

From Simple Labels to Time-Use Integrations: Supporting the Spectrum of Qualitative Travel Behavior Data

Jack Greenlee, Alireza Raei, Sebastian Barry, Maliheh Tabasi, Amarin Siripanich, Taha Hossein Rashidi, and K. Shankari ¹ National Renewable Energy Laboratory, 15013 Denver West Parkway, Golden, Colorado 80401, ² University of New South Wales

Particul Care all Mile

ferrenter entitiene

0.00

O Milliop Gentr Gross Pile gentlers Rith App

E Statement-state and Street and

Whether wet and see with

The survey questions themselves can be created and edited

with a web builder (pictured) or a spreadsheet file.

TRBAM-24-05818

TRB 2024 Annual Meeting January 7-11 2024

INTRODUCTION & MOTIVATION

In transportation research, applications of travel behavior data collection are context-specific, While passive data collection may be sufficient in some use cases, others may benefit from qualitative input from participants. These inputs can be viewed as spanning a spectrum of user burden and data quality, from simple trip labels to complex time-use surveys.



We will demonstrate that any or all of these can be collected by a smartphone travel diary app that collects both location data and input from users. Mode and Purpose Labels

choice format

Classic Travel Questionnaire

detailed information.

size, and more

Time-Use Survey

different activities

and transportation planning.

Prompt users to label the modes and purposes of their

· Options presented in a drop-down menu or in multiple-

the impact of a particular mode versus another.^{1,2}

· Used in program evaluation, where the goal is to evaluate

Per-trip or per-place questionnaire that can provide more

· May prompt for mode and purpose, as well as cost, party

Travel diary apps could also prompt users to record

income, elderly, and disabled populations.

"missed trips" or "trips not taken" in a travel diary app.

· Time-use data tell us how people allocate their time among

Sheds light on work-from-home behavior, online shopping

habits, and immobility rates, all impacting travel demand

travel patterns and choices is desired

Counterfactual "Trips Not Taken" Survey

Used in research contexts where a deeper understanding of

0.45 054
Mon July 1, 2020 United and the second secon
7.14 PM
t con t c
C 40 PM
Mon July 3, 2023 North Main Street, Fort Brigg + Add Trip Not Taken
6045 PW
(11) (11)
Mon July 3, 2023
North Main Street, Fort Bragg
+ Add Activity
(111)

RELATED WORK

IMPLEMENTATION: NREL Open Platform for Agile Trip Heuristics (NREL OpenPATH)

A review of the existing literature and other travel diary apps revealed that while there have been many smartphone-based travel diary solutions, most of them do not cover the full spectrum of use cases. Based on the publicly available information about various travel diary

platforms, we evaluated their capability to support multiple use cases.

	license	sense	label	questionnaire	time	App last updated
rMove	closed	Y	?	Y	?	2022 (Google Play)
MotionTag Catch-My-Day	closed	Y	Y	N	N	2023 (Google Play)
TimeUse+	closed	Y	N	N	Y	2022 (App Store)
Atlas II	closed	Y	Y	Y	?	2019 (Google Play)
City Logger	closed	Y	Y	N	N	2017, not in stores
Daynamica	closed	Y	Y	Y	Y	2023 (App Store)
Itinerum	open	Y	Y	N*	N?	2018 (Github)
MEILI	open	Y	Y	N	N	2017 (Github)
ohmage	open	Y	N	Y	?	2015 (Github)
Statstics Netherlands TABI	open	Y	Y	Y**	N	2020 (Gitlab)
**TABI supports day-level ques be verified	tionnaires,	but supp	port for t	rip-level or place-	level q	aestionnaires could not
icense: open-source p repository; closed-	latform source	s have platfor	e their rms ai	code public re proprietar	ly visi y or c	ble in a Git therwise not pub
sense: support for cont	inuous	collec	tion-	i.e., backgro	und :	sensina.
abel: support for mode	and p	imose	label	s		
unetionnaire: support	for a d	ataila	d trave	al questionn:	aire a	which may prome
Jueauonnane. auppon		otanot	u uavi	or queationna	ano, v	which may promp

ques for a variety of qualitative inputs.

time: support for time-based survey prompts, which may be used to record activities performed (time-use survey) or that might have been performed under some other circumstance (counterfactual survey).

Information on the reviewed closed-source projects was limited, particularly with reference to the level of configurability they support. Since the details of the architectures underlying these platforms are not publicly available. we based our findings on screenshots of the apps, promotional descriptions of app features, and literature describing how the apps were used in research contexts

The open-source projects on this list generally had more public information, including documentation, describing their functionality. However, many of these projects have unfortunately become obsolete due to a lack of active maintenance. Insight into latent demand and barriers to mobility for low-

> This suggests a compelling need for a universal, open-source travel diary platform that supports a broad range of use cases while also outlining a clear path to customization for each of its applications.

We expanded NREL OpenPATH to support a dynamically configurable in-app survey mech	anism. This means that each
deployment of the app has its own set of options and its own surveys, but all deployments	benefit from the same shared
architecture.	

