Effect of Custom Cruise Control on Traffic Energy Use

Work Research Group

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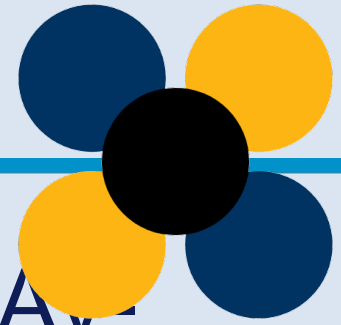
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CIRCLES Consortium

- Congestion Impacts Reduction via CAV-in-the-loop Lagrangian Energy Smoothing
- Interuniversity research group aiming to reduce traffic instabilities through deep reinforcement learning [1]
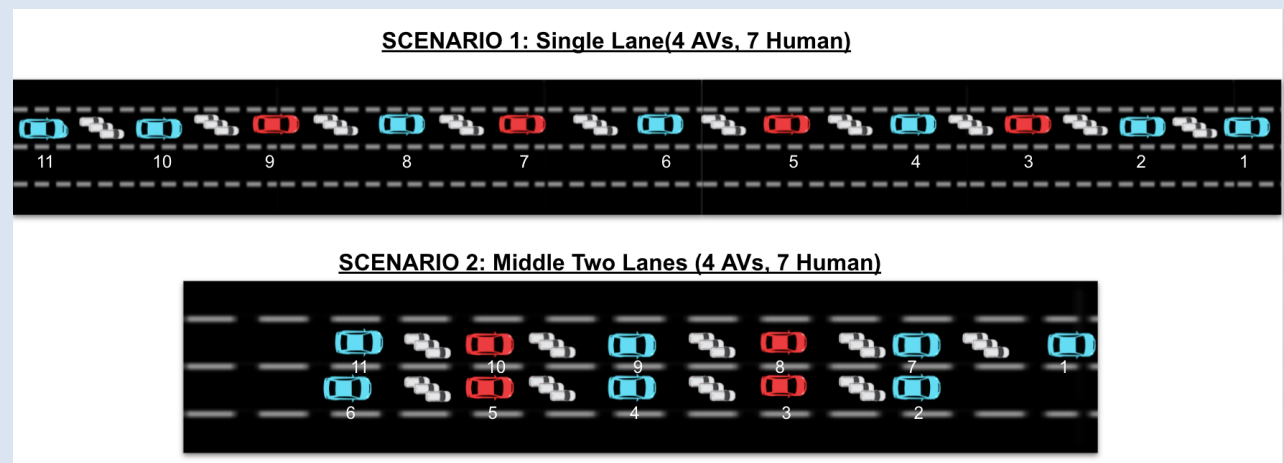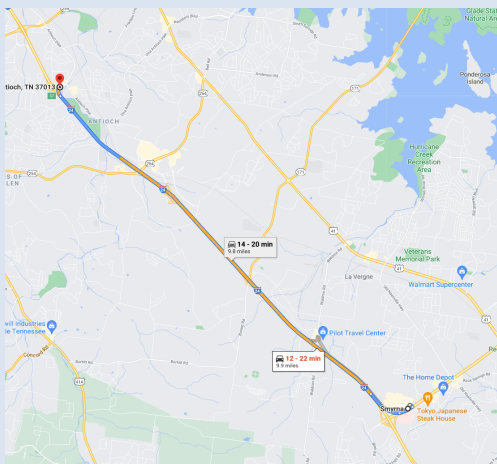
Background Research

