UTSA Community Micromobility Research Workshop Report

Greg Griffin, Jeffrey Jobe, Raveen Wijewickrama, Murtuza Jadliwala, Anindya Maiti, Sushil Prasad

Workshop held November 5, 2020 on Zoom

Report date: Nov. 29, 2020

Research in this report was supported by the United States National Science Foundation (NSF) under award number 2016717.

Executive Summary

This report describes the planning, organization and outcomes of the workshop aimed at bringing together the University of Texas at San Antonio (UTSA) and local San Antonio micromobility research community to plan for the development and implementation of ScooterLab, a proposed community research testbed comprising of dockless e-scooters operating on the UTSA campuses. First of the many planned activities with support from NSF award #2016717, this workshop focused on local community expansion and inclusion efforts to build and deploy a more useful, accessible, and inclusive micromobility research infrastructure. An additional goal of the workshop was to build knowledge and engagement at the university about micromobility research. This workshop was organized virtually by means of Zoom (due to the COVID-19 pandemic related restrictions) on Thursday, November 5th, 2020, and was attended by a diverse set of faculty and researchers from UTSA and the local San Antonio community, which enabled rich discussion in both transportation, as well as computing-centric micromobility research challenges. Besides discussing open research challenges in relevant areas, the workshop participants also gave feedback on the planned ScooterLab testbed. The workshop concluded with a roadmap for future such meetings and engagements. Some key products coming from this workshop include participant discussion recorded on video, chat log, and notes, in addition to a brief follow-up survey.

Table of Contents

List of Tables

List of Figures

Workshop Planning and Recruitment

To plan for the organization of the first ScooterLab workshop as a local or university-wide event, the research team met several times remotely to plan the interdisciplinary content, invitees, and process for the workshop. The research team invited faculty from UTSA's College of Architecture, Construction and Planning, College of Engineering, and College of Science, in addition to five transportation practitioners. The invitation email is attached as Appendix 1 behind this report. Thirteen researchers registered to attend the workshop, spanning UTSA departments including architecture, computer science, civil engineering, construction science, management science, and statistics, and one from community and regional planning from the University of Texas at Austin. The list of registrants is available in Appendix 2. Including the research team, a total of thirteen participated in the online workshop. We encouraged invitees to present their own research related to micromobility in one slide at the workshop.

The agenda included brief introductions, and overview of the workshop and micromobility testbed planning, participant research, sessions on computer science-oriented research, and transportation-oriented research. The full agenda is attached as Appendix 3.

Workshop Results

Overview

Murtuza Jadliwala opened the workshop with an overview of ScooterLab as a community research infrastructure in advancing micromobility and computing research disciplines. He outlined the planned details of this future publicly-available micromobility testbed and crowd-sensing/crowd-sourcing infrastructure which aims to provide researchers access to a community of riders and a fully operational fleet of highly customizable dockless e-scooters. These e-scooters will be retrofitted (in an on-demand fashion) with state-of-the-art sensors in partnership with collaborators, enabling real-time collection of fine-grained research data from micromobility rides. He outlined the current focus of the project on: (i) growing a community to understand the needs of micromobility researchers across multi-disciplinary areas such as machine learning, high-performance computing, urban planning, transportation engineering, and public policy, (ii) building proof-of-concept vehicles, sensors, and computing platforms, and continuously improving designs based on community feedback, (iii) organizing focused events, such workshops

and tutorials to update the community on development of the micromobility testbed. Murtuza Jadliwala further stressed ScooterLab as an inclusive and interdisciplinary research community which will provide valuable data that is difficult to attain at the proper scales needed to address interdisciplinary research challenges.

Participant Interests

Followed by the ScooterLab overview, Greg Griffin facilitated brief presentations by participants on their research interests in micromobility, which sometimes reflected past work, in addition to future ideas.