We also outline a streamlined process for the app to be deployed for a particular use case. Thus, the app can be easily customized without changing the code.

		20101	10.44	
		To Label (1 5/12)	35040016 D	(
			OTHE PM	hu August 04, 2016
"survey.info": { "truy-labels"; '%XiTLABL"	"eurvey.info": ('eurvey.': ('touveys': (Mode	(👇 for mon	e)
	"fernfaib": dBL>,	Wak		۲
) }	E-bike		0
	'trip-labels': 'EOUTD'	Repular	Diko	0
		Bikesha	ar0	0
Commence of the second s	····	Scooter	r share	0
"sarwpy": ("sarwpy": ("DestarfactualServes": ('sorvey_sale ' ('sorveys': ('Timesefermet': (Gas Ca	r Drovo Alono	0
"furnPath": <381>,	"formPath": «UK.»,	Gas Car	r Shared Ride	0
)),	-) - h	E-Car D	Irove Alone	0
"bettens": { "place-coles": {	"bottens": { "place-motee": {	E-Car S	Reared Ride	0
"ost-filled-in-label": ("est: filled-in-label": ("est: fágregar viaja no realizado",	"art-filled-is-label": ("es": "Add Ariivity", "es": "Mddir actividad",	10 -	(02:18 PM	The August 04, 2016
		 Image: A start of the start of		8
), Designability (METTIARD)	2. Annine label after ADDITION	Local	Dasticion	Protia
)	>	Mode	and Purp	ose Labels
		Operador 🗢	11/52 a.m	
Each program or study has	its own configuration file		Encuest	a Desp
specifying which surveys w	Il be used.	▼ Pregunt	tas sobre el	uso del tiemp
1 Mart		 		

Fecha	[*] Hora de inicio	instutudaenojtudelo?		
Jul 3, 2023	8:05 PM	reproductysto		
		ີ ຄົນອາເພຣິສາ ອີລດ່າ		
Fecha	[•] Hora de finalización	🗌 สินอาเมอิสา ชีวยาว		
Jul 4, 2023	9:07 AM	🗌 มาธาระเปน สมี มาถิน		
		en@onc@ueen		
Tino de actividad		ຄາຊີວັ		
 Tipo de actividad 		Baccon anculare		
En caso de recebera, po	edw Inweccoust varies activitation.	 escalars lungenseron marendario 		
 Actividades 	de cuidado personal			
 Actividades y la educaci 	relacionadas con el empleo	i ikug		
Activitation	domesticas	dawconithium		
Recreación	v ocio	_		
Trabajo volu	ntario y actividades de	ébi		
010300		ອັດເພື່ອນໃດຍ B		
- VIV				

รับสินล่างหนึ่น⁶ะเ Actividades de cuidado personal Time-Use Survey (in Spanish) Demographics Survey (in Lao

2:47.PM

Survey

Trip-end survey

Didn't park (waited, drop-off, drive-thru)

Powered by INKET

Trip Questionnaire

érron.

Jehicle trip: Parking location Oan driveway/parace

Someone else's driverva

Parking lot/garage

On street parking

Park & ride lot

) Other

🔻 ຊໍ່ມູນຂອງສ່າງ



NREL OpenPATH has already been deployed across several use cases, including:

- The CanBikeCO e-bike program^{1,2} ("mode," "purpose," and "replaced mode" labels)
- "Essential Worker" and "Bike" surveys (trip questionnaire)
- Chicago Time-Use Study (time-use survey, still ongoing).

CONCLUSIONS AND FUTURE WORK

EVALUATION (Deployment Results)

Our work suggests that:

- · A single, open-source platform can be used for a multitude of data collection and analysis scenarios in transportation research.
- The research community could benefit from a more unified effort in developing and refining the tools supporting the research; by collaborating and pooling resources, the community can collectively advance the field much more rapidly.
- Smartphone app-based travel diary data collection possesses distinct characteristics and abilities compared to traditional methods, and the scale and duration at which collection can occur is much greater.

We look forward to working with the community to explore novel use cases and refining the implementation of our tools

REFERENCES

- 1. Shankari, K., A. Duvall, and L. Bovce, 2021, "The CanBikeCO Mini Pilot: Procedure and Preliminary Results."
- 2. Akcicek, C., Z. Aemmer, K. Shankari, and A. Duvall. 2023. Freewheeling: What Six Locations, 61,000 Trips, and 242,000 Miles in Colorado Reveal About How E-Bikes Improve Mobility Options, Golden, CO: National Renewable Energy Laboratory,

NREL/PO-5400-88306

Acknowledgments

This work was authored in part by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy (DOE) under Contract No. DE-AC36-086028308. Funding provided by the U.S. Department of Energy Vehicle Technologies Office as part of the Energy Efficient Mobility Systems program's Core Tools activity area. The views expressed in the article do not necessarily represent the views of the DDE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

 \sim k.shankari@nrel.gov

Winter and production and ------