India.

Mailing Address: GIS Cell, MNNIT Allahabad -211004, U.P., India.

Email Address: sarvjeetpal.it08@gmail.com

Telephone number: +91- 9621398208

Author's Photograph:

Brief biography:

I, am Sarvjeet Pal, M.Tech final year student GIS and Remote Sensing from MNNIT Allahabad. I completed my graduation in Information technology engineering from Jabalpur Engineering Collage Jabalpur, (a Govt. institute – affiliated to RGPV, BHOPAL, India) with 69.31% marks in the year 2008. My intermediate and matriculation is done successfully from CBSE Board. My native place is Lucknow. My area of interests is in my core field like Web GIS, Open source GIS Software, Software Engineering.