- Data driven scooterist behavior analysis, multi-sensory and crowdsensing based infrastructure assessment – **Jiannan Cai**
- Sustainability in transportation on campus and surrounding areas, specifically e-scooters via mobile apps utilizing predetermined routes from docking stations, reducing student carbon footprint – **Anjulie Hira**
- Sensors and privacy & security as well as pricing models with micromobility vehicles – **Anindya Maiti**
- ScooterLab born with discussion of most effective pricing models among private micromobility companies and how it effects users – **Murtuza Jadliwala**
- Datasets involving travel behavior traditionally providing location data using GPS pinpoints, traffic and parking violations caused by e scooter users, as well as policies instilled by private companies and cities to combat violations, sidewalk obstruction by e-scooters – **Shunhua Bai**
- Understanding how short distance travel demand is extremely important in micromobility studies vs. technology component – **Shunhua Bai**
- Growth of micromobility use in the context of technological innovation and internet availability – **Greg Griffin**

Topical Discussion

More focused discussions followed the brief research presentations and introductions by the participants. To facilitate dialogue and ideas from participants, researchers prompted the group with questions spanning transportation and computer science-related topics across micromobility. The following are a few of the questions used by the researchers to prompt participants and spur discussion:

- *Tell us more about the **kind of research** you want to do with ScooterLab. Are you interested in safety, policy, travel behavior, or other topics?*
- *We are currently prototyping combinations of e-scooter hardware and sensors to allow virtually any kind of data collection. What **types of data** would you like to be able to gather from experiments?*
- *What **other questions** do you have—maybe topics we haven't discussed?*

Participants covered a wide range of topics, suggesting opportunities for further exploration in larger workshops and later research. The relatively small group enabled all participants to attend both discussion groups, rather than having separate breakout sessions as planned in the agenda. Figure 1 shows the context of the Zoom-based workshop during Murtuza Jadliwala's overview.

