DEVELOPMENT OF AN INTERMODAL INFORMATION SYSTEM FOR CHENNAI CITY

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ABSTRACT

Transportation planning is changing its face from evolving new transportation facilities to that of developing strategies that promote efficient use of the existing Transportation infrastructures keeping Environmental protection as high priority. Emphasis on Planning methods and procedures that address requirement of people and reach them through proper information system are the need of hour. Intermodal travel and transfer facilities play a vital role in the changing scenario of transportation of a city leading to efficient usage of existing modes of transport. For achieving effective Transportation using various modes of transport for a trip, it is very important to have proper Information system that helps the users in understanding the routes, costs, time and such parameters prior to their journey.

The data needed for development of such information system is network specific. Geographical Information System (GIS) provides a perfect platform to develop such a kind of information system. The use of GIS provides a generic, user friendly and visually attracting environment aimed to provide a quality information service to the users in all the stages of travel.

This paper attempts to describe the procedure for such a system to be designed with an example of a case study. Intermodal Information System for Chennai city in India developed by Author(s) benefits the trip makers by assisting them to optimize their trip costs in terms of time and distance from any origin to any destination.

BACKGROUND

Many of the world's populous cities are in Asia, especially in India and China. About a quarter of India's population is residing in urban areas. Numerically that is about the whole population of USA. At least 23 Indian cities have over million residents. Delhi, Calcutta, Mumbai and Chennai are the four main cities of India. The first three cities have over 10 million residents each. The next city gearing up to such levels of population is Chennai. The population of the Chennai Metropolitan area (CMA) is about 75 lakhs (i.e., 7.5 Million) as per the 2001 census. Public transport service for Chennai includes buses operated by Metropolitan Transport Corporation (MTC), suburban trains and MRTS trains operated by Southern Railways. The rapid growth in private vehicle ownership and IPT over the past two decades is demanding large road space and resulting in increase of road accidents. This can be attributed to deficient network connectivity, lack of proper information, increased waiting time and over crowding in public transport which encourage the use of personalized modes by causing damage to the environment. This problem of inefficient usage of the modes of transport can be solved by means of integrating different modes of transport giving priority to public transportation.

Integration of different means of transport is best obtained by disseminating the information on availability of public transportation / other mode for a particular origin and destination pair. This can best be achieved by pictorial format rather than verbal format. Hence, a system that can give Information in pictorial form, specifically, based on network is needed.

OBJECTIVES OF SYSTEM DESIGN

The design of Intermodal Information System is aimed at achieving the following objectives –

- To analyse and address the traveler needs in the field of intermodal information.
- To develop a systems to give the information for the travelers about planning a trip and for managing the connections.
- To install in an appropriate location

INTERMODAL INFORMATION NEEDS OF USERS

Trip making can be considered as a dynamic process within which the user has to coordinate different tasks like planning, tracking and assessment. *Planning stage* defines the way in which the tasks must be performed to attain the goals of the trip. This is the stage prior to start of the trip. Each user (trip maker) has different criteria like time, distance, money etc pertaining to his/her personal context and reasons for making the trip.

In the next stage known as *Tracking Stage*, during the trip making, the user tries to track the routes, modes, which are considered in this trip making. In the next stage, *Assessment,* the user acquires experiences from his travels and attempts to apply the knowledge to prior to his next trip. Thus, the whole process is a loop with assessment task influencing the planning and tracking for the next trip. The dynamics of trip making can be pictorially presented as shown in Fig 1.

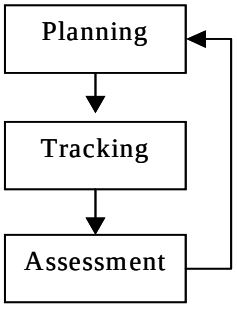

Figure 1. Dynamics of Trip Making

Considering the dynamics of trip making the information required for a user can be classified into three types as –

- Pre-trip information
- On-trip information
- End-trip information

The information required prior to the start of trip is termed as Pre-trip Information. Pre-trip information is required essentially in the planning stage of the trip. This is the instance when the user prepares for his future trip. The planning step defines the way in which the task must be carried out to achieve the goal of the Trip. In particular, at the planning stage the user determines which activities should be carried out, and in what sequence.

The information required during the trip is called as on trip information. This information is the essential at network entrance with different connections / routes until the exit of the vehicle.

The information required from the exit of the vehicle to the final destination is called as end trip information. The end-trip information concerns the link between the network and the activity center.

Apart from regular trip makers, the old (age) user and occasional users, particularly, prepare their way from the station to their destination prior to making the trip, writing down notes or even drawing sketches of these ways. Intermodal Information System will help in avoiding the feed back loop in Figure 1 as presented above. The information requirements of users (trip makers) at various stages of their travel are given in Table 1.

