

Activity-based Household Travel Survey through Smartphone Apps in Tennessee

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Outline

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

Project Background

Conventional Approaches



Interview-based

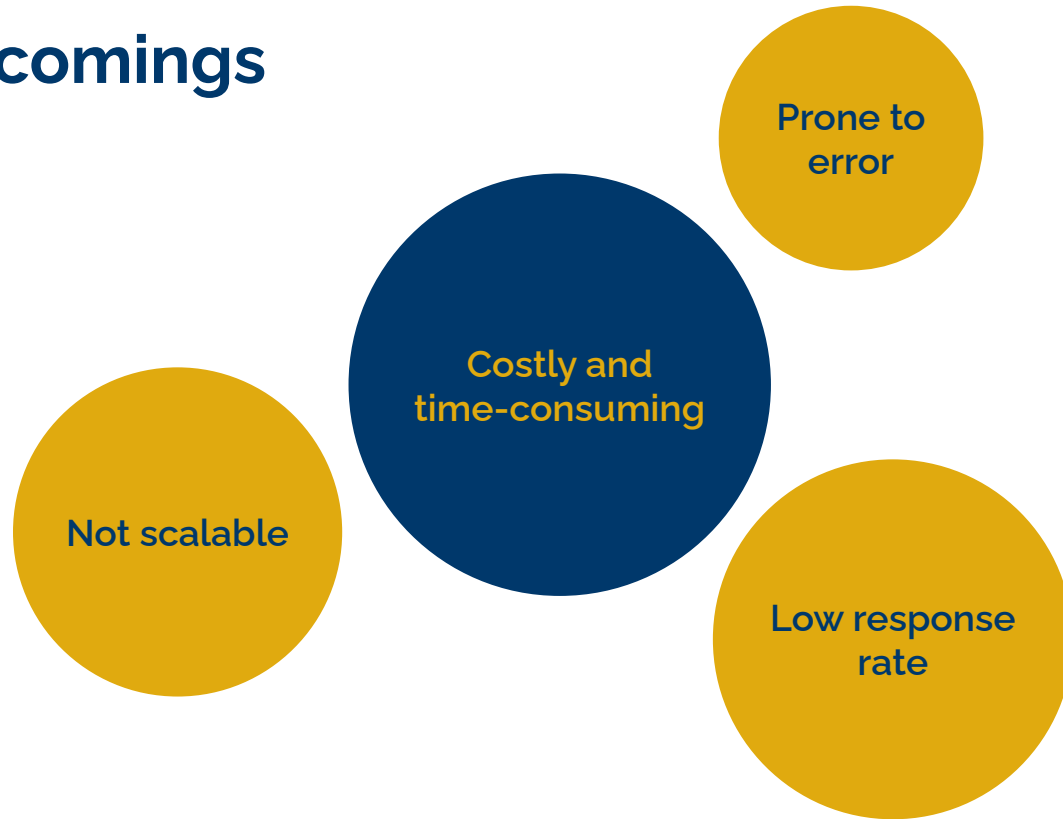


Mail-based



Internet-based

The Shortcomings



New Trend



Smartphone & GPS-based

- ❖ 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

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

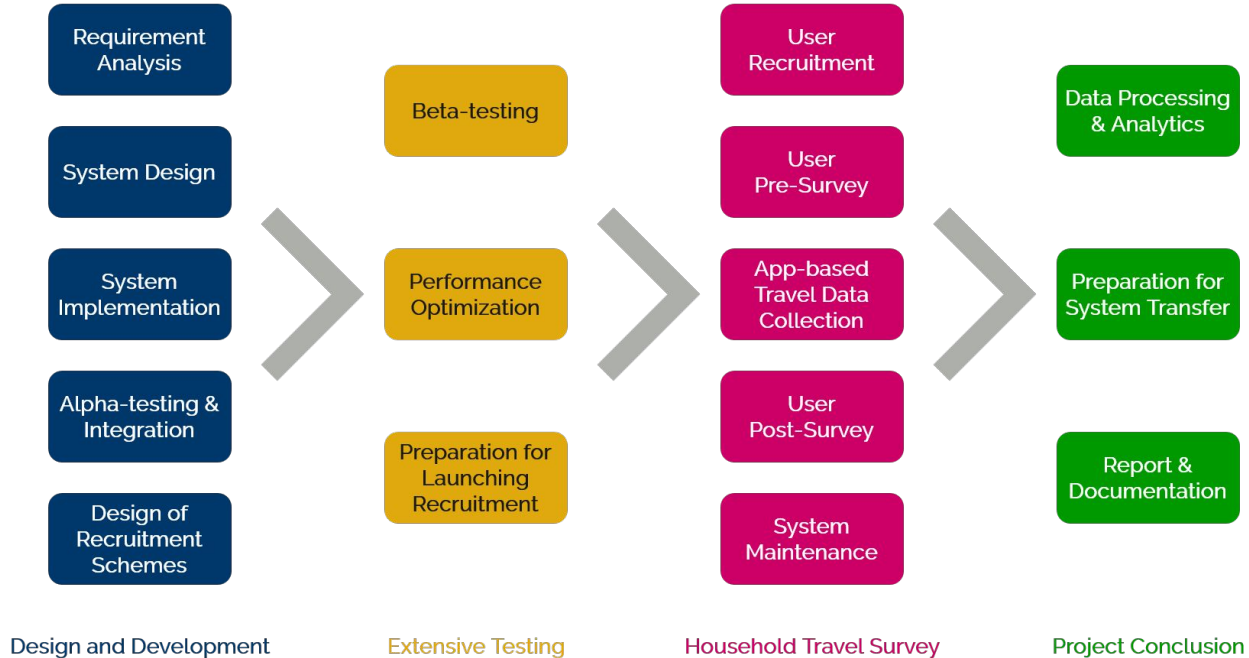
- ❖ Offer an effective, economical, scalable, and secure approach
- ❖ Improve the quality and accuracy of collected survey data
- ❖ Provide fine-grained data records and rich data features

