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ATLAS Project – Developing a mobile-based travel survey

Hamid Safi[1], Mahmoud Mesbah[2], Luis Ferreira[3]

[1] PhD Student, School of Civil Engineering, The University of Queensland, Brisbane QLD 4072 Australia
[2] Lecturer, School of Civil Engineering, The University of Queensland, Brisbane QLD 4072 Australia
[3] Professor, School of Civil Engineering, The University of Queensland, Brisbane QLD 4072 Australia
Email for correspondence: h.safi@uq.edu.au

Abstract

Travel data collection has always been considered as a fundamental part of all transport planning studies, and there has been a continuous effort to employ new approaches in order to increase the accuracy of collected data and reflect the real behaviour of individuals. Many approaches have been utilized for performing travel surveys, but there are still significant areas for improvement, as they need considerable financial and human resources, have an insufficient time-coverage and mostly engage respondents considerably, which sometimes implies biased results.

This paper introduces a research framework, which is focused on using innovative technology of smartphones to develop a practical and accurate travel survey approach and better understand the pattern of individual's travel behaviour. The first section of this paper is devoted to reviewing previous studies and methods of GPS assisted travel surveys. Then after reviewing available data collection approaches, the appropriate approach to increase the accuracy of collected data and also reduce the burden on respondents has been employed. In the next step, ATLAS Project, an iPhone application which has been developed specifically for travel data collection is introduced and the procedure of designing, developing and employing of this application is explained.

1. Introduction

Travel survey has been considered as an inevitable part of every travel and transport study. It reflects the travel behaviour of users and help to better understand the current demand and plan and prepare the required network and infrastructure for future growth. Traditionally, travel behaviour data have been collected through paper, phone or interview assisted surveys, where people are asked to describe their travel behaviour during a limited time (usually a working day) or to reconstruct their travel behaviour in one or more specific days. While, all of these conventional methods only rely on the memory of respondents, and also impose significant burden on respondents and thereby adversely impact the quality and quantity of the collected data.

Technological improvements in global positioning system (GPS) technology, besides recent advancements in positioning systems on smartphones, make people and objects growingly locatable and have provided transportation planners with an alternative and powerful tool for more accurate travel data collection. The desire to use GPS for travel surveys comes from the ability to gather the data streams of individuals' trajectory, and extract their travel attributes, such as start and finish times, distances, chosen routes, and interim stop locations as well as their trip mode and purpose more accurately (Doherty, Papinski & Lee-Gosselin 2006; Srinivasan, Bricka & Bhat 2009).

This paper aims to introduce a smartphone application, ATLAS Project, which has been designed specifically for performing travel surveys. This application not only provides the possibility of extracting the travel attributes of participants based on their travel trajectory, but also equipped with a specifically designed questionnaire for collecting the socioeconomic details of participants conveniently. In this paper after a brief overview of previous work, this application and its different capabilities will be introduced, and then some conclusion will be made based on the preliminary results of performing travel surveys.

2. Literature Review

The employment of GPS data in travel surveys began with a series of demonstration studies designed to prove the possibility of using GPS data for identifying travel patterns, and has expanded to several more advanced applications (e.g. André (1997) Ohmori, Y et al. (1998) Murakami and Wagner (1999). With the success of these initial studies, GPS devices were widely used in other household travel surveys. Most of initial GPS-assisted travel surveys employed vehicle-based GPS method, and technological improvements handheld GPS devices were employed as well for performing travel surveys.

2.1 Car-mounted GPS-based travel surveys

In this type of travel survey, travel data are collected by equipping respondents' vehicles with GPS loggers to continuously record the position of their vehicle. It is generally approved that data collected by vehicle-based GPS are fairly reliable in reporting accurate travel times and locations (Gonzalez et al. 2010); however, this method has some shortcomings that affect the quality of collected data. First of all, this method focuses on private mode and other modes, such as walking, biking and public transportation, are omitted, while these modes have significant mode-shares and necessary to be considered, especially in complicated urban environments. Moreover, the real origin and destination of trips need to be guessed since only vehicle movements are recorded, and also analyst cannot determine which person is driving the vehicle without collecting further information. In addition, user is required to turn on the device before every trip, so that either accidentally or deliberately neglecting to turn on the device would still result in trip underreporting even in the GPS data (Auld et al. 2009).