- Current algorithms are being developed from baseline data collected from morning and afternoon rush-hour drives on I-24
- Collected data from March - May 2021
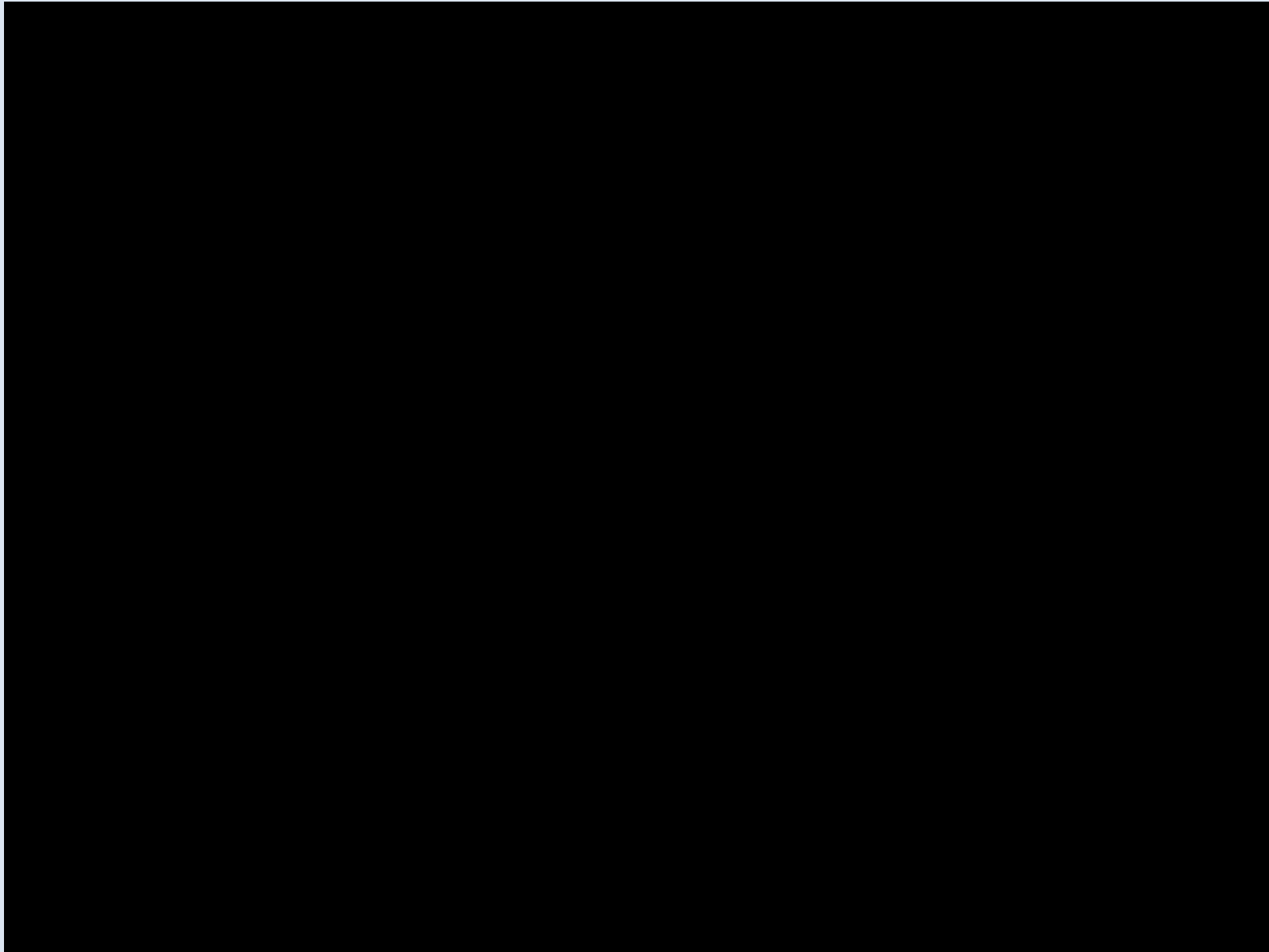- 44 drives conducted
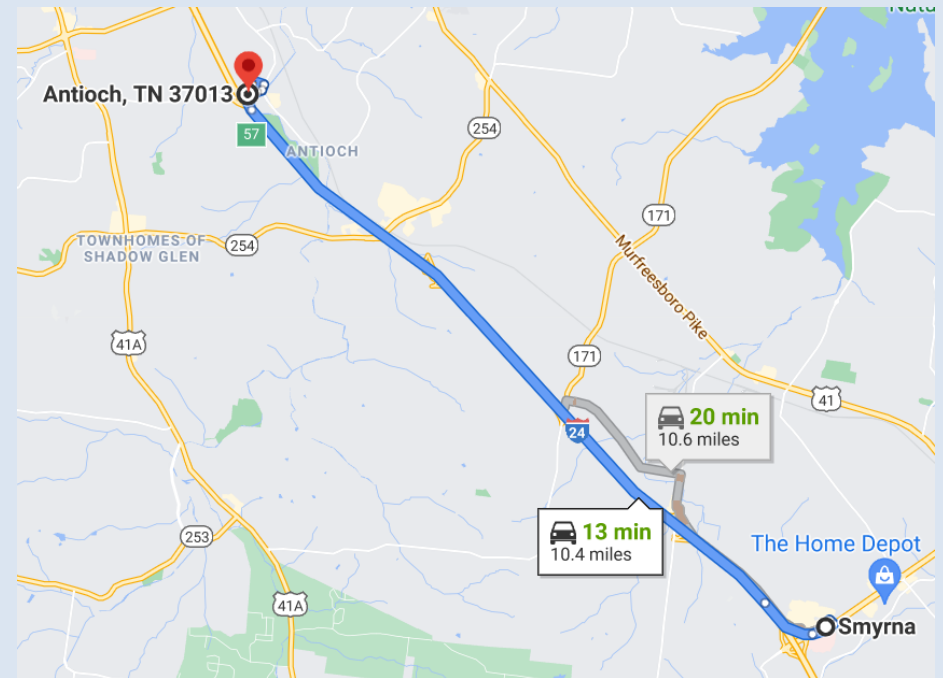
Upcoming Experiment

