Chapter 13

Smartphone-Based Travel Survey: A Pilot Study in China

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ABSTRACT

This chapter describes a smartphone-based prompted recall travel survey that aims to collect more accurate data for transportation modeling. It details the design and implementation of the survey, including the smartphone app for the Android platform, the mobile phone-based prompted recall method, and the management, manipulation, and analysis of GPS data for trip characteristics imputation. The survey commenced in October 2013 and was a person-based pilot study designed to be collected over a week. Although it did not provide a statistically representative sample, the overall experience helps establish the various parameters and procedures for the development of surveys with similar initiatives. The chapter concludes with findings and lessons learned from this smartphone-based travel survey and suggestions for how future smartphone-based surveys might be prepared and conducted.

INTRODUCTION

There are two broad categories of travel data collection modes: self-reporting of activity and travel information by mail, computer aided telephone interview or Web, and GPS methods administered by stand alone GPS devices or GPS enabled smartphones. From the last decade, GPS devices have been used increasingly as a means to tackle those problems with self-reporting approaches such as trip under-reporting (Stopher & Greaves, 2010), respondent burden (Bricka & Bhat, 2006), non-response (Stopher & Greaves, 2007), and inaccuracies in temporal and spatial data (Stopher et al., 2007).

Early GPS devices were for in-vehicle use only. Then, there was the “Active GPS,” which comprised a GPS module connected to a personal data assistant and required the participant to enter related data while traveling. Subsequently, a wear-
able version of the GPS device was developed, which expanded the implementation of GPS-based travel data collection. While largely successful, stand-alone and separate GPS recording devices suffer from some drawbacks. They make respondents aware that their behavior is being recorded, pose distribution and recollection problems, and represent a significant investment. Recently, smartphones are increasingly ubiquitous and provide a powerful travel information recording mode. Besides GPS, smartphones combine GSM/GIS/WIFI technologies to provide more detailed information on travel, even when there is a GPS signal loss or degradation or during GPS cold/warm start. Although smartphones have many advantages over handheld GPS loggers in collecting travel information, smartphone-based travel surveys are in their infancy.

This chapter describes the design and implementation of a smartphone-based prompted recall travel survey, including the smartphone app for the Android platform, the mobile phone-based prompted recall method, the management, manipulation, and the analysis of GPS data for trip characteristics imputation. The survey commenced in October 2013 and was a person-based pilot study designed to be collected over a week. Although it did not provide a statistically representative sample, the overall experience helps establishing the various parameters and procedures for the development of surveys with similar initiatives. The paper concludes with findings and lessons learned from this pilot study and suggestions for how future smartphone-based surveys might be prepared and conducted.

BACKGROUND AND OVERVIEW

A comprehensive description of GPS and its capability to provide detailed time and location information for travel surveys and research is given in the Handbook of Transport Geography and Spatial Systems (Wolf, 2004). The first GPS-based survey is attributed to the Lexington area travel data collection test in 1996, which was a successful “proof of concept” study (Division, 1997). Since then, GPS-based recording of travel has been promoted rapidly worldwide (Doherty et al., 2001; Stopher & Collins, 2005; Bar-Gera, 2007; Moiseeva et al., 2010; Zhong-wei et al., 2010; Spissu et al., 2011). Although GPS devices can provide accurate data on travel time and location, detailed information about stops, travel mode, and purpose still have to be obtained by imputation algorithms.

GPS-based prompted recall surveys are gaining momentum. Various methods can be applied, either face-to-face interviews, paper-based, phone-based or Web-based. GPS-based prompted recall surveys began as early as 1997 in the first GPS-based pilot study in Lexington (Division, 1997). Wolf et al., (2000) examined the complete replacement of paper or electronic travel diary with GPS loggers and pointed out that the prompted recall method is valuable for confirming imputation algorithms and collecting missing details. Stopher et al., (2003) described the use of a spatial approach using a pencil and paper survey to convert GPS data. It allowed the data to be compiled in the paper survey with images of maps for each trip and supplemented with questions about activities and trip details. Doherty et al., (2005) discussed three possible approaches to prompted recall surveys, including sequential, temporal/tabular, and spatial. Practical GPS-based prompted recall surveys often combine elements of one or more of these types (Du & Aultman-Hall, 2007; Stopher,et al., 2007; Greaves et al., 2010; Marchal et al., 2011; Bricka, et al., 2012; Wilhelm et al., 2012).

Although stand-alone GPS devices enable the collection of detailed travel behavior data with less respondent burden, they also face disadvantages. GPS-enabled smartphones provide an opportunity to combine real-time data availability, personalized travel information, and advanced sensor technologies to significantly advance data collection and information provision for transportation purposes (Vautin & Walker, 2011). Abdulazim et al., (2013)
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