2.2 Handheld GPS-based travel surveys

With technological improvement and reducing the size and weight of GPS devices, handheld GPS devices were introduced to bring about more accurate and extensive travel surveys and cover the shortcomings of previous method. In this method, respondents are invited to carry GPS loggers during the travel survey interval, which could be a day or several weeks. After finishing the travel survey, all collected data are transferred manually, by research-team members or respondents to the data bank. This method provides the possibility of full tracking of individuals, which is an important additional point over the traditional method. Several studies have been done employing handheld-GPS devices for travel surveys (e.g. Chung and Shalaby (2005); Tsui and Shalaby (2006); Bohte and Maat (2009); Oliveira et al. (2011); Schuessler and Axhausen (2009); Elango and Guensler (2010); Auld et al. (2009); Stopher, P, Prasad and Jun (2010); Roorda, Shalaby and Saneinejad (2011); Chen et al. (2010); Stopher, Peter et al. (2010); Shen and Stopher (2011); Gong et al. (2012)).

Although, handheld GPS-based travel survey has covered most of the weaknesses of car-mounted GPS-based travel survey method, and in recent years has become the most prevalent method of GPS-based travel survey, it has some shortcomings that affect the results of survey considerably. First of all, performing this type of survey needs meaningful investment, as each respondent has to be equipped with a GPS device during the travel survey. The loss of GPS device means the loss of collected data, as all collected data are saved on the data logger. Moreover, participants need to remember to carry an extra device during the travel interval and also upload the collected travel logs to the server, which cause a burden on them. In addition, since all handheld GPS loggers need battery to run and for most cases their battery needs to be charged or replaced during the survey period, an extra burden will be forced on respondents and even may change their real behaviour. Finally, some GPS loggers, specially low-cost devices, need to be placed on a flat surface with a clear view of the sky to have enough sensibility in obtaining GPS data of respondent for travel attributes' detection. While most of the time in real travel patterns, for instance when the respondent drives, uses public transport or puts the logger in their pocket, providing this situation is impossible, which significantly leads to reducing the accuracy of collected data.

2.3 GPS equipped mobile-based travel surveys

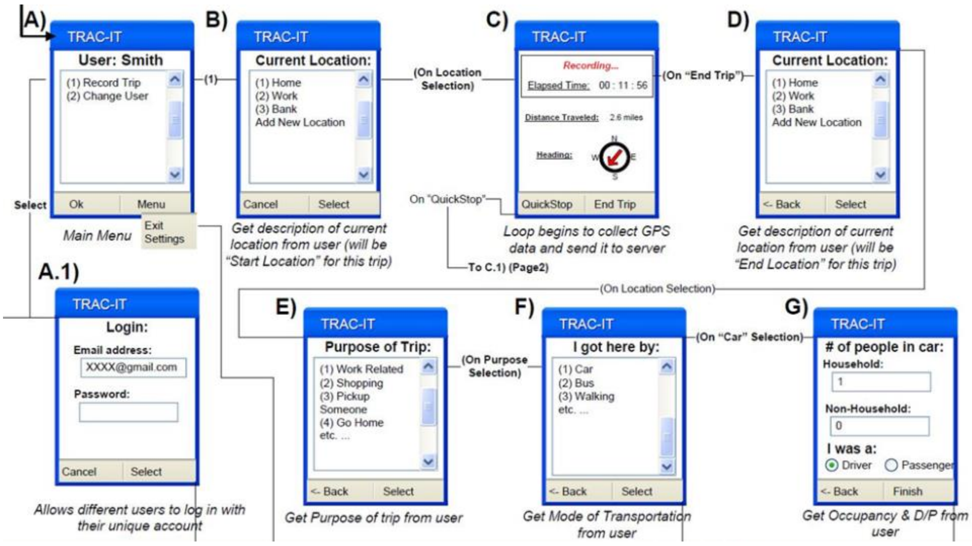
In recent years, mobile phones have been a matter of interest for traffic investigation and travel behaviour analysis. Initial employments of mobile phones in travel surveys were mainly focused on using cellular phone positioning, dead reckoning sensors, and RF-ID (Radio Frequency Identification) methods to detect the position of respondents at micro level and rarely spoke about travel survey at macro level, such as household travel survey. (e.g. Izadpanah and Hellinga (2007); Bar-Gera (2007); Takada (2006); Takada, Hellinga and Fu (2006); Byeong-Seo, Kang and Park (2005)).