Table 1. Information Requirements of User (trip maker) at Various Stages

Trip Stage	INFORMATION NEEDS
Pre-trip	Network information like time, price, mode and etc., Information about links between public transport and city; public transport and private transport Advice and planning help
On trip	Waiting time Pricing Transfer information Destination information Links between city and public transport network
End trip	Links between network and city (Door-to-Door logic)

INTERMODAL INFORMATION SYSTEM DESIGN

The design of the Intermodal information system is dependent on the area to which it serves. In the present case, area selected to install the system was in Central Business District (CBD) of Chennai City, Parrys corner. Parrys corner is a well-known hub for commercial activities in the city. The location at which the system to be installed was taken as bus stop opposite to the Bar Council of Chennai High Court near NeoRanga Vilas Hotel. This place was selected to install the system for its unique features. The location is accessible by both the public transport modes viz. Train and Bus. Starting points of two routes of sub urban trains are very nearer to this location. Since it is CBD with proximity to High Court, the percentage of non-resident Chennai travelers was high. It was decided to develop the system in this location to facilitate the trip makers to plan for their trip in advance and to optimize the travel cost (Time / Length).

The design procedure for the system is given in self-explanatory flow chart shown below in Fig 2. The "ArcAvenue" Programming language is used to develop the system.

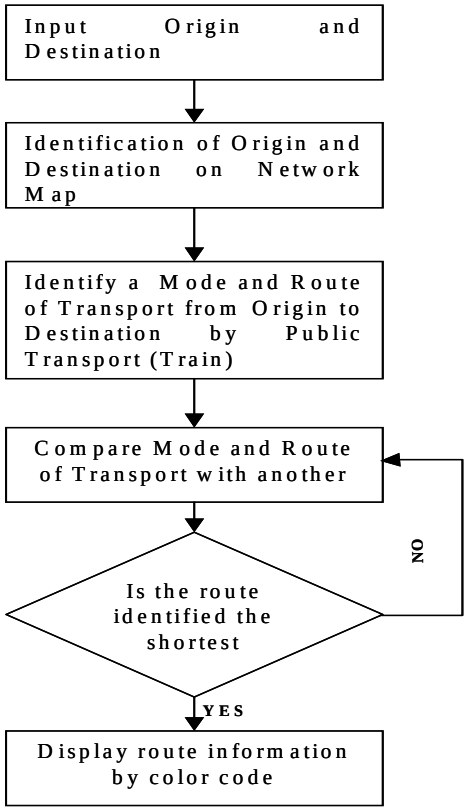

Figure 2. Flow chart for the Design of System

Information System has to consider all the network options available and all the modal transfer options available between any origin and destination. Hence, a huge data base needs to be developed as Base map with all the features available within by a query. The critical part of the design is the determination of shortest route for a trip based on the choices of the users.

An opinion survey was conducted to fix the criteria for the choice of mode selection with respect to distance of travel and time from a origin point to origin station and destination point to destination station. A sample of hundred users were interviewed at four existing railway stations namely Guindy, Mambalam, Thirumailai and Perambur by using structured questionnaires to determine the user choices in preferring the modes for trip making. The results of the survey are presented in Figure 3 below.

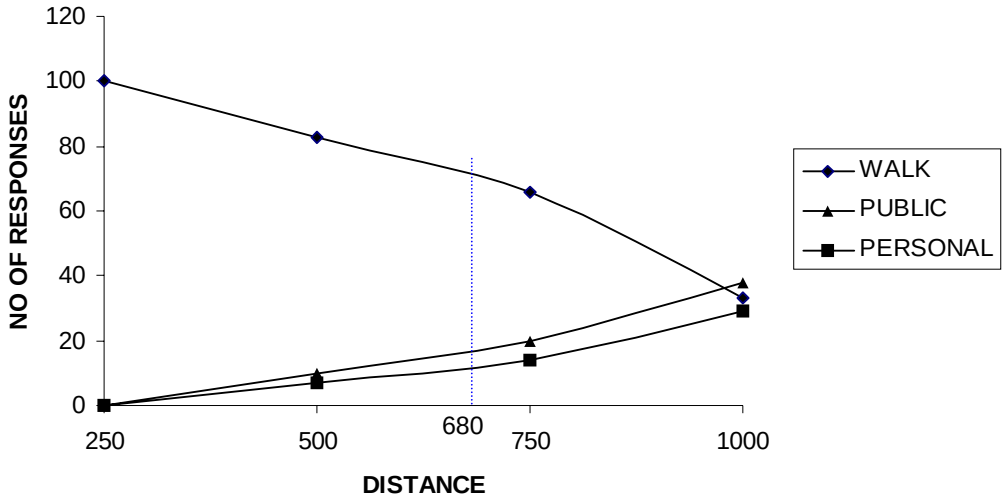

Figure 3. Results of the Opinion Survey

Analysis of the interview survey has revealed that more than 75% of the respondents prefer to walk up to a distance of 680 m. Hence the criteria for the choice of mode are set as given in Table 2 below.