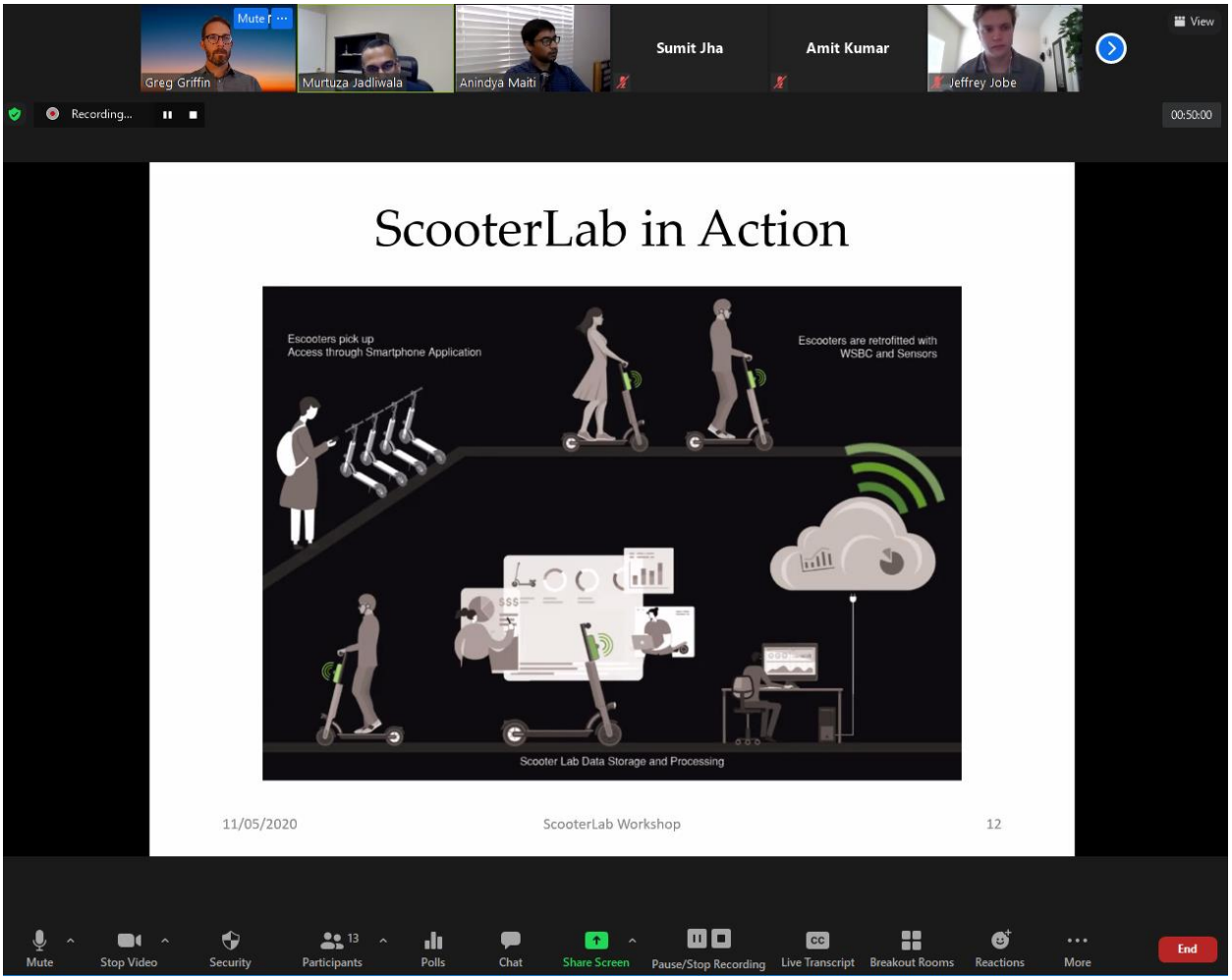

Figure 1. Screenshot of videoconference

Data/Sensors/Computer Science-Centered Discussion

During the discussion sessions, many of the participants' ideas were interdisciplinary or transdisciplinary, connecting computational and engineering possibilities across potential and practical applications in transportation. Several of the salient ideas in this discussion are listed in Table 1, along with opportunities for potential applications. Data processing topics include exploring hardware and software configurations that could open possibilities for privacy and efficiency. Integration and placement of sensors on the vehicle may support new research across multiple disciplines with fundamental and practical opportunities. Experimentation with new sensors could be user-focused to improve riders' knowledge of potential hazards such as pavement conditions or oncoming vehicles, in addition to providing new data sources for addressing gaps in research spanning urban environments. Participants were interested in computational challenges spanning efficiency, reliability and privacy issues, and onboard vs centralized data processing. Many of these topics may support transportation applications, but others could reveal insights on human behavior or urban environmental characteristics, as well.

Table 1. Computer science-oriented research discussion

Topic	Opportunity
3D cameras, IR/Night vision cameras	Improved situational awareness/sensing
Automatic braking	Collision prevention and speed control
Data transfer via hotspots	Reduce reliance on cellular connections with data transfer at route nodes or at charging stations
Lifecycle analysis	Durability of hardware
Onboard data processing	Possibility of increasing software/data autonomy on vehicle
Sensor positioning	Location of sensors on vehicle for detecting phenomena—handlebar vs. post or deck.
Sensors for cleanliness	Test methods to evaluate condition for vehicle rental.
Specialized sensors	Cameras for infrastructure condition assessment, Lux for light and shade
User privacy	Willingness for users to share data, including imagery with faces
Vehicle sensor integration with user electronics	Multi-sensory research may reduce the number of sensors needed on scooters

Transportation-Centered Discussion

Research interests in the transportation-centered discussion spanned travel behavior, safety, and urban sensing. In addition to the direct roles of micromobility for transportation, participants found opportunities for urban sensing. As suggested in the discussion on hardware, scooter-mounted sensors could develop 3-D maps of infrastructure, and accelerometers could develop data on roadway quality, or lux or temperature sensors could support understanding urban environments. A combination of sensors and communication tools could test methods to improve safe travel behaviors, including speed through intersections or sidewalk riding when a bike lane exists. The target population of students was also discussed as to the possibility of introducing bias into the testbed. Other potential challenges to consider include privacy when video sensing is involved and Institutional Review Board processes with remote study deployment.

Table 2. Transportation-oriented research discussion

Topic	Opportunity
Automating law enforcement	Warning riders of undesignated sidewalks, etc.
Co-location algorithms	Integration of GPS with research topics such as roadway conditions and crash locations
Geo-located speed control	Reduced speed in high-conflict zones
Granularity of travel data	GPS can provide individual route choices, whereas public data is typically aggregated origins and destinations
Identifying biases	Expanding target population to general public vs. exclusively students
Infrastructure condition	Assess sidewalk and neighborhood conditions for current and future infrastructure assessments
Modal similarities & differentiation	Relationship to other vehicles and pedestrians and safe roadway space
Navigation assistance	Map integration to handlebar/dash
Pricing/insurance models	Impact of cost on ridership and frequency of use
Route choice	Sensor integration for heat and light (shade) and related topics
Target population	Student population allows for possible collection of demographic data
Vehicle to infrastructure (V2I) integration	Traffic flow and safety, a possible replacement for GPS data (e.g., detection at intersections)

Follow-Up Survey

To capture post-workshop reflections, the research team sent a follow-up survey to participants. Questions used multiple choice and Likert scales to address overall helpfulness of the workshop, the respondents' field of work, thoughts on the micromobility testbed, additional resources, and open-ended responses for potential research questions for the planned testbed and other research needs. Four respondents completed the survey, so results cannot characterize a larger population of potential collaborators. Respondents characterized their backgrounds as spanning transportation (n=2), computer science (n=1), and urban planning (n=1).

Overall, all respondents described the workshop as "very helpful" to establish the goals and methods of ScooterLab. All respondents regarded the research testbed as "very" or "extremely interesting." Two noted ScooterLab would be "definitely" useful for their research, and two responded it would "probably" be useful for their research.

Specific research questions respondent proposed for the testbed in the survey included:

- *How does micro-mobility interact with macro-mobility (e.g., automobile vehicles, public transportation systems)?*
- *How do adverse weather events affect the usability and sensor reliability of the e-scooters?*
- *How could micromobility options such as e-scooters affect travel patterns on UTSA and other college campuses?*

Most (n=3) said they would not require additional resources for them to collaborate with ScooterLab. One described the need for "someone who can design mobile apps for data collection. For example, we can deploy mobile apps such as noisetube meter to understand ambient noise, or app for pavement/sidewalk surface quality".

Appendix 1: Workshop invitation

[VIA email]

Greetings Colleagues,

UTSA recently received a planning grant from NSF to build and deploy a community research infrastructure in the form of a micromobility (specifically, e-scooter) testbed on UTSA campuses, referred to as **ScooterLab**. Vehicles (e-scooters) in this testbed will be freely available to UTSA students, and will be equipped with state-of-the-art sensing capabilities in order to collect large amounts of highly contextual and heterogenous data, with the goal of advancing research in the areas of micromobility and transportation systems, urban planning, public policy, user privacy and security, AI/machine learning, high performance computing, and Big Data systems and algorithms. In order to create a testbed which holistically serves the interests and needs of diverse sections of the research and academic community, we are organizing a series of workshops and community engagement events to solicit critical feedback from the research/academic community vis-à-vis ScooterLab and to build potential interdisciplinary research partnerships that will leverage the ScooterLab testbed. As part of this series of events, we will be organizing the first virtual workshop primarily geared towards UTSA and local (San Antonio) researchers interested in the above topics. A summary of the planned event is below:

What is this workshop about?	Planning for ScooterLab – A community testbed of micromobility (e-scooter) vehicles on UTSA campuses.
Who should attend?	Researchers and practitioners in multi-disciplinary areas such as AI/machine learning, high performance computing, urban planning, transportation engineering, public policy, security, privacy, and Big Data, to name a few. **If data from this testbed will be useful to you in your research, then you should attend!**
When is the workshop?	Thursday, Nov. 5, 1:30-4pm.
How do I attend the workshop?	Zoom link for the workshop will be emailed to the registered participants.
How can I register/RSVP to attend the workshop?	https://scooterlab.utsa.edu/workshopregistration.php
Where can I find more information about ScooterLab?	https://scooterlab.utsa.edu/index.php

If you are interested in participating in the workshop, please register/RSVP at the above link by Oct. 30 at 5 pm . Also, to promote collaboration opportunities and to facilitate the creation of the program, we are soliciting a one-minute (max. 1-2 slides) research overview from our participants. If you are interested in giving a brief overview of your research, please indicate that in the registration form. More information on slide preparation and submission will be sent later

Appendix 1: Workshop invitation

to interested participants. In the meantime, if you have any further questions, please email us at scooterlab@utsa.edu.

We are looking forward to seeing you'll at the workshop!

Regards,

Murtuza Jadliwala, Sushil Prasad, Anindya Maiti and Greg Griffin.

This workshop is supported by the National Science Foundation award #2016717, CCRI: Planning: ScooterLab: Development of a Programmable and Participatory e-Scooter Testbed to Enable CISE-focused Micromobility Research, Principal Investigator Murtuza Jadliwala, Co-PIs Sushil Prasad, Anindya Maiti, and Greg Griffin.

Greg P. Griffin, PhD, AICP
Assistant Professor and Graduate Advisor, Urban and Regional Planning
The University of Texas at San Antonio
greg.griffin@utsa.edu | bit.ly/gregpgriffin
Research-in-progress: NSF ScooterLab

Appendix 2: Workshop Registration List

Name	Organization
Shunhua Bai	University of Texas at Austin School of Architecture
Antonio Martinez Molina	UTSA Dept. of Architecture
Anjulie Hira	UTSA Civil and Environmental Engineering
Raghav Rao	UTSA College of Business
Hamidreza Moradi	UTSA Computer Science
Sumit Jha	UTSA Computer Science
Mark Eli	UTSA College of Engineering
Amit Kumar	UTSA Civil and Environmental Engineering
Tulio Sulbaran	UTSA Dept. of Construction Science
Wenbo Wu	UTSA College of Business
Heena Rathore	UTSA Computer Science
Jiannan Cai	UTSA Dept. of Construction Science
Ao Du	UTSA Civil and Environmental Engineering
Name	Organization
Shunhua Bai	University of Texas at Austin School of Architecture
Antonio Martinez Molina	UTSA Dept. of Architecture
Anjulie Hira	UTSA Civil and Environmental Engineering
Raghav Rao	UTSA College of Business
Hamidreza Moradi	UTSA Computer Science
Sumit Jha	UTSA Computer Science
Mark Eli	UTSA College of Engineering
Amit Kumar	UTSA Civil and Environmental Engineering
Tulio Sulbaran	UTSA Dept. of Construction Science
Wenbo Wu	UTSA College of Business
Heena Rathore	UTSA Computer Science
Jiannan Cai	UTSA Dept. of Construction Science
Ao Du	UTSA Civil and Environmental Engineering

Appendix 2: Workshop Registration List

Program: UTSA Community Micromobility Research Workshop

Thursday, Nov. 5, 1:30-4pm
UTSA researchers are hosting an NSF-Sponsored Workshop on Micromobility, Privacy, and Big Data.

Zoom https://utsa.zoom.us/j/91341027084
This workshop will be recorded to follow up on research opportunities.

1:30 pm **Introductions**
Greg Griffin facilitates participants' brief introductions.

1:40 pm **Overview of the Workshop and Micromobility Testbed Planning**
Murtuza Jadliwala explains the workshop flow, purpose, and goals to facilitate a multi-disciplinary research community and planning for a testbed instrument grant.

2:10 pm **Participant Research**
One slide for 1 minute each. Research team and participants who provided a slide introduce their research to workshop attendees.

3:00 pm **Introduction to Breakout Sessions**
Murtuza Jadliwala explains the two (or more) breakout sessions, each focusing on computer science-oriented research, and transportation-oriented research.

3:05 pm **Breakout Sessions**
Computer science-oriented research, facilitated by Anindya Maiti: https://utsa.zoom.us/j/93231303448
Transportation-oriented research, facilitated by Greg Griffin: https://utsa.zoom.us/j/99997148633

3:45 pm **Review and Next Steps**
Participants re-join as a group to review collaborative research opportunities. Drs. Maiti and Griffin will review the breakout sessions. Murtuza Jadliwala will close the workshop with an overview of next steps towards collaborative planning for a micromobility testbed at UTSA.

UTSA Community Micromobility Research Workshop is offered with support of National Science Foundation award #2016717, CCRI: Planning: ScooterLab: Development of a Programmable and Participatory e-Scooter Testbed to Enable CISE-focused Micromobility Research, Principal Investigator Murtuza Jadliwala, Co-PIs Sushil Prasad, Anindya Maiti, and Greg Griffin.