In the meanwhile, some other researchers such as Asakura and Hato (2004); Ohmori, N, Nakazato and Harata (2005); Itsubo and Hato (2006); Gonzalez et al. (2010); Jariyasunant et al. (2011); Niu et al. (2012) and Cottrill et al. (2013) focused on using GPS-equipped phones following the trajectory of individuals. In 1999, Asakura and Hato (2004) performed the first mobile-based pilot travel survey, with 100 respondents, in Japan. They suggested a simple algorithm for detecting and labelling trip-legs, as move-or-stay identification algorithm, and the results of this study proved the feasibility of performing phone-based surveys and the usefulness of their results in empirical models.

Ohmori, N, Nakazato and Harata (2005) investigated the possibility of combining positioning technology and mobile devices for activity data collection. They developed a phone-based activity diary survey system and performed two pilot travel surveys, with 50 participants, in 2004. Their approach was using smartphone as a personal digital assistance and asking respondents to enter all required data manually. They developed a mobile-based questionnaire and asked respondents to enter the start/end times of their trip, information on activity type, location, travel mode and accompanied persons manually. The collected data were stored on the mobile phone, and when the capacity of the mobile phone's built-in memory reached full, by pushing some buttons, all collected travel diaries were transmitted via e-mail to surveyors. Ohmori, N, Nakazato and Harata (2005) concluded that users recorded their travel attributes more frequently and with less time delay through their mobile phones rather than the paper diary. Additionally, the time of data preparation and analysis phases were considerably reduced compared to traditional paper surveys. This study was one of the first steps of using mobile-based questionnaires in order to collect travel diaries; however, had some deficiencies. For instance, in this study respondents were asked to enter their entire travel diary manually using their mobile phone, which was bothersome and time consuming. Moreover, in order to have enough battery for 5 to 6 hours tracking, which was not enough for covering an ordinary working day, they increased their GPS logging intervals to 10 minutes, which was too much and leaded to increase the inaccuracy of collected data. In addition, besides the expensive rate of data transfer which was 900 JPY (10.9 $AUS) for one day for each respondent, the application couldn't work if the user wanted to have a call or use message services of the cellular phone.

In another study, Itsubo and Hato (2006) demonstrated the accuracy of mobile-based methods compared to conventional paper-based methods. In this study, they improved the method of Ohmori, N, Nakazato and Harata (2005) and combined it with a web-based travel data collection. In this study each respondent carried a GPS-equipped mobile phone, with an application on it, to save their travel attributes. The invited respondent edit their travel diary when they finished they travel day using a specifically designed webpage. They performed their pilot survey on 31 participants in 2004, which took 5 days, and compared the results with a previously performed paper-based travel survey on the same participants. The comparison showed a significant increase (12 precent) in the number of recorded tripsusing mobile-based approach compared to paper-based method (Itsubo & Hato 2006). Similar to Ohmori, N, Nakazato and Harata (2005), this study encountered several challenges. Besides the expensive cost of data transfer and the unacceptable cycle time of acquiring locations, which was 30 sec, battery depletion was a serious problem in this study. As their application consumed the battery of the mobile phone extensively and with a fully-charged battery they just could collect the travel diary of respondents for just 3-4 hours. Moreover, respondents had to neglect some of their calls and messages, because the software used by (Ohmori, N, Nakazato & Harata) prevented the user from making phone calls or sending emails or text messages while the tracking application was running. It would be predictable that due to these limitations respondents might alter the real travel behaviours, as they probably reduced their travel because of the limited battery life of the phone, and also reduced their communication with others since they could not place phone calls, text message or email while the tracking application was active (Gonzalez et al. 2010). From a surveyor's point of view, this is not desirable since the observed travel behaviour might be biased and don not reflect the real travel behaviour that would have otherwise occurred.