Approach

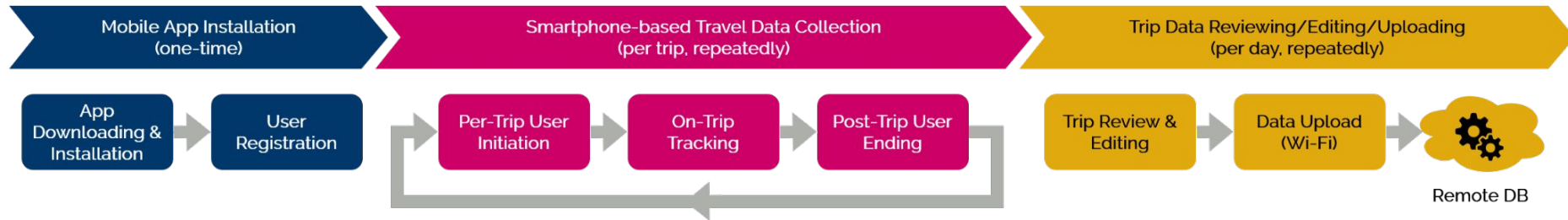
- ❖ Cross-platform design for smartphone apps
- ❖ Popular, open standards: HTML5, HTTPS, SQL
- ❖ Data quality: recruitment survey, sensor data
- ❖ Usability: automatic address auto-completion, trip recording with GPS polling and geocoding

Research Methodology

Project Design



Participation Workflow



Recruiting Users

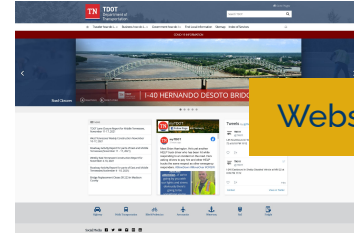
We plan to recruit participants from Tennessee via:



