Activity-based Household Travel Survey through Smartphone Apps in Tennessee

Mengjun Xie, Li Yang, Dalei Wu
Ruipeng Zhang, Heston Friedland
The University of Tennessee at Chattanooga

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Outline

❖ Project Background
❖ Our Objectives and Approach
❖ Research Methodology
❖ Current Progress
❖ Demo
❖ Conclusion
Project Background
Conventional Approaches

- Interview-based
- Mail-based
- Internet-based
The Shortcomings

- Prone to error
- Costly and time-consuming
- Not scalable
- Low response rate
New Trend

- Popularity and availability of smartphones
- Ability to collect rich sensor data, including GPS coordinates
- Intuitive and inviting user interface
- Easy to deploy, fast to evolve

Smartphone & GPS-based
Our Objectives and Approach
Objectives

❖ Design and develop a smartphone-based solution to the activity-based household travel survey (HTS)
❖ Conduct a pilot HTS study in Tennessee to test the solution
❖ Provide the solution to TDOT
❖ Perform data analytics if time permits
Innovations

Our smartphone-based household travel survey solution aims to

❖ Offer an effective, economical, scalable, and secure approach
❖ Improve the quality and accuracy of collected survey data
❖ Provide fine-grained data records and rich data features
Approach

❖ Cross-platform design for smartphone apps
❖ Popular, open standards: HTML5, HTTPS, SQL
❖ Data quality: recruitment survey, sensor data
❖ Usability: automatic address auto-completion, trip recording with GPS polling and geocoding
Research Methodology
Project Design

Design and Development
- Requirement Analysis
- System Design
- System Implementation
- Alpha-testing & Integration
- Design of Recruitment Schemes

Extensive Testing
- Beta-testing
- Performance Optimization
- Preparation for Launching Recruitment

Household Travel Survey
- User Recruitment
- User Pre-Survey
- App-based Travel Data Collection
- User Post-Survey
- System Maintenance

Project Conclusion
- Data Processing & Analytics
- Preparation for System Transfer
- Report & Documentation
Participation Workflow

1. Mobile App Installation (one-time)
2. App Downloading & Installation
3. User Registration
4. Per-Trip User Initiation
5. On-Trip Tracking
6. Post-Trip User Ending
7. Trip Data Reviewing/Editing/Uploading (per day, repeatedly)
8. Trip Review & Editing
9. Data Upload (Wi-Fi)
10. Remote DB
Recruiting Users

We plan to recruit participants from Tennessee via:

- Social Media
- Flyers
- Website Postings
- Public Institutions
- Mailing List
- Radio Stations
App Installation & Registration

- User downloads the app from app stores
- User signs up with an email address, password, and an optional referral code
- User must complete recruitment survey before proceeding
Recruitment Survey

❖ User fills in household information, member information, and vehicle information
❖ We will review user submitted survey information to decide whether to enroll
❖ Most questions are from 2017 National Household Travel Survey
Travel Data Collection

- Users can record a trip manually with basic trip information
- Users can also record a trip through GPS, which keeps track of a trip in real time
- User can edit the trip detail or delete it after a trip is recorded
Data Processing and Analytics (if time permits)

1. Data Preprocessing
   ❖ Identify outliers and invalid trip data
   ❖ Merge and split trips
   ❖ Remove spurious trips

2. Data Analytics
   ❖ Visualization and exploration
   ❖ Statistical analysis
   ❖ Machine learning

3. Data Interpretation
   ❖ Compare with other HTS studies
   ❖ Interpret patterns of interest
Current Progress
Current Status

❖ Developed smartphone apps for iOS and Android
❖ Developed a backend management tool for basic data management
❖ Conducted small scale internal testing and system optimization
❖ Developed consent, terms of service, and policies for the app
❖ Developed recruitment flyers
❖ IRB application submitted to UTC and pending on approval
❖ Pilot survey study targets UTC students and TN residents
❖ Project ending date: 2/28/2022 → 5/31/2022
Recruitment of Study Participants

- Aim to recruit up to 1,000 participants from TN
- UTC students: ~371
- Must be at least 18 years old
- Successful participation in and completion of the study will receive a reward of $15 Amazon gift card
- Please help us to recruit participants
Deliverables

❖ Smartphone apps for both Android and iOS
❖ Household travel survey datasets
❖ Strategies and procedures for recruiting household travel survey participants
Conclusion

- We have developed a smartphone-based solution to activity-based household travel survey
- We will be testing the solution through a survey study targeting up to 1,000 participants
- Please feel free to contact us at mengjun-xie@utc.edu.
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