Figure 1: Some snapshots of the user interface of TRAC-IT (Gonzalez et al. 2010)



Gonzalez et al. (2010) performed a travel survey study using GPS-enabled phones. They developed a mobile phone application, called TRAC-IT, to collect real-time GPS data and passively determine trip mode through the collected data of mobile phones using neural network approach. In 2008, TRAC-IT was developed in Java Micro Edition, and able to passively determine record the position of respondents. In data collection phase, 14 participants were provided with a mobile phone, beside their own mobile phone, on which the TRAC-IT Java ME software was installed and set to record the GPS position of the mobile phone user every 4 seconds. While participants were travelling using different modes of transport, the application logged their GPS data and sent the recorded position data to the server of study. In next step, participant added manual notes regarding their chosen trip modes, which was used to check the accuracy of mode detection algorithm. Some snapshots of different section of TRAC-IT is presented in Figure 1 (Gonzalez et al. 2010).This study had some limitations as well. For instance, the immediate data transfer which was used in this study not only raise ethical concerns, but also forced extra costs on respondents and used the battery of mobile considerably.

Jariyasunant et al. (2011) developed a smartphone application, called "Quantifiable Traveller", which was mainly designed for monitoring users' movement. This application is designed to provide users with personalized feedback and statistics on their travel habits, burned calories, greenhouse gas emissions, travel time and travel cost. Passive data collection approach was employed in this application to minimize the burden of users. In order to minimise the battery consumption, a combination of WIFI (80%) and GPS (20%) was utilised for position and travel route recognition. "Quantifiable Traveller" records the location of respondents in 2 minutes intervals; however, considering the fact that in most cases the position of respondent is determined using WIFI coverage, this logging interval might lead to inaccurate travel route detections. In order to cover the probable inaccuracy of the application in detection of the correct route and mode of travel, prompted recall approach was employed and respondents were asked to review their recorded data and modify them if needed to the imputed route and travel mode. The results of a pilot survey on 80 participants show that the application can detect around 86% of trip modes and 94% of the routes of private mode, while this ratio was around 50% for BART trips (Jariyasunant et al. 2011).

The "PaceLogger" is another application for smart phones which is designed for travel surveys. NuStats and Portland METRO performed this research project to show the utility of mobile-based travel surveys in compare to conventional travel survey approaches and also evaluate the performance of PaceLogger for ordinary participants. They provided each member of recruited household who used the "PaceLogger" application an incentive of $10 per day; however, it was concluded that this incentive was not the primary driver of respondent participation, rather that curiosity, novelty, and respect for technological efficiency of this approach. The result of a survey on 1,000 participants shows that the "PaceLogger" application can successfully capture the detailed GPS trip data of participants, and proved that Smartphone applications could serve as an inexpensive, easily deployable means of travel data collection. However, there are some deficiencies in this research project as well. For instance, the real time collected-data transfer to server is costly for participants and will use their quota. Moreover, considering the fact that they don't collect any reliable data regarding the trip mode and trip purpose of participants, they couldn't validate their mode and purpose detection models. As a result, no meaningful accuracy ratio was presented in published reports and papers regarding this approach. (TRB Committee on Travel Survey Methods 2010). This project is an undergoing project and it is predictable that some of these deficiencies will be resolved in future.

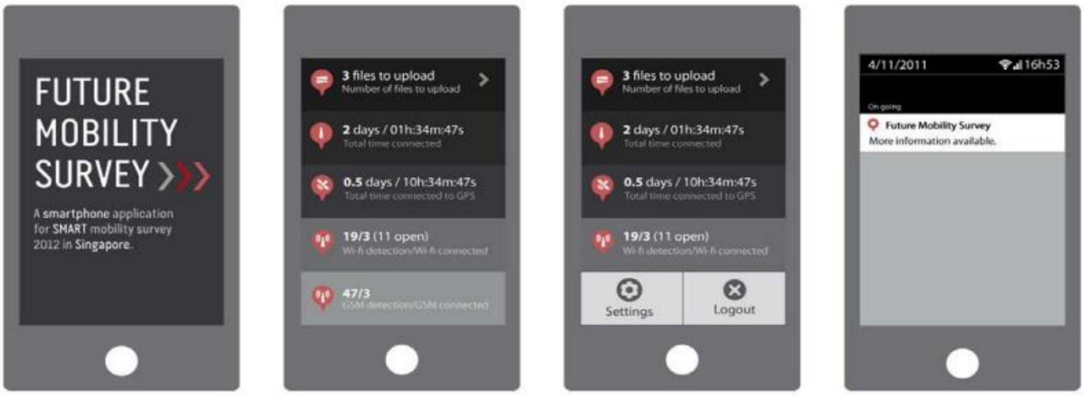
In 2009, Charlton et al. (2010) developed and employed "CycleTracks" to study the travel behaviour of the city cyclists of San Francisco. This application collects the actual bicycle routes traversed by city cyclists based on rider characteristics (e.g., level of experience) and characteristics of the bike network (e.g., hills, bike lanes). Active data collection approach has been employed in this application, and this application is currently being used by several agencies across the US. This application invites the user to launch the app and click finish/save button, when the saved data will be uploaded automatically to a SFCTA web server using the owner's quota. A bicycle bell noise and vibration alert occurs after an initial 15 minutes of GPS data collection (and every five minutes thereafter) to remind users that the app was still running. An interesting point regarding the process of recruiting for this application is the active approach of research project in involving cycling associations and groups in their project. Based on feedbacks, they found that making the app start up quickly, and minimizing battery usage during recording were two critical factors in getting good quality data. This application has some shortcomings. For instance, although research project claimed that their application has the ability of working while it is minimized; in reality it seems that their application doesn't have this positive point. Moreover, it seems that their application has some problem in locating cyclists especially in the CBD areas. The other concern is the burden which will be forced on the participant during working with the application, as they have to interact actively with the app during their working day and also pay for the instant data transfer cost, which not only could be a negative financial issue for the app, but also can consume the data quota of their phones.

