Public Information System using GIS-GPS untegration

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ABSTRACT

The present paper deals with GPS-GIS integrated system which when fully implemented helps the bus commuters to know the exact arrival time of their desired bus at the respective bus stop. The system uses the Arc View software and its extensions to implement the idea. In addition, Geotracker analyst module was used as an interface between the GPS and the GIS System.

It is hoped that the bus department officials would find this software useful to implement a real time vehicle location. The results are generated in Arc View environment and would later be sent to the display board in the respective bus stop.

The existing scenario of the bus system in Chennai is such that the passengers are not aware of the exact time schedule of the bus as often the time schedule is unable to be followed due to traffic congestions. The network manager at present doesn't have the knowledge about the real time positions of the bus.. All these deficiencies exist in spite of the fact that city buses are the major source of transportation in Chennai city and the public seems to be disenchanted with it.

The present system aims to make the bus system to be more effective and efficient both to the passengers and the department. It will help the passengers to plan their journey effectively.

STUDY AREA DESCRIPTION

Chennai is the capital of TAMIL NADU and fourth largest city in INDIA. It has a substantial amount of population who depend on the government transport buses for the daily transport.

Geographical location:

LATITUDE: 13.04 N

LONGITUDE: 80.17 E

DATA SOURCES

This paper requires sufficient amount of spatial as well as non-spatial data to implement the integrated system. These are listed below:

Spatial Data

- **Line Data**

Road map of Chennai city at 1:2000 scale supplied by CMDS, Chennai.

- **Point Data**

Location of metropolitan transportation corporation buses provided by the GPS receivers. The control point co-ordinates obtained by GPS survey.

Non-Spatial Data

The following non-spatial data are to be collected by numerous ground surveys through out the Chennai city.

- Road names and addresses
- Corporation speed data for various roads
- Road conditions
- important land marks

MAP DIGITIZATION

Required Map Accuracy

The digital map forms the heart of this real time automatic vehicle location system. The end user is going to monitor the position and the path of his vehicle on this map. The map has to be user friendly and should give important landmarks around the area so that the user knows the ground location of the vehicle. The accuracy of the map is around 3 meters.

The positional accuracy of this map is also a very important factor to consider. This is because of two important reasons. They are:

- The whole objective of the paper is to display the position of the vehicle and hence if the map is not accurate enough, the high precision GPS coordinates would not be of any use. Also, since the coordinates of any vehicle are going to be changing quickly the map should display these changes effectively.
- The communication link of the system is going to introduce certain errors because accurate systems require high costs and infrastructure. Hence, the map needs to be accurate enough to offset the uncertainty in position caused by weak signals.

Map Scanning and Vectorization

The map obtained should be first scanned and it can be stored in a digital format.

Next, the scanned map should be vectorized using onscreen digitization. Once the whole map is digitized it can be imported to Arc Info software as coverage. Using the edit features of Arc Info, the various node errors are removed and labels can be added to denote various roads and streets.

Control point surveys using GPS

To provide the required plannimetric control to the map accurately surveyed and well located control points are required.

A reconnaissance survey of the whole Chennai city should be first conducted to locate suitable control points, which could be easily located on the map as well. About fifty control points should be chosen which could be easily located on the map.

Control survey should be done using GPS to obtain a high degree of accuracy. Survey can be done in relative positioning mode. After the control point survey the best-surveyed control points out of the fifty could be selected.

Geocoding of the map to the WGS84 system using PC Arc-Info

The various control points for which survey was carried out can be entered as tic points in the arc info coverage. Tic points can be helpful for transformation of the coverage from the digitized map coordinate system to the WGS84 system. This is necessary because the signals transmitted by the vehicle will contain its coordinates in the WGS84 system.

The transform command of Arc Info can be used to transform the whole coverage into the WGS84 system.

To check the transformation and the accuracy of the geocoded map, the where command of Arc Info can be used to display the coordinates of various points selected randomly across the coverage.

