Introduction

Mobile phones with integrated GPS (Global Positioning System) are beginning to be utilized to assess traffic conditions in real-time. Data from these mobile phones, while valuable to the user, is not commonly used to optimize the road network operation, neither for planning purposes.

Most Departments of Transportation (DOT) in the U.S. rely on historical data in order to design and maintain their traffic control plans. To use the data of historic data, real-time data is needed. Mobile phones appear to be the great asset to excellent traffic data in real-time.

Still there are a few challenges for mobile phones to become the main tool to acquire traffic data. Some progress towards the use of mobile phones as data gathering tools has been made. Hellings et al. (2008) described several steps to determine traffic condition from positioning data. Within these steps probe filtering and travel time allocation continue to be a challenge to obtain without user-input.

The challenges range from the technology itself (no limitations) to the interpretation of the data. The power presents specific challenges (traffic) by the authors and the possible solutions to overcome them in order to be able to begin recollecting data from mobile phones.

Previous research complemented positioning data from the phones with input from users. The complexities of avoiding user-input are regarding the irregular way in which a single person moves. This technology promises to change the way transportation engineers gather data.

The objective of this study is to determine if mobile phone technology without user-input can detect the origin and destination of trips, and transportation modes used in the transportation system. This is done to avoid premature aging of the facilities, by improving the Dynamic OD matrices and utilizing that information to establish contingency plans.

Background and Significance

Hellings et al. (2008) sets out that determining traffic conditions from positioning data requires five steps: map matching, path identification, probe filtering, travel time allocation and travel time aggregation. The relation of these five steps with data from cell phones follows:

1. Map matching1
   - The first step of determining the position of a vehicle in the transportation network.

2. Path identification2
   - When several paths can be utilized, this step decides with road selection.
   - The problem is due to the time interval between data points.

3. Probe filtering3
   - Counts of determining the transportation mode being used.
   - The data have to be analyzed to establish the transportation mode.

4. Travel time allocation4
   - Extraction of travel time in each link.
   - When a change in travel mode occurs, this step separates the travel time in each mode.

5. Travel time aggregation5
   - The calculation of the average travel time for any link occurs in this step.

Previous research utilized user-input to perform probe filtering and travel time allocation. In probe filtering the specific topics are: identify travel mode and travel mode change. In travel time allocation the specific topics are: starting and ending trip times, and time of travel mode change. Furthermore, this research will include public perception to this use of cell phones.

Problem

Taking on the question posed in the title “Data, data, data - Where's the data?” by Tate-Glass et al. (2000) is the main reason for this study. Research in traffic control is active, but the methods to obtain data to apply it in real world situations is still under development. Recollecting the data necessary to improve traffic control requires the recollection of historical data and data in real-time. The challenges of using mobile phones to gather traffic data will be shown here.

Calculating Speeds

Speed is one of the most important parameters to identify the transportation mode used. The following figures show that at different intervals, not all the data is needed. The shapes of both equal charts (Figure 3 and 4) show that we will be able to select greater intervals without losing critical information. In the figures shown, gathering data at an interval of 10 data points seems to be adequate. Each data point is gathered every 1 to 2 seconds. Therefore we can sample that time can be cut down to 10 seconds.

Calculating Speeds with All Data at Different Intervals

Speech Calculated with All Data at Different Intervals

Calculating Speeds with Selected Data at Different Intervals

Conclusions

The challenges shown here, such as, the nature of the problem, the capacity of the technology and the sampling rate, are the most critical. To utilize mobile phone data, we need to be able to do so, but at the same time we do not want to recollect more data than needed. Still the biggest challenge lies ahead, and that is the need for an algorithm capable of determining the transportation mode used.

Key References


Mobile Millennium (2009), The Mobile Millennium project http://traffic.ucsd.edu/Millennium.html (July, 2009).


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