Figure 2: Snapshots of the CycleTracks App (iPhone version) (Charlton et al. 2010)

"Future Mobility Survey" is the name of a transport survey which is based in Singapore. In this research project it is aimed to integrate travel survey questionnaires (including socioeconomic and travel behaviour report questions) with web-based prompted-recall survey and smartphone location-tracking abilities and propose a new approach for performing travel surveys more accurately. On Feb 2012, a pilot survey was performed on 30 participants, each of whom will be asked to install a location tracking application on their smartphone, or on a smartphone provided by the project. Each participant was provided with a SG$30 incentive (roughly the cost of a one-month data plan), and was asked to track their location via the application for a period of two weeks, and periodically validate the identified stops and activities (Cottrill et al. 2013).

In order to control the battery usage of application, Cottrill et al. (2013) consider a trade-off between GPS and GSM and also put some constraints on the transmission of data from smartphone to the server. Moreover, the application is designed to work ta background and not to interrupt the interaction of user with mobile phone. In addition, respondents are provided with an online interface to recall and validate the collected data of their activity.

Figure 3: Snapshots of the Future Mobility Survey App (iPhone version) (Cottrill et al. 2013)



In summary, based on literature mobile phone assisted travel surveys could cover some limitations of previous GPS-assisted methods; however, they have some limitations as well. Battery depletion has been considered as a serious concern, because GPS services consume the battery of mobile, which leads to reduce the participation rate and none-responsiveness of study. The next limitation of mobile-based GPS assisted travel surveys is the privacy concerns of participants, as no one is interested to be tracked during their daily life; however, this concern could be solved with employing correct data collection approach and also providing meaningful incentives for participants.

3. ATLAS Project (iPhone application)

'ATLAS Project', which stands for 'Advanced Travel Logging Application for Smartphones', is an iPhone application designed specifically for performing travel surveys. This application is compatible with iPhone 3GS, and later versions and also current iPods, and those who are interested in this research can download and work with this app for free from AppleStore™. The main purpose of developing this application is to develop a user-friendly and convenient device to record respondents' real travel behaviour with minimum burden and maximum accuracy.

3.1 Data collection approach

Based on literature, three approaches have been employed for performing GPS assisted travel surveys, passive data collection, active data collection, and a hybrid approach which sometimes called prompted recall survey approach. The earliest attempts of GPS-assisted travel surveys were conducted by using passive data collection method, where the GPS data are collected without additional input from the participants. This approach eliminates respondent burden, increase participation rate and reduce the cost of performing travel surveys. However, the collected data cannot be validated as there is no interaction with respondent during or after the data collection. On the other side, active data collection approach entails participants' additional inputs to increase the accuracy of collected data. Several researchers believe that due to some technological problems, such as urban canyon effect, cold (or warm) start problem, or systematic errors, it is necessary to confirm or revise the collected data with participant during or after the travel survey (e.g. Tsui and Shalaby (2006); Bohte and Maat (2009); Oliveira et al. (2011); Schuessler and Axhausen (2009); Elango and Guensler (2010); Auld et al. (2009)). Some studies used the combination of GSM and GPS services to promise more complete spatial data (origin, route, destination) when tracking individual's travel paths (e.g. Murakami and Wagner (1999); Draijer, Kalfs and Perdok (2000); Ohmori, Y et al. (1998); Asakura and Hato (2004); Ohmori, N, Nakazato and Harata (2005); Rehrl et al. (2007); Itsubo and Hato (2006); Barbeau et al. (2009); Gonzalez et al. (2010); Niu et al. (2012)).