USING GEOTRACKER AND NETWORK ANALYST

Geotracker Module

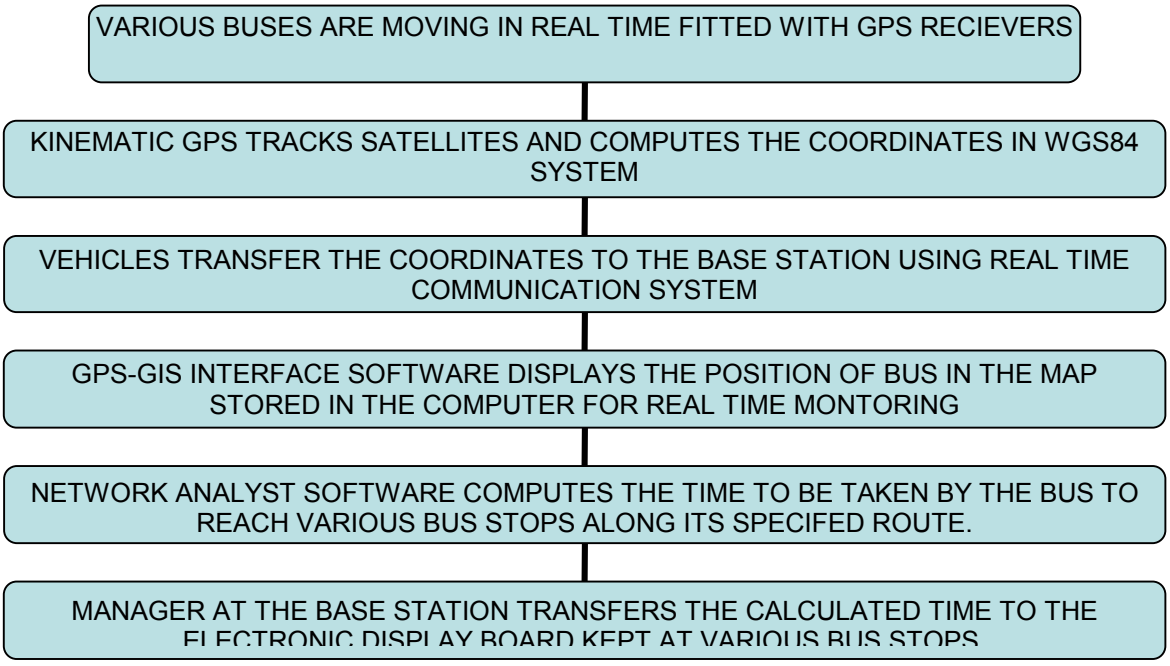
The Geotracker is an extension of the Arc View software that acts as the interface between the GPS and the GIS by displaying the positions of the buses in the form of latitude and longitude on the map.

Network Analyst Module

Once the vehicle can be tracked on the map, the user in the control room has to be able to use the Network Analyst module to locate a particular bus and find the expected time to be taken by that bus to reach the various bus stops along its route. Arc View offers a separate extension called **Network Analyst** that helps the manager to take these decisions. Before using this module, a suitable line theme is required on which the network analysis could be carried out. Also, the bus stop locations and the real time bus locations could be loaded on to the viewer. If the analysis is to be carried out in the off line mode, then the GPS file containing the locations could be loaded into the viewer.

The basic output of this paper is a graphic display of the real time bus locations, the calculated time to be taken by it to reach the various bus stops along its route and the time at which it will reach the final destination. The user views all these options on a computer screen and then they are sent to the ELECTRONIC DISPLAY BOARD kept at various bus stops. The results are not exhaustive by any means and are just representative of the numerous outputs and options available from this system.

METHODOLOGY



Thus we have given our ideas to incorporate technology to inform the public better and it also helps in maintaining the bus fleet.

Results and Discussions

The transformed map gave excellent results as far as the accuracy was concerned. This was verified by checking the map coordinates of the five checkpoints with the coordinates obtained from the control survey. The difference was less than a tenth of a second that converts to a very good positional accuracy if we assume that one second corresponds to about 30 meters on ground.

The group has aimed to get as accurate a map as possible within the available time. Specific attention was paid to the control survey so that the control points were of good planimetric accuracy. It is hoped that this accuracy is good enough to achieve the end result of this paper.

The next step was the preparation of the Geocoding index for the theme containing the streets. The Geocoding index tells the computer the address format to be used while identifying various point locations on the map. The address format chosen to represent the addresses was the US Single Street numbering system without zone information. Before doing this the fields like roadname, fr_add, to_add, distance, time and speed were added in the theme's attribute table. Once the required fields were entered into theme's attribute table, the theme was ready for the Geocoding index to be built. To do this the following option in Arc View main menu was followed:

Theme → Properties → Geocoding editor

Using the above option, the Geocoding index was prepared. The various address locations collected from the ground survey were entered into the respective fields and using the address locator, the addresses were displayed on the map. Next, certain fields were added to the theme's attribute tables that are required to determine the optimum route to be determined between the call taxi and the service call. Thus this proves to be a better system for Call taxi owners in Chennai instead of present conventional system.