February 2016

NCITEC
National Center for Intermodal Transportation for Economic Competitiveness

TECHSUMMARY

SIO No. 30001396 / LTRC Project No. 13-2SS

Travel Time Estimation Using Bluetooth

INTRODUCTION

Travel time estimates are useful measures of congestion in an urban area. The current practice involves using probe vehicles or video cameras to measure travel time, but this is a labor-intensive and expensive means of obtaining the information. A potentially more efficient and less expensive way of measuring travel time is to use Bluetooth technology to track vehicle movement in a network. The kind of information this study wanted to obtain from the measurement of travel time was (1) overall congestion in an urban area, (2) the trend in overall congestion in an urban area, (3) individual locations where congestion is high, (i.e., identification of "hotspots"), and (4) the level of congestion at hotspots.

OBJECTIVE

The objective of this study was to investigate the feasibility of using a Bluetooth Probe Detection System (BPDS) to estimate travel time in an urban area. Specifically, the study investigated the possibility of measuring overall congestion, the trend in congestion, the location of congestion "hotspots," and the measurement of the level of congestion at the hotspots using a BPDS. A secondary objective was to assess the possibility of obtaining travel time from other quicker and cheaper methods such as simply purchasing it from a commercial vendor.

METHODOLOGY

To achieve the objectives of this research, the study team deployed a BPDS on a route that was identified as the most congested within the Baton Rouge area. For identification of the most congested route, the study team formulated, developed, and validated a novel image analysis technique capable of analyzing historical traffic maps for a presence of congestion patterns. The image analysis technique was then applied on historical traffic maps collected by using Google Maps traffic layer for a period of one month. The application of the image analysis technique revealed that Airline Hwy between Pecue Lane and Greenwell Springs Road is a road section that experiences most chronic congestion in the Baton Rouge area. The BPDS system was then deployed on Airline Hwy and travel-time data was collected for a period of six months. In addition to travel-time data, traffic-volume data was also collected. The travel-time data obtained was then used to compute an hourly travel delay, travel time index, and planning time index for a six-month period. The road section between Goodwood Blvd.

LTRC Report 557

Read online summary or final report:
www.ltrc.lsu.edu/publications.html

PRINCIPAL INVESTIGATOR:
Chester Wilmot, Ph.D

LTRC CONTACT:
Kirk Zeringue, P.E.
225.767.9169

FUNDING:
SPR: TT-Fed/TT-Reg

Louisiana Transportation Research Center

4101 Gourrier Ave
Baton Rouge, LA 70808-4443

www.ltrc.lsu.edu

and Old Hammond Hwy was identified as the most chronic and frequently congested section of all sections on the identified congested road.

To achieve the secondary objective of the study, the research team bought historical travel-time data from commercial vendor INRIX for the study section that was identified as the most congested one. The process of acquiring travel-time data by simply purchasing it from a commercial vendor did not involve the same amount of effort that was required for acquiring travel time using the BPDS system. However, the convenience in obtaining data was offset by the restrictions that were placed by the vendor on the usage of the data.

CONCLUSIONS

The research conducted in this study led to the following conclusions:

1. A BPDS appears to be the best way to measure the level of congestion at a location. Other methods such as probe vehicles or license plate matching appear to be more expensive and time-consuming than the use of a BPDS.
2. A BPDS is easy to use and can be deployed quickly if there is infrastructure to which the BPDS can be attached. BPDS systems can start measuring travel time and transmitting data to a central server without delay, thus providing access to travel time data very quickly.
3. Obtaining permission to attach Bluetooth devices to structures or light poles that do not belong to the fixing agency can be a time-consuming and frustrating task. However, agencies that own such facilities can install BPDS quickly and easily.
4. Purchase of historical travel-time data involves less administrative work and requires fewer resources than obtaining travel-time data from BPDS. However, it comes with certain caveats such as abiding by the contractual terms and policies established by a commercial vendor in using the data. Moreover, historical travel times obtained from the commercial vendor may not always be between a desired starting and ending point on a route but between points that are defined and identified by the commercial vendor. Thus, a compromise might have to be reached between accuracy and ease of access.
5. Real-time travel time data is expensive and is time and distance sensitive. Thus, for real-time data over long distances for a reasonable period of time, the acquisition of BPDS equipment appears to be preferable to purchasing data from a vendor.
6. Maintenance of a BPDS might be problematic if an agency wants to handle all the maintenance of BPDS by itself. This is especially true for BPDS during winter season that is dual powered by both battery and solar power. When there is no sunlight for considerable amount of time, then there is a potential for a BPDS unit to run out of battery power.

RECOMMENDATIONS

It is recommended that travel times be measured by Bluetooth Probe Detection Systems at individual locations or in short corridors where the number of instruments needed is not too large, and real-time data is needed over a period of time. The travel-time measurements that are produced by the BPDS can be used to compute congestion indices such as travel delay, travel time index, and planning time index.

It is also recommended that hourly paired match counts recorded by Bluetooth devices be used as a surrogate for deriving hourly traffic volume distribution when such data is available.