CHAPTER 1

INTRODUCTION

1.1 Motivation and purpose

Advancements in Global Positioning System (GPS) technology now make GPS data collection for transportation studies and other transportation application a reality. Opportunities abound for increased quantity of data, improved quality of data and for new data elements, which were once considered too burdensome or too expensive to capture. A GPS receiver can accurately capture the location of a vehicle, which can be used to trace its departure and arrival times, as well as its trip lengths and travel routes. With the automation of the manual data collection process, the labor costs could be reduced greatly. The data collection process could, however, be costly.

This thesis details the use of GPS technology to produce route maps that can be used to predict arrival time of a bus. This application is particularly useful in rural areas, since the bus headway in a rural area is generally larger than that in an urban area. This creates a need for message signs showing the bus arrival time at bus stops to reduce the anxiety of passengers waiting for the bus. The information is normally communicated through various interfaces such as internet, cable TV, etc., based on the GPS bus location data.

1.2 The problem – Need for digitized route maps

An important input to the bus arrival time prediction procedures is the digitized route maps with link-node representation (Lin and Zeng, 1999). As shown in Lin and Zeng, the digitized map can be utilized to determine the actual location of a bus with respect to its schedule. In the past, the route map was often constructed manually. It is useful to develop an algorithm to automate the process and obtain the digitized route map directly from the raw GPS bus location data or the base map.

1.3   Objective of thesis

The objective of this thesis is to develop an operational procedure to obtain the digitized route map of any desired interval or link length and to examine the accuracy of the digitized map.

The operational procedure involves data collection, data processing, algorithm development and coding to produce the digitized route maps. The accuracy comparison is made to determine the consistency between the digitized route map and the base map.

1.4   Methods to obtain base map

Base maps for routes can be obtained by importing the road centerline map into GIS software like AutoCAD Map, Arc/Info, or MapixTM. The data points on any particular route can be obtained by separating the route on the map. This can be done by clicking the links along any route and sending the data points to a single text file. The nodes obtained using this technique lie on the centerline of the road. However, such kind of Road Centerline maps are not available for all places. So it may be necessary to collect the data using GPS units as explained in Chapter 2.

Advantages of using GIS software:

1) If the Road Centerline map is readily available, then it reduces the work involved. The data collection step for obtaining the base map can be eliminated.
2) The Road Centerline maps are standard maps used in most applications and can be considered more accurate.
3) In case of detours, the map of the new route can be obtained easily without any more data collection. The prediction procedure can be resumed as soon as the base map is digitized into required intervals of distance.

1.5   Thesis organization

The thesis is organized into five chapters including this introductory chapter.

Chapter 2 discusses the use of a GPS unit, the Trimble GeoExplorer II receiver, to log the position data of a vehicle along a selected route. The preparation phase in the office, field data collection and the post processing issues are addressed in detail. The text file containing the coordinates of every GPS data point logged is obtained. The base map of the route is a plot of the coordinates of the points in the file.

Chapter 3 provides the algorithm to produce the digitized route map from the base map of the route. The steps in the algorithm are explained in detail. The algorithm is coded in MATLAB and can be used to digitize the base map into any desired interval of distance.

Chapter 4 compares the digitized route map with the base map. The comparisons are made for different digitizing intervals, different routes, and different intervals of data collection. The results of the comparisons are given in the form of tables and figures.

Chapter 5 provides a conclusion and summary of the results found in the previous chapters of this work. In addition, it provides suggestion for future work in this area.