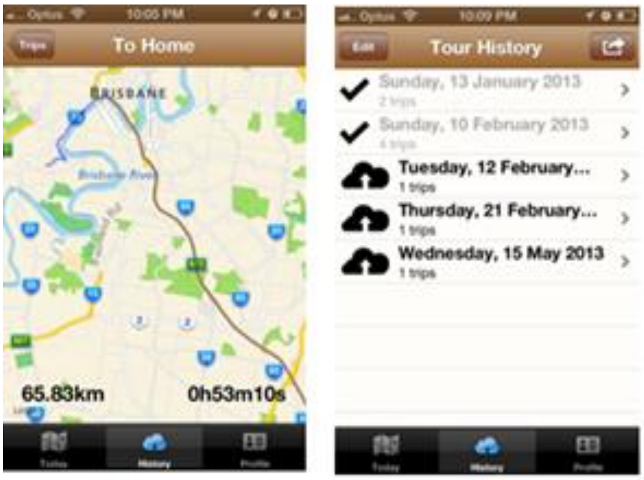
In this study considering the importance of collecting validated data to check the accuracy and preciseness of proposed algorithms and models, active data collection approach has been employed in the process of application design and development.

3.2 Structure of ATLAS Project

ATLAS Project includes several sections and procedures. It has three main tabs, as 'Today', 'History' and 'Profile', and a tutorial section which helps new users to become familiar with how to work with the application. Each user who installs this app will have a unique profile, where they can choose the survey they want to participate and also choose a user-name, password for their profile. In addition, users are asked to enter a valid email address, which will be used for further communications with user.

Considering the fact that in some of previous mobile-based travel surveys, the real travel behaviour of respondents had been changed due to the limitation of data collection device and battery depletion concern (e.g. as Asakura and Hato (2004); Ohmori, N, Nakazato and Harata (2005); Itsubo and Hato (2006)) in the process of designing and developing the ATLAS Project, it has been tried to reduce or at least minimize any probable effects on the travel behaviour of respondents. For instance, ATLAS Project has been designed to be minimized during the tracking process, and let respondents to the use of services of their cell phones during the process of tracking. Moreover, as can be seen in Figure 4(a), in order to encourage respondents to participate in our travel surveys, they always can have access to their current location and the path they took in a graphical environment, and also their purpose and duration of their trip when they launch the application, during the process of tracking. Moreover, users can have access to the details of their previous trips which were recorded and saved automatically by the application.

Figure 4: Snapshots of the 'history' tab and the details of a recorded trip in ATLAS Project



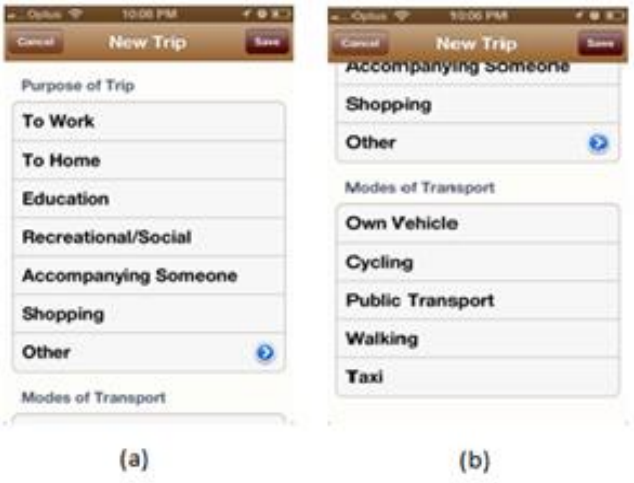
(a) (b)

In the 'History' tab, all previous records of each user are saved automatically, and participants can have access to the details of their previously completed trips, such as the date and time, and also the mode and purpose of each trip. Participants can take advantage of these details in order to review and manage their daily travel activities. Moreover, user can upload their entire recorded trip to the server of this research project by clicking just one button.

