Next-Generation Smartphone/Tablet-Based Commercial Vehicle Survey

Lynette Cheah[1], Linlin You[2], Melvin Tan[1], Kyungsoo Jeong[3], Peiyu Jing[3], Fang Zhao[2], Moshe Ben-Akiva[3]

[1]Singapore University of Technology and Design (SUTD)
[2]Singapore-MIT Alliance for Research and Technology
[3]Massachusetts Institute of Technology (MIT)

Presenter: Peiyu Jing

Motivations

- Concerning freight transport, there is a need to understand freight vehicle and commodity movements for policy and technological assessments
- Wide variation in freight vehicle operations → need large-scale, extensive data collection
- GPS traces of vehicles increasingly available, but there is a gap in understanding trip purposes, stop activities, commodities handled
- Provide a more convenient mobile option for drivers to independently verify their activities without requiring assistance from surveyors

Background: Truck Surveys in US and Singapore

- 2014-2017: experimental trials with 125 US drivers

- 2017- ongoing: full-scale Heavy Vehicle survey in Singapore. As of submission, we collected data from 5,133 heavy freight vehicles. 1,679 drivers completed the verification of their daily timeline for 5 days
- 2018 – ongoing: full-scale Commodity Flow Survey in Singapore. As of submission, we collected data from 26 freight vehicles. 23 drivers completed the verification of their daily timeline for 5 days.

Solution: A New Freight Survey Instrument

- Integrated freight vehicle tracking + follow-on online driver activity survey

- Survey process:
  - Drivers are invited to participate
  - GPS loggers are installed
  - Pre-survey is administered
  - Vehicle tracked for x days
  - Drivers verify and complete a daily timeline for y working days

- Drivers' socio-economic data
- Employment
- Vehicle
- Vehicle operations

- Stop purpose
- Commodity and quantities handled
- Abnormal events

Method Overview

- The web survey platform leverages the integration of several technologies to reduce respondent burden (stop detection, pre-filling)
- Incentives are provided to the respondents for participating
- Drivers and their companies can access analytics on their vehicle operations using dashboards

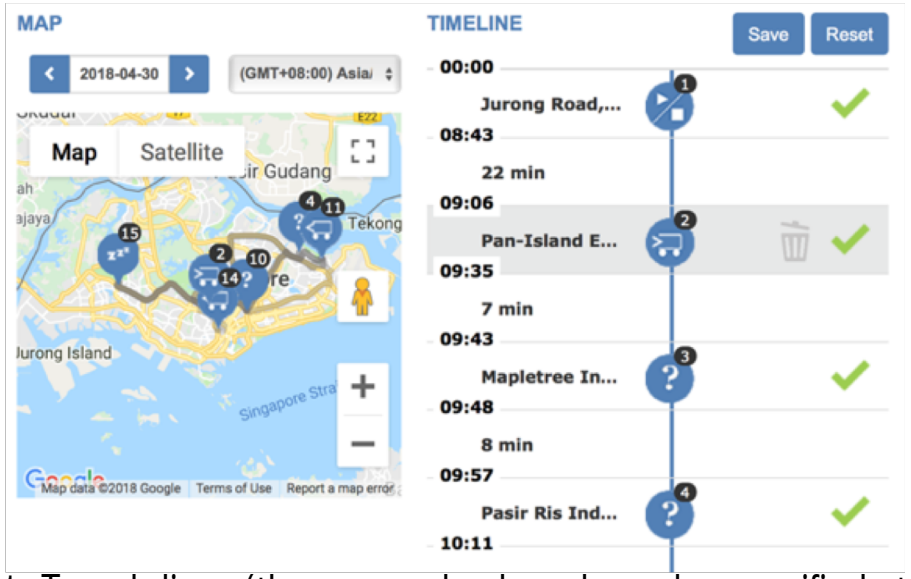


Fig 1: Travel diary (the green checkmark marks a verified stop)

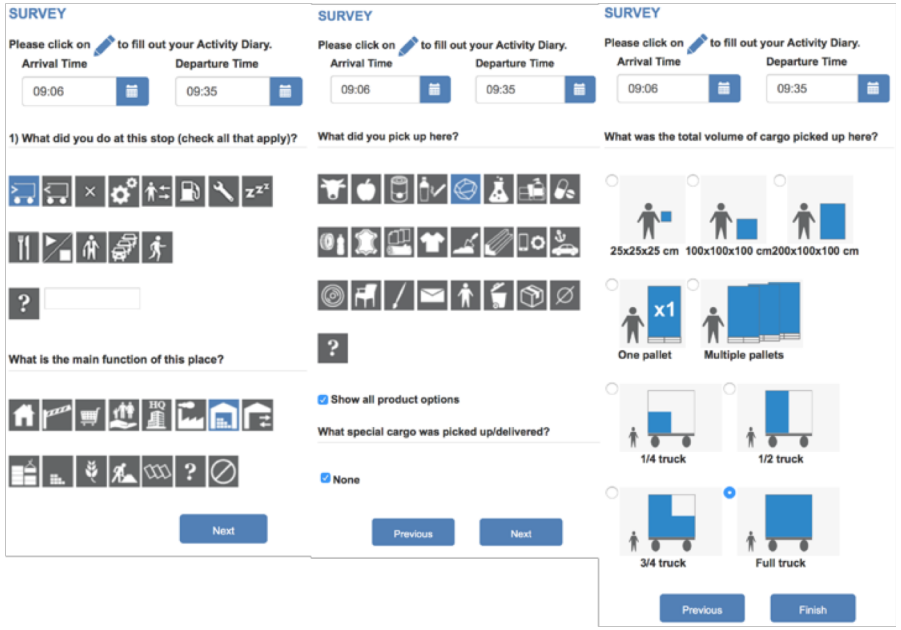


Fig 2: Driver survey example questions

Objectives

- Improve tracking data accuracy using mobile devices equipped with multiple sensors
- Improve recruitment success with a user-friendly mobile app
- Improve self-completion rate and reduce the reliance on surveyors

