

Evaluating interventions through long-term human mobility data: initial methods and lessons learned

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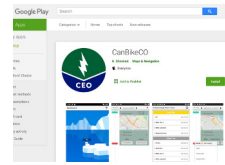
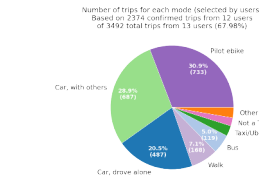
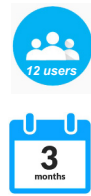
OpenPATH

<https://nrel.gov/openpath>



This poster focuses on generalizable results related to long-term human mobility data collection. The results focus on the lessons learned from the data collection process. For a summary of the evaluation results from **this specific** program, see our companion poster or tech report

Colorado Energy Office mini-pilot providing e-bikes to low-income workers



Motivation:

- Shared mobility health concerns
- Pandemic cuts to transit service
- Reduce shifts to single occupancy vehicles

Objectives:

- Assist low-income essential workers
- Improve mobility cost and productivity
- Improve emissions, energy, and air quality

Participant photo courtesy Colorado Energy Office

Auto-generated trips with user labels: better response rate and richer data



Comparison of qualitative and quantitative data collection. Survey responses are left-weighted showing few responses, active days (right weighted showing many active days), and % of labeled trips (right weighted showing good response rate).

Comparison of platform-reported and survey-reported metrics. In the participant index, red = no survey response, purple = app was inactive, and blue = the app was active, but metric was zero

Comparison of platform-reported and survey-reported data collection. L-R: number of unique purposes per user, distribution of trip purposes, distribution of per-user trip purposes. The survey-reported data only includes categories, so cannot be used to generate the last two charts. Participant colors same as above.

Richer data supports better evaluation

$$(EI_{replaced} - EI_{eBike}) * L_{trip} = EO$$

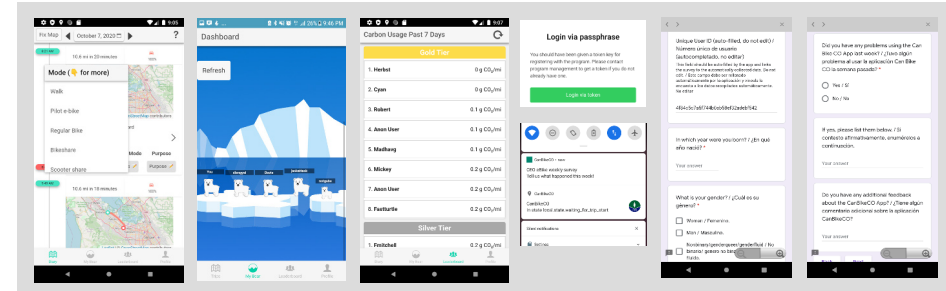
Energy/emissions impact (EO): requires replaced mode and trip length. Replaced mode is a user label, but trip length is challenging for users to estimate

$$(EI_{mode} - EI_{eBike}) * L_{trip} = UPES$$

Untapped Potential Energy Savings (UPES): determine which trips could have been made on the e-bike. This indicates potential energy/emissions savings with additional behavior change. Requires all trips with mode labels and lengths

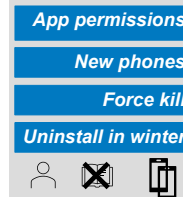
Route choice, potential infrastructure improvements to support biking: Requires all trips with mode labels and trajectories.

Multi-month real-world travel diary data with trip-level user labels

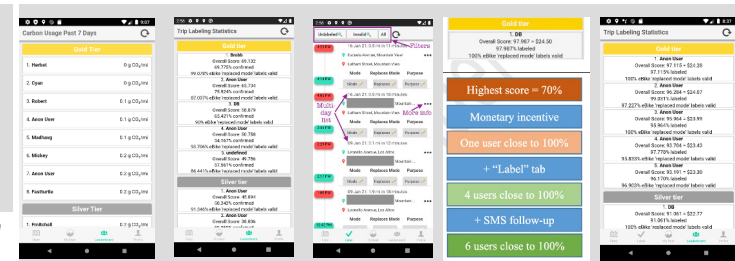


CanBikeCO version of OpenPATH platform with program specific customizations: L-R: trip labels, polar bear gamification, leaderboard, passphrase authentication for privacy and control, demographic survey, weekly survey

App interaction behavior challenges: app settings and labeling

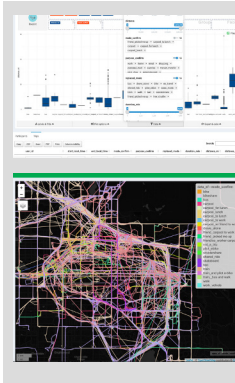


Participants used their own phones to ensure that they would carry them everywhere. But they didn't always read the instructions! Some also upgraded phones multiple times over the 3 months.



Labeling incentives: Switched leaderboard to rank by completed labeling %, added option to label multiple days at once, and offered a monetary incentive. The combination of all these incentives was required to bump up labeling rates. The monetary incentive would not have been sufficient if the labeling was not easy, but even easy labeling was too much of a burden for three months without some money to back it up.

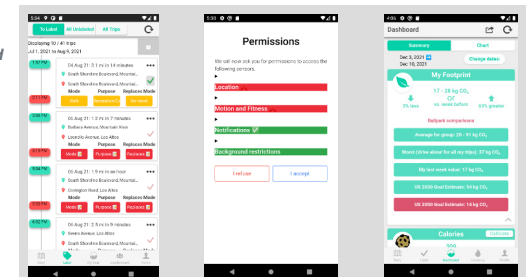
Deployer dashboard (from UNSW)



Real-time data to support participants: Adapted the dashboard contributed by the University of New South Wales (UNSW) to provide real-time status to program admins. Can be used to support participants in (1) proper settings (2) labeling reminders (3) using the e-bike for more trips. Can also be used for route choice and infrastructure shortfall identification to inform cities, administrators.

Ongoing work

Addressing challenges: Label assist, status screen and individual transportation "meter"



Conclusion summary

The tool generated a rich dataset for research and evaluation of behavior that would otherwise be unobserved. The data enabled robust energy estimation of the program. Practice revealed a need for further refinement to reduce participant data input burden.