- 11 car test on I-24 from Aug. 2-6
– 4 vehicles with autonomous velocity control and 7 manually driven cars
- Testing various velocity controllers and their effect on fuel consumption in various scenarios
– Controllers developed by CIRCLES team

SCENARIO 1: Single Lane(4 AVs, 7 Human)

SCENARIO 2: Middle Two Lanes (4 AVs, 7 Human)

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I-24 Dashcam Footage

Logistical Preparation

- Driver recruitment and training
  - 7 drivers from Vanderbilt
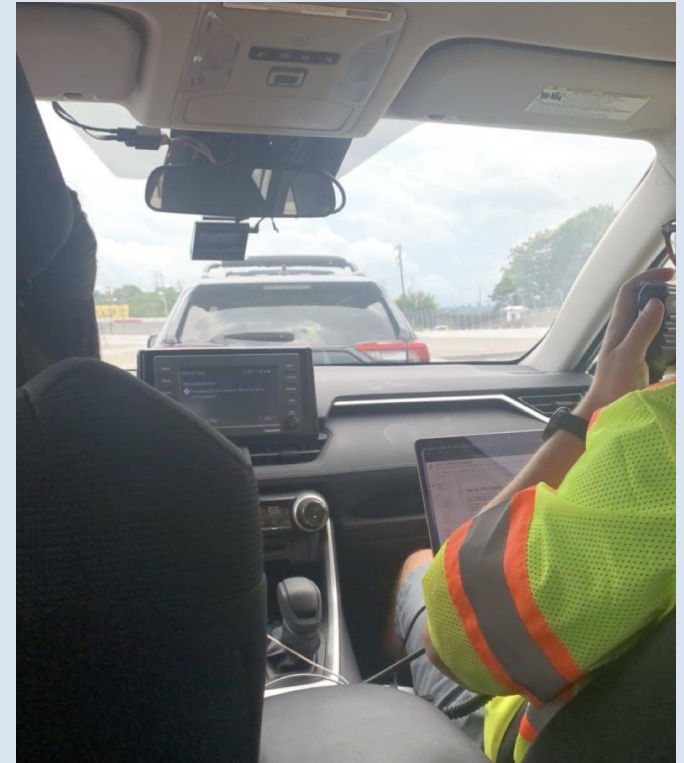 - 1 from University of Arizona
  - 2 from UC Berkeley
- IRB submission
 - Consent forms, driver directions, etc.
- Hotel booking
- Practice drives
  - Nashville Fairground Speedway

