

Smartphone-based collection of transport data

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In recent years, travel surveys have moved from the traditional questionnaires and interviews towards web questionnaires and smartphone applications. The new technologies provide new possibilities of enriching the details and correctness of the trip data, but it also provides a number of issues which need to be considered carefully before replacing or adding a new alternative to the existing well-functioning methods.

The Danish Travel Survey collects detailed trip diaries of a representative sample of the Danish population from age 6 years. The respondents provide detailed information of all trips (trip start and end time, distance, transport modes used) and stays (address, purpose) conducted during a day. Approximately 10,000 interviews are collected per year. 80-85% of the respondents answer by telephone interview and 15-20% via the web questionnaire. The Danish Travel Survey might benefit from adding also the possibility of answering via smartphone, and this possibility was to be explored via a user test of existing smartphone applications. Possible benefits are the opportunity to reach people who were not reachable with the existing answering options and judgement of whether the methods from the traditional travel survey leads to lack in the data in form of underreporting of trips, particularly short trips/errands that might be underreported in traditional surveys. In addition, smartphone applications have the benefit of measuring routes and travel speeds, and they may run for more days with decreasing response-burden making it possible to collect "panel-data".

A large number of smartphone apps to collect location data and/or data for travel surveys exist. The apps typically monitor the GPS and the accelerometer of the smartphone and use this data to extract information to analyze the movements and stays of the person carrying the phone. The applications considered in this study convert this data into day programs consisting of trips and stays/errands. These stays and trips (or trip stage = part of trip) have to be assigned with a purpose and a transport mode, respectively. This can be recognized and suggested automatically by the app or manually by the user, but the user needs to be able to correct purpose and modes if the assignment is done automatically.

Method

The project investigated three apps with the goal of selecting an app suitable for the future use as a supplement to the present alternatives in the travel survey, and/or obtain learning experience with regard to possible problems with such apps in a Danish context of high bicycle and public transport ridership. The apps were tested by 10 users for three weeks in a rotations scheme where each user tried all apps shifting every week between apps and between using one or multiple apps.

For the test a set of requirements were formulated with regards to: 1) Robust performance, 2) App costs (time and money), 3) Questionnaire, and 4) Data collection and quality. Some details are mentioned below:

For the *Robust performance* we need the GPS data locking to be frequent and of high quality. We also need to assure that the app is not draining the battery on the smartphone since this can lead to

respondents removing the app. Finally, the app should run consistently on the phone not crashing the app or the phone.

For the *App costs* we need to assure that the costs for using the app and getting data are reasonable and that it is reasonably easy to adapt the user interface to Danish conditions.

For the user the *Questionnaire* should be user friendly, easy to navigate and easy to make changes within. It should be reasonable easy to add additional questions.

For the *Data collection and quality*, we set a requirement that we want to be able to access both the raw and the processed data. A possibility of being able to collect data outside the TU cycle would be preferred for use in research projects. The app should work in both the iOS and in the Android framework.

The apps chosen for further tests are:

- 1) TRavelVU (Trivector, Sweden)
- 2) MMM "intermediate native app version" (MobileMarketMonitor, U.S./Singapore)
- 3) rMove (RSG, U.S.)

All selected apps have previously been used in other travel studies (see Svaboe & Tørset, 2017, Nahmias-Biran et al. 2018 and Greene et al. 2016) where initial test have been conducted. The tests at DTU were therefore more detailed and tailored for the possible future use in the Danish Travel Survey.

Results

The results from the test were provided in the form of the data collected and from interviews with the test participants. The results give insight in the user experiences and the quality and magnitude of the data. The paper presents details from the test about the pros and cons of the tested apps. We present how the apps perform on the issues mentioned as important for the test and the travel diaries and map matched trips are presented and discussed. The final assessment of the performance of each app compared to the other apps and compared to the existing options in the travel survey conclude the study together with the final recommendation for the future use of a smartphone based data collection for the Danish Travel Survey.

References

Greene, Elisabeth, Flake, Leah, Hathaway, Kevin & Geilich, Michael (2016). A seven-day smartphone-based GPS household travel survey in Indiana. *Transportation Research Board 95th Annual Meeting Transportation Research Board*.

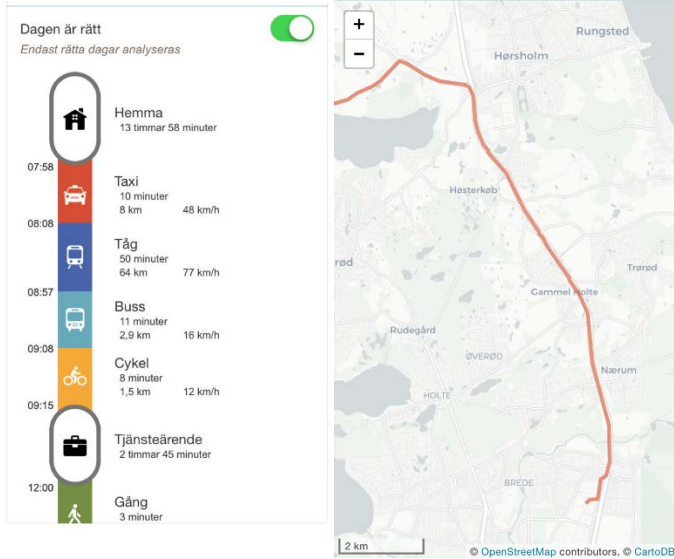
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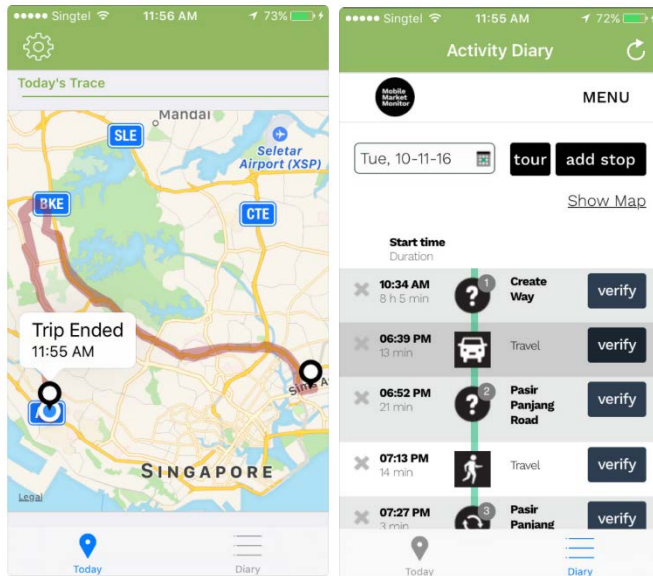
Screen dumps

The following shows examples of the user interface in the apps:

TRavelVU (picture from app store + phone):



MMMonitor (pictures from app store):



rMove (pictures from app store):