3.3 Travel Recording Procedure

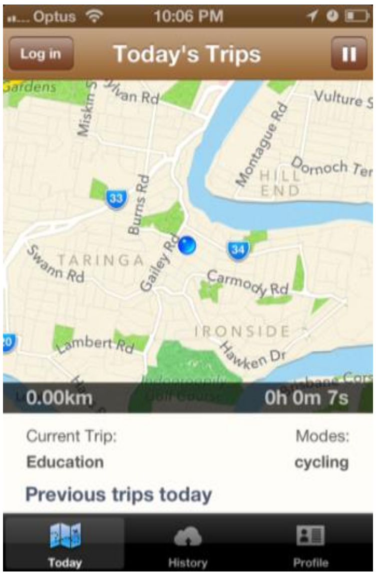
In order to increase the accuracy of trip-leg detection and also collecting their attributes, respondents were asked to define each trip-leg independently. It means that before starting a trip, respondent defines their trip mode and purpose, and also stop recording after finishing the trip. In order to save the time of answering questions and reduce the burden of responding, all questions were designed in multi-choice format. The order of questions and also the choices of each question have been presented in Figures 5(a) and 4(b). It was initially predicted that the process of travel recoding may cause some burden on respondents, but received feedback showed that respondents are happy with the current procedure of travel recording.

Figure 5: Snapshots of the trip definition tab of ATLAS Project



ATLAS Project has been configured to log the GPS data of respondent for every 10 meter in order to increasing the accuracy of collected data and having a precise view over the attributes of each mode. Considering the fact that this type of configuration could lead to battery depletion, some notifications have been designed in the app to remind the user to stop tracking when the app doesn't recognize any significant location change. A snapshot of the page where a new trip-leg and its attributes are defined in the application can be seen in Figure 6.

Figure 6: A snapshot of the page where a new trip-leg and its attributes are defined



3.4 Socioeconomic data collection

Considering the fact that the socioeconomic attributes of respondents completely affects on their travel behaviour, collecting the socioeconomic details of respondents become as important as collecting their travel behaviour details. In order to have a clear over view about the socioeconomic situation of each respondent, a brief socioeconomic questionnaire has been designed and added in the app. This questionnaire was designed based on the socioeconomic questionnaire which is currently used by Transport and main Roads (TMR) for performing household travel surveys. This questionnaire has been designed in a way that on one side provides a clear view about the socioeconomic situation of the respondent, and on the other side doesn't interrupt their privacy. The main attributes covered in this questionnaire can be listed as follow:

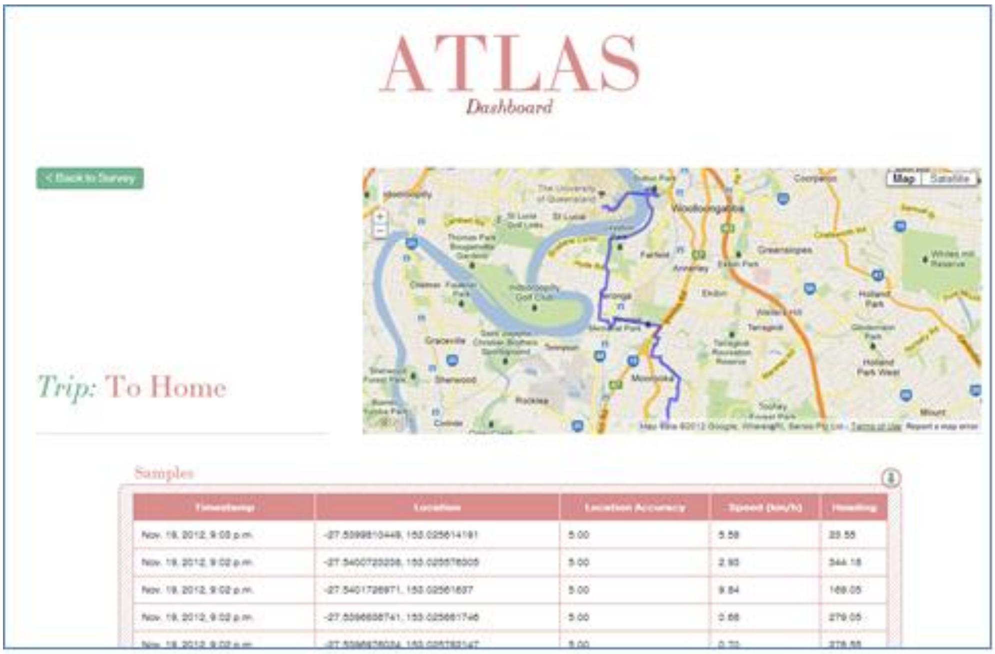
- Age range of participant;
- Gender of participant;
- Financial situation of participant;
- Vehicle ownership and accessibility of participant;
- Usual mode choice of participant in weekdays and weekends.