Future Mobility Sensing (FMS) Freight App

Collection

Processing

Interfaces

Collection

FMS Freight App collects data

From drivers:

Activity History

Preference

Via tablets:

GPS

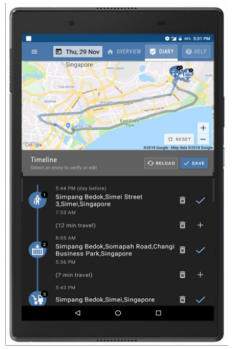
Accelerometer

GSM

Wi-Fi

Processing

FMS Freight App processes three kinds of data



- GPS Data
- Wi-Fi location

- Driver profile
- Activities at each stop
- Frequent places

- Point of Interest information
  - OpenStreetMap
  - Google Maps

Tracking Data + User Data + Contextual/External Data

Supported by Machine Learning

Interface

FMS Freight App User Interface

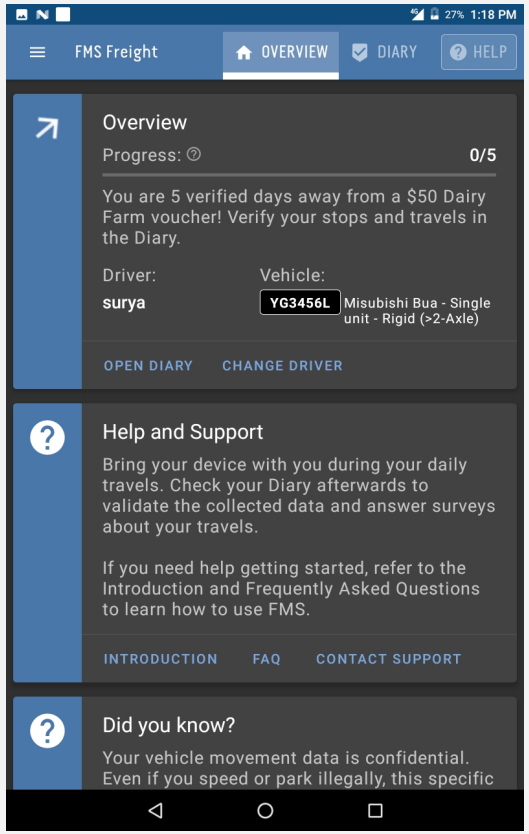


Fig 3: Splash Screen

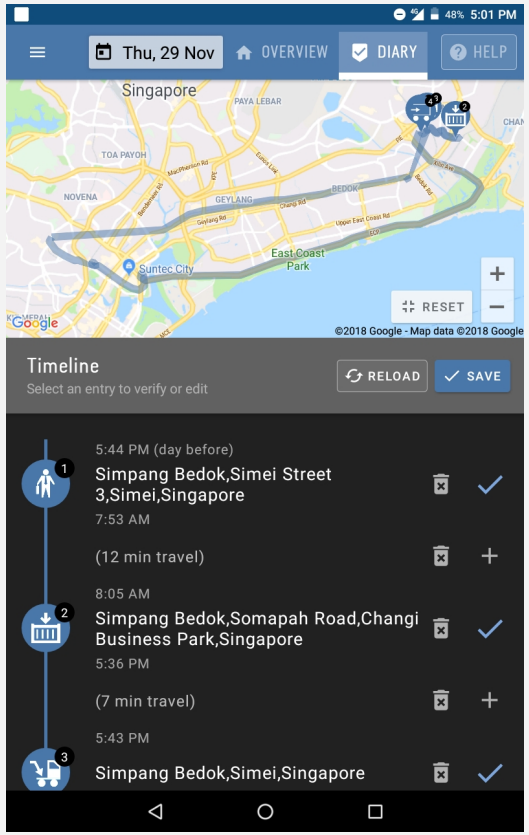


Fig 4: Activity Diary

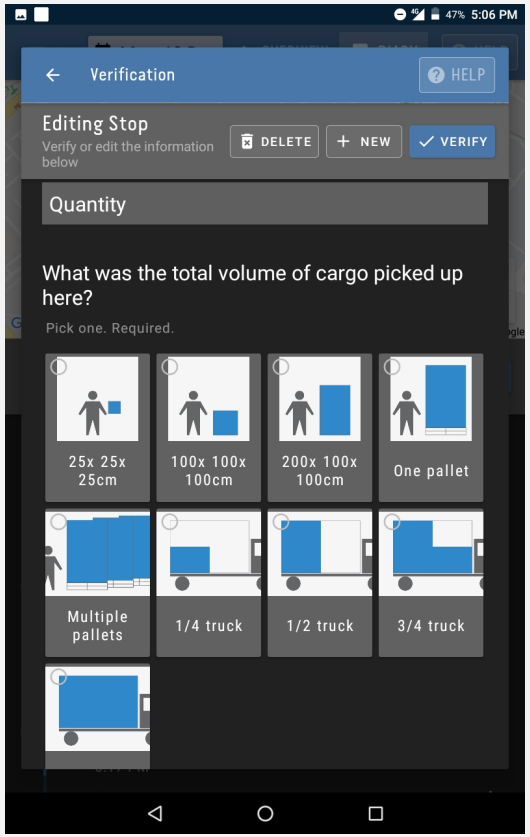
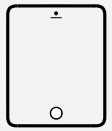