Social Media



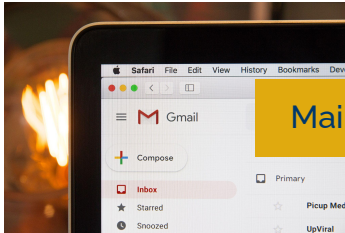
Flyers



Website Postings



Public Institutions

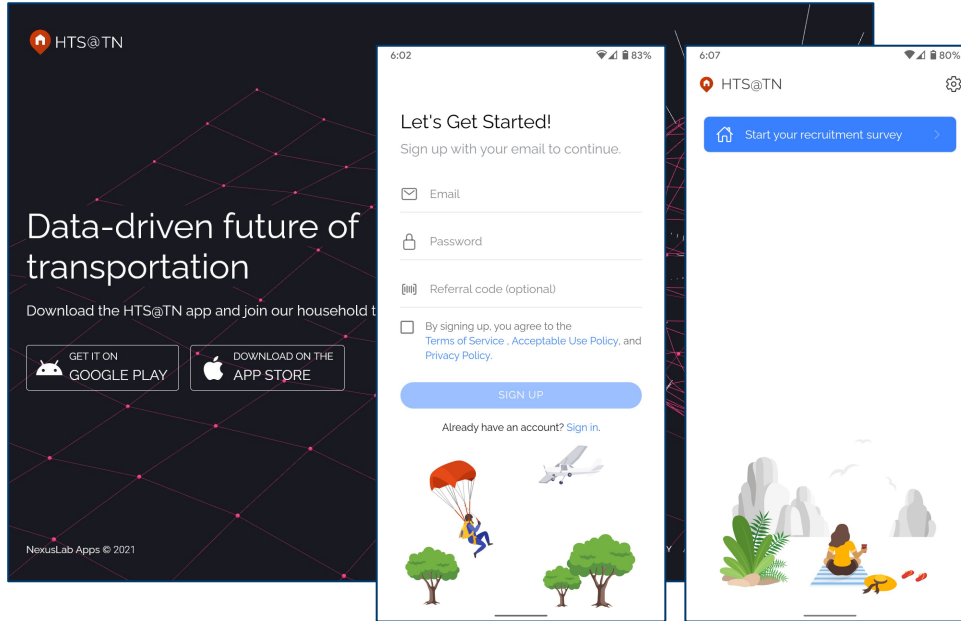


Mailing List



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

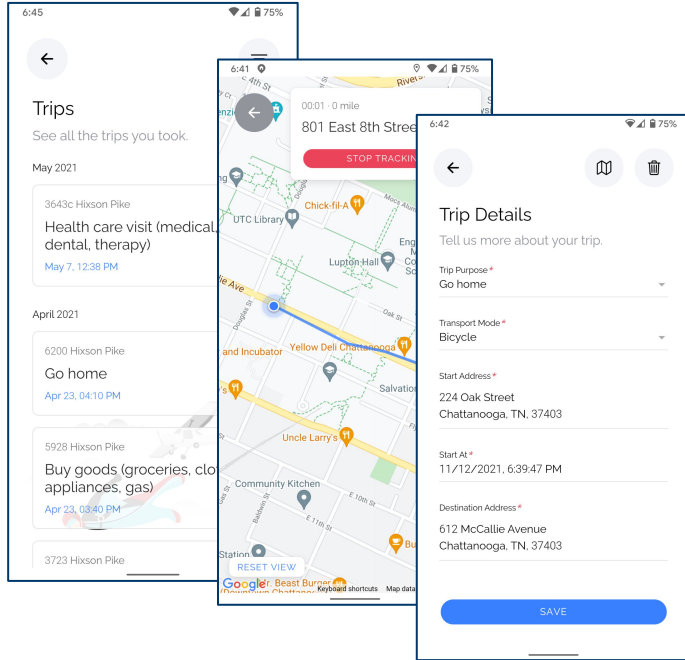
Recruitment Survey

The image displays four overlapping mobile app screens illustrating the recruitment survey process. The screens are as follows:

- Vehicle Screen:** Shows a list of vehicles with a blue 'ADD' button at the bottom. Visible text includes 'Vehicle S', 'Tap on a vehi', '2020 Honda CR-V', and '2019 Ford Mustang'.
- Member Screen:** Shows a list of members with a blue 'ADD' button at the bottom. Visible text includes 'Member', 'Self Rick Astley', 'Member Stefani German', and 'Member Edward Sheera'.
- Household Screen:** Shows a form for household information with a blue 'SUBMIT' button at the bottom. Fields include 'Address *' (600 Douglas St, Chattanooga, T), 'Housing Type' (Townhouse), 'Ownership Status' (Rent), 'Number of Years Liv' (3), and 'Household Income' (\$15,000 to \$24,000).
- Survey Summary Screen:** Shows a summary of the submitted information with a blue 'SUBMIT' button at the bottom. It includes a 'Household' section with a trash icon, a 'Members' section with '3 MEMBERS SAVED', and a 'Vehicles' section with '2 VEHICLELESS SAVED'.

- ❖ 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

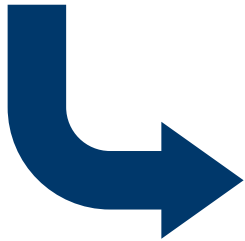


- ❖ Users can record a trip manually with basic trip information
- ❖ Users can also record a trip through GPS, which keeps track of a trip in real time
- ❖ User can edit the trip detail or delete it after a trip is recorded

Data Processing and Analytics (if time permits)

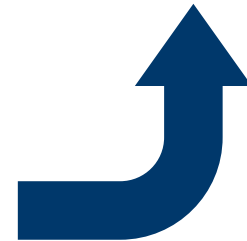
① Data Preprocessing

- ❖ 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

TN **TDOT**
Department of
Transportation

Help TDOT gather travel data with
HTS@TN 

- 1 Download the app**
Search for HTS@TN on your device's app store.
- 2 Create your own account**
This way, your travel data can be stored under your profile.
- 3 Complete the Questionnaire**
The questionnaire will verify your enrollment in the app.
- 4 Log your travels**
Whether it's a trip to the grocery store, work, or dinner with friends, log your travels in the app.

Use HTS@TN to record your travels for 7 days to receive a **\$15 Amazon gift card!**

Download HTS@TN today!



Find out more



This study has been reviewed and approved by the University of Tennessee at Chattanooga (UTC)
IRB #21-139
IRB email: instrb@utc.edu
Investigator email: mengjun-xie@utc.edu

Deliverables

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

Demo

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.

Acknowledgement

- ❖ This project is supported by TDOT under award # RES2020-19
- ❖ Special thanks to Dr. David Lee, Mr. Chris McPhilamy, Dr. Mohammad Molla (lead staff), Ms. Melanie Murphy, Dr. Golnaz Sarram, Mr. Jacob Thompson, Mr. Marshall Wilson and other TDOT staff for their guidance, support, and help.

Q&A