The structure of the socioeconomic questionnaire and also list and order of questions has been presented in Appendix 1.

3.5 Server of ATLAS Project

Along with the process of designing and developing the application and in order to have access to the collected database and the server of the research, a webpage portal was designed and developed for the research-team members. A screenshot of this webpage portal is presented in figure 7. Considering the privacy concerns of respondents, the server of this research is located on the server of the University of Queensland, and collected data have been backed up in SQL format regularly.

Figure 7: Snapshot of the web portal which is designed for ATLAS Project



4. Conclusion

This paper reviews different methods of performing GPS assisted travel data collection and concludes that considering the shortcomings of car-mounted GPS-based methods and handheld GPS-based methods, mobile-based travel survey can collect the travel attributes of respondents more comprehensively and accurately. However, this method needs to be studies and evaluated more as GPS-enabled smartphones are rather new. In this paper, ATLAS Project, as a novel smartphone application, has been introduced and the procedure of socioeconomic and travel data collection in this application were discussed. Although the process of design, development and implementation of a survey system (employing this smartphone application) have required an extensive period of time, the feedback and results of pilot surveys demonstrated the acceptable performance and accuracy of this application.

The project of developing ‘ATLAS Project’ will continue to focus on increasing the participation rate and dealing with battery depletion concern. Moreover , although the ‘active data collection approach’ was employed and evaluated in the first phase of this research, and reached acceptable results, ‘prompted recall approach’ will be evaluated in next steps of this study to increase the participation rate and also reduce respondents’ engagement.

Appendix 1 - List and order of socioeconomic questions in ATLAS Project

1) Please enter your email address?

2) Choose the range of your age:	
less than 16	41 - 45
16 - 20	46 - 50
21 - 25	51 - 55
26 - 30	56 - 65
31 - 35	66 - 75
36 - 40	more than 75

3) Which type of home do you have?
Separate House
Unit/Apartment
Villa
Townhouse/Terrace house
Other (please write in)

4) What is your gender?
Male / Female / Other

5) How many people currently live in your household?	
2	5
3	6
4	more than 6

6) what is the situation of your Dwelling Ownership?
Owned
Being Purchased
Rented
Other (please write in)

7) In which suburb is your home located?

8) In which suburb is your workplace located?

9) What is your employment type?
White collar
Blue collar
Student
Unemployed
N/A (e.g. Under 16)
Other

10) If you are employed, what is your work situation?
Full-time worker (35 hours per week)
Part-time worker (less than 35 hours per week)

11) What is your financial situation?
Independent
Partially dependent
Dependent

12) What is your average total weekly income bracket before tax	
less than 199	1000 - 1249
200 - 299	1250 - 1499
300 - 399	1500 - 1999
400-599	2000 or more
600 - 799	rather not say
800- 999	

13) which types of driver's licence do you have?
Full licence
Probationary licence
Learner's permit
Motorcycle licence
Other licences (please write in)
No licence

14) Which type of ticket do you usually use for Public Transport?
Ordinary GoCard
Concessional GoCard
paper
Free

15) What types of vehicle do you have access to for your daily trips?	Ownership Situation (Privetaly owend / Company owned)	Payment of running costs (Privately paid / paid by company)	Payment of parking costs (Privately paid/paid by company/None paid)	When do you usually use it? (weekdays/ Weekends/ all days)
Car				
4WD				
Motorcycle				
Ute				
Van				
Truck				
Bicycle				
Other (please write in)				

16) Which modes of Transport do you usually use on week-days? (You can choose more than one item)
Type
Private vehicle
Public transport
Cycling
Walking
Other (Explain)

17) Which modes of Transport do you usually use on weekends? (You can choose more than one item)
Type
Private vehicle
Public transport
Cycling
Walking
Other (Explain)

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