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Influencing Travel Behavior via an Open-Source Platform Phase 3: Transforming Multimodal Travel Behavior Data to Support Traffic Congestion Reduction Strategies

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POLICY BRIEF

BACKGROUND AND OBJECTIVES

Public transportation is crucial for improving mobility, accessibility, and overall quality of life by providing reliable alternatives to private vehicle use. However, transit systems may suffer from inefficiencies, leading to low user engagement. Transportation professionals have been developing strategies to enhance the transit system and increase ridership. One strategy involves offering real-time transit data to users through a real-time passenger information (RTPI) system such as OneBusAway (OBA). This allows transit customers to use their time more efficiently and feel more comfortable using the transit system.

OneBusAway (OBA) is an open-source platform developed to enhance public transportation accessibility and efficiency. It provides real-time data on bus arrival times and other transit-related information, reducing waiting times and uncertainty at stops. The system is widely used in various U.S. cities to improve transit ridership by providing instant information in urban and rural areas near city centers. The OBA platform offers real-time transit information on iOS and Android devices, encouraging more people to choose public transportation over private vehicles. In Puerto Rico, specifically in the city of Mayagüez, the implementation of OBA has been a multi-phase project aimed at studying how travelers choose between different modes of transport, such as public transit and micro-mobility solutions.

This research was conducted by the University of Puerto Rico at Mayagüez (UPRM) in collaboration with the University of South Florida (USF). It began two years ago with the introduction of OBA in Mayagüez. The goal this year was to enhance the quality of data collected from OBA and other apps to assist in urban planning. The aim was to provide decision-makers with valuable insights to create strategies for reducing congestion and improving mobility. Due to the bus routes being located in mountainous terrain with low GPS coverage and dense vegetation, the study faced limitations in accuracy and precision in OBA's multimodal data collection. As a result, a complementary application called Travel Transit Tracker (TTT) was developed.

The study focused on technical issues such as data cleaning, GPS accuracy, and software optimization for iOS and Android. The research showed the potential of incorporating accurate data from GPS-based mobile applications to enhance transportation operations and planning.

METHODOLOGY

The project's methodology involved several phases focused on collecting and analyzing data to improve public transportation through real-time passenger information. The first step was to choose OBA as the primary tool for tracking users' trips. The data from OBA was checked to see if it could effectively track different modes of transportation. However, there were differences between the OBA and actual data, so additional cleaning and validation processes were necessary. A new application called Travel Transit Tracker (TTT) was created to address these needs.

The new TTT application was developed as a supplementary tool to enhance OBA's data collection capabilities utilizing the OBA processed data as a starting point to provide automatic tracking information. The TTT development became possible after the second year of implementing OBA, when the state of the servers became adequate for a Representational State Transfer (REST) application for third-party software. The developed REST Application Programming Interface (API) was used to support OBA and other additional services. The external mobile application TTT was created using this API to address specific user multimodal data acquisition needs.

TTT allows users to manually input trip information, providing data on various modes of transportation such as buses, e-scooters, and walking. This data is then compared with automatically generated OBA data to improve the accuracy of multimodal travel behavior insights.

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Both the OBA and TTT applications were integrated into the system, with testing and deployment carried out on various iOS and Android devices. The development process leveraged platforms like Expo and REST API services from OneBusAway and Traccar for data integration. The testing phase also focused on validating OBA data with real-time tracking features and manual input from users to optimize the accuracy of transit and multimodal behavior data.

At the same time as developing the mobile application, the Mayagüez transportation planning model was created. This involved defining census zones, creating an origin-destination (O-D) matrix to show the volume of trips between zones, defining the transportation network (including bus routes), and completing the transportation planning model. Additionally, a procedure was developed to integrate crowdsourcing tracking and multimodal data with the planning models based on field observations and advancements in the literature related to using crowdsourcing data in transportation planning modeling.

RESEARCH FINDINGS

The Research Findings from the implementation of the OBA system in Mayagüez, Puerto Rico, highlight several key insights presented below.

The project revealed issues with GPS accuracy in the mountainous terrain of Mayagüez, which caused discrepancies between OBA's automatically collected data and the manually verified ground truth data. These challenges demonstrated the need for additional data cleaning and validation to ensure reliable data for transportation planning.

To overcome the limitations in data collection, the project team developed the TTT application as a supplementary tool. This open-source application was designed to enhance data accuracy by allowing users to log their trips and transportation modes manually. This addition significantly improved the quality of multimodal travel behavior data, which is critical for optimizing transit planning and reducing congestion.

Testing and deploying the TTT app on Android and iOS platforms confirmed its ability to capture trip destinations based on user input. The app also demonstrated the potential for broader use in other urban settings, as it could track multiple modes of transport such as walking, buses, and e-scooters.

The study emphasized the importance of improving GPS accuracy, particularly in areas with difficult terrain, and suggested integrating advanced GPS technology or alternative data sources like Wi-Fi. Furthermore, future versions of OBA and TTT should incorporate automatic data cleaning tools to enhance data reliability.

POLICY AND PRACTICE RECOMMENDATIONS

The recommendations are geared towards improving the accuracy, reliability, and overall utility of the transit applications for both users and planners.

Future versions of the TTT and OBA apps should focus on improving GPS accuracy, especially in areas with challenging terrain or poor signal reception. Advanced GPS technologies or additional data sources like Wi-Fi or Bluetooth could be utilized to enhance location precision.

In the future, the TTT and OBA applications should include automatic data cleaning tools and algorithms to minimize problems like missing or duplicate trip data. This will enhance the reliability of the collected data, making it more valuable for transportation planning. Additionally, it is essential to incorporate continuous data monitoring from the beginning to identify anomalies early and maintain data reliability throughout the project.

Future studies should focus on increasing participation by offering incentives, collaborating with transportation authorities, and promoting public outreach campaigns. This will help gather more comprehensive data that better reflects user behavior.

When developing urban planning models and strategies, it is vital to incorporate user-oriented information that considers multimodal behavior. This means using data-driven, user-centered transportation planning solutions.

By utilizing crowdsourced travel data for planning, modeling, and analysis, cities can significantly improve their understanding of travel patterns, obtain a more complete picture of urban mobility, enable better-informed decision-making, and effectively address traffic congestion within complex transportation systems.

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