Table 2. Criteria for Choice of Mode

DISTANCE TO STATION	CHOICE OF MODE
Up to 680 m	Walk
680 m and more	Public or personal mode

BASE MAP CREATION

The base network of Transport links was prepared with the help of the commercial available map of scale 1:25000 as reference using the GIS software, ArcView. The map was then projected to real world system with all the features along with location of the existing activity centers entered into the network. The database for the base map was built in ArcView separately for each theme. Separate tables were fed into database for the train details obtained from railway timetable. The travel time for each link was built as additional field in the attribute table of road network. The program for the Information System is written using ArcView Avenue programming language and the specific Graphical User Interface (GUI) was developed for the Information system. The thematic maps included in this study for better presentation and easy identification of places are given in the Table 3 below.

Table 3. List of thematic maps in base map

S.No	FEATURE	NAME OF THEMES
1	Polygon	City boundary Greeneries and Water bodies
2	Linear	Rail network and Road network
3	Point	Railway stations Bus stops Places of interest Hospitals Temples Churches Mosques Consulates Police stations Hotels Theatres and Educational institutions

DATABASE ANALYSIS

The preferred mode of travel depends on the time of operation of the bus or train, would be obtained from the Timetable (schedules) of both buses and trains. The output from the system will vary from time to time. Queries were built for different timings to different locations in order to ascertain the functionality of the system developed. The system gives the option in selecting the travel cost. The travel cost considered was in terms of time and distance traveled. For presentation purpose color codes were used for the mode of travel. Blue color was assigned for Walk, Green color for Bus and Red color for train. Incase of uni-modal trip the route is represented by Blue color irrespective of mode. Some examples of the queries and the respective visuals are presented below.

QUERIES

The output from the system for a query on identification of the location at which the system was installed will generate the picture shown in Figure 4.

Query Made at 10:40 A.M to Perambur as Destination

The output from the system for the given destination in Perambur at 10:40 A.M was shown in Figure 5. From this figure it is clear that the system recommends the user to take bus to Beach station and transfer to train from there. The next train via Perambur starts at Beach station by 10:50 A.M while the next train via perambur starts at Chennai Central by 11:10 A.M only. Further the system recommends the user to alight at Perambur Railway Station and further directs the route to be followed to reach the given destination point. The total travel cost was given as message box.

Figure 4. Place of installation and Route to Perumbur at 10.40 A.M and 11.00A.M

Query Made at 11:00 to Perambur

The output from the system for the given destination in Perambur by 11:00 A.M recommends the user to take bus to Chennai Central and transfer to train from there. This is for the reason that the next train via Perambur from Chennai Central Station starts

by 11:10 A.M, while the next train via Perambur starts from Beach station later at 12:20 P.M. Further the system recommends the user to alight the train at Perambur railway station and directs the route to be followed to reach the given destination and the travel cost is shown in a message box.

Query Made at 10:10 A.M to Police HQ

The output from the system for the given destination in Police HQ at 10:10 A.M was shown in Figure 5. The train going via Police HQ reaches the Fort station by 10:32 A.M. Hence the system recommends taking a bus. The shortest route to be followed was highlighted and the total travel cost is given in the message box..

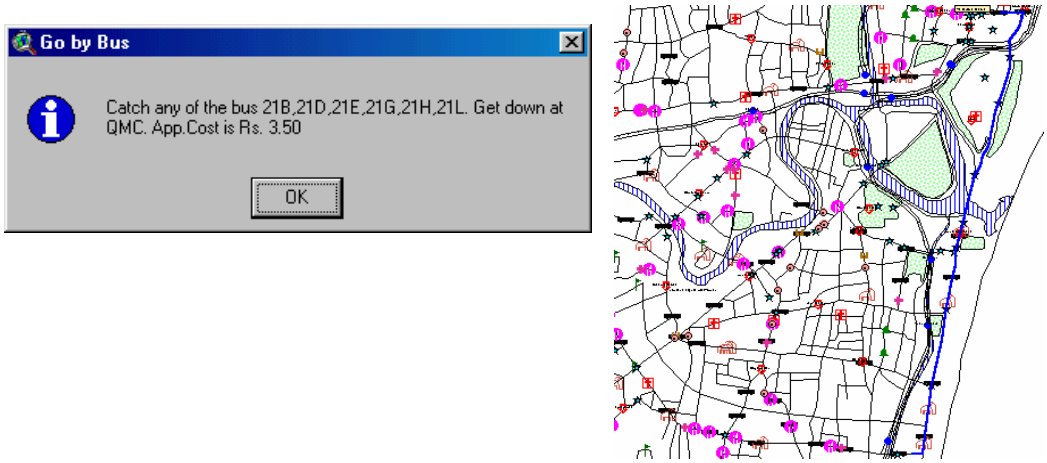

Figure 5. Route to Police HQ by Bus at 10:10 A.M

CONCLUSIONS

The Intermodal Traveler Information System designed works satisfactorily for all tested conditions. The system gives Real Time Information for the location to which it is designed. The system operates on a fixed time public transport system basing on the database created using schedules of the modes. Incase the travel by train is not suitable it gives a message to use bus as means of transport. The system is capable of working out total user fare and display the complete travel plan along bus routes / numbers via given destination point. The database created with the schedules (time table) of buses and trains can be updated for future with ease.

The views presented in this paper are of Author(s) and not necessarily of Wilbur Smith Private Limited

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