Experimental Preparation

- Instrumented vehicles using COMMA.AI hardware to collect CAN data
- Analyzed I-24 driving data using Strym
  - Python package developed by CIRCLES researchers to synchronously visualize CAN data using provided APIs
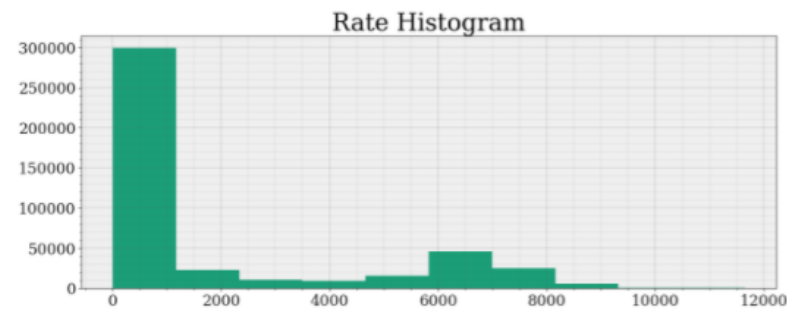- Installed advanced GPS devices to calculate error on I-24 MOTION camera network
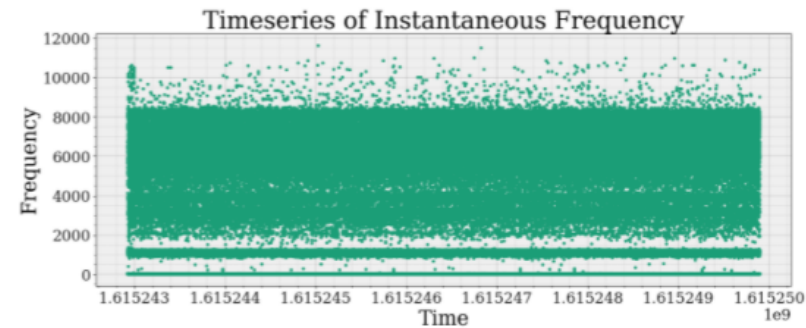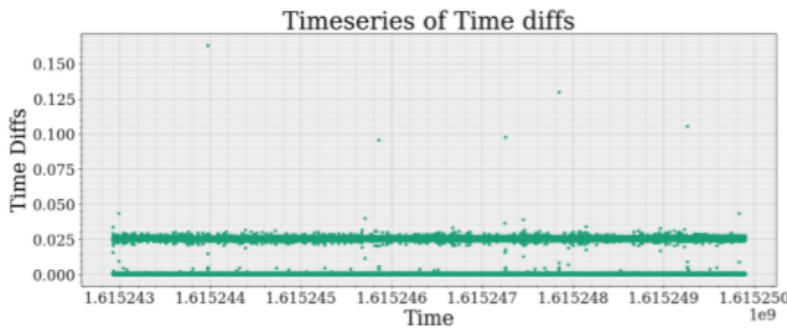

[2]
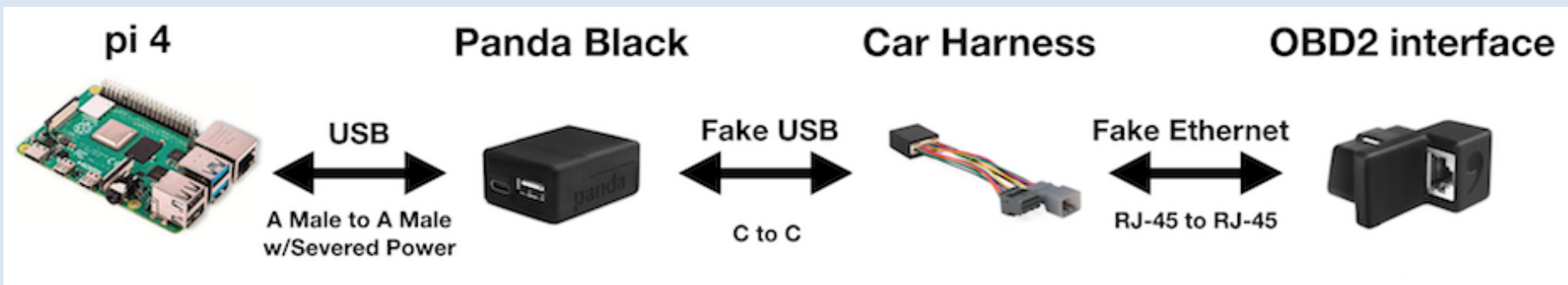
strymread

	MessageID	Counts_Bus_0	Counts_Bus_1	Counts_Bus_2	Counts_Bus_128	Counts_Bus_130	TotalCount
36	36	537535	0	0	0	537536	1075071
37	37	537535	0	0	0	537535	1075070
166	166	537536	0	0	0	537536	1075072
170	170	537536	0	0	0	537536	1075072

Message Rate Analysis: Timeseries

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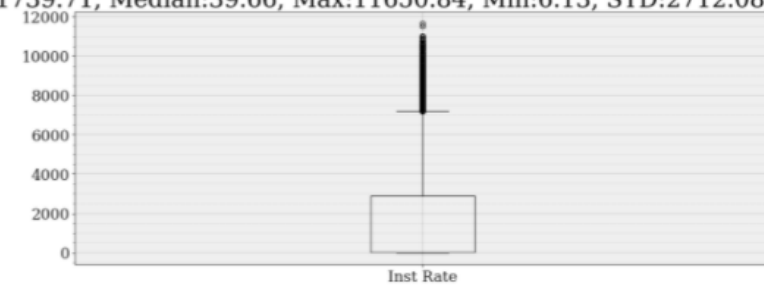
strymmap

Drive Route for 2021-03-08-22-35-14_2T3MWRFVXLW056972_GPS_Messages.csv

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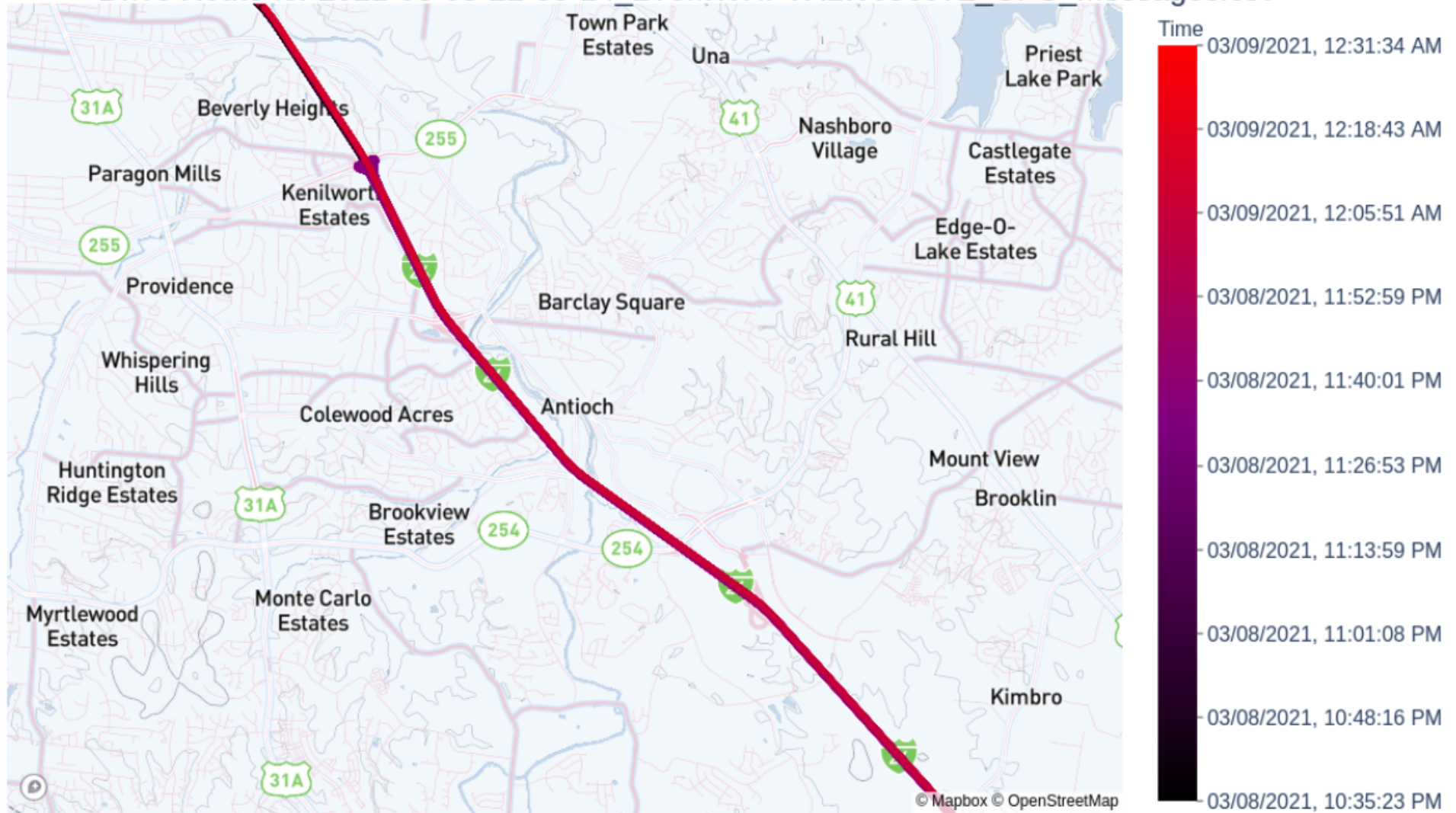
Future Research

- Summer 2022:

  – 100 car traffic smoothing experiment

  – Extension of I-24 highway sensing infrastructure

  – Testing various custom velocity controllers

[3]

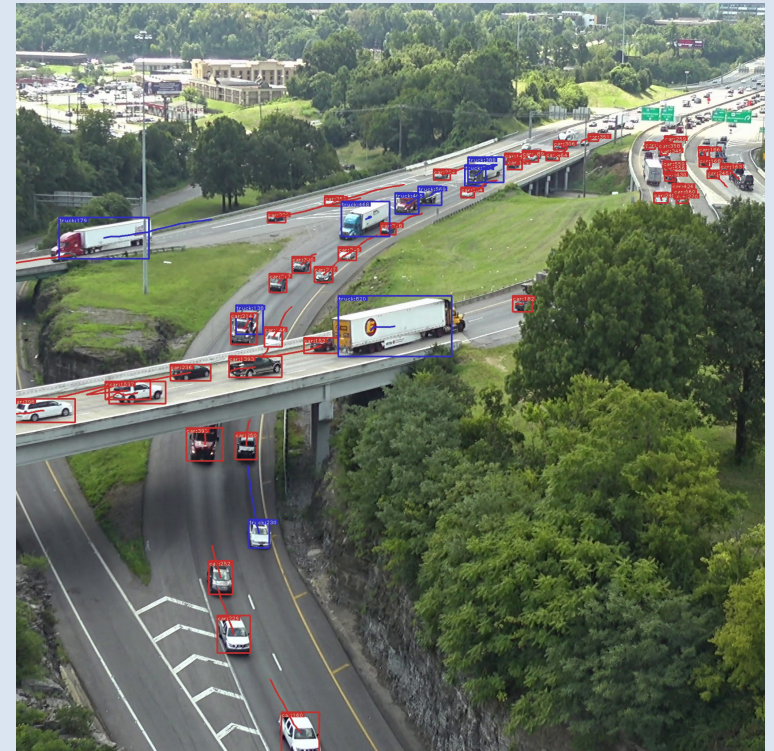# Challenges and Lessons Learned

- The smaller logistics regarding travelling and work spaces are just as critical as the larger details, such as installing hardware
  - Booking a rental space for staging area
- Getting Raspberry Pis connected to battery packs to automatically upload data to Cyverse after the vehicle is turned off
- Observed challenges involved in taking an idea from theoretical to execution
- Issues seen now, if not resolved well, will be amplified in 100 car testing next summer

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Work Cited

[1]   "CIRCLES." https://circles-consortium.github.io/ (accessed Jul. 19, 2021).

[2]   "libpandac: Hardware tutorial." https://jmscslgroup.github.io/libpanda/ (accessed Jul. 19, 2021).

[3]   D. Gloudemans, *DerekGloudemans/I24-MOTION-examples*. 2021. Accessed: Jul. 19, 2021. [Online]. Available: https://github.com/DerekGloudemans/I24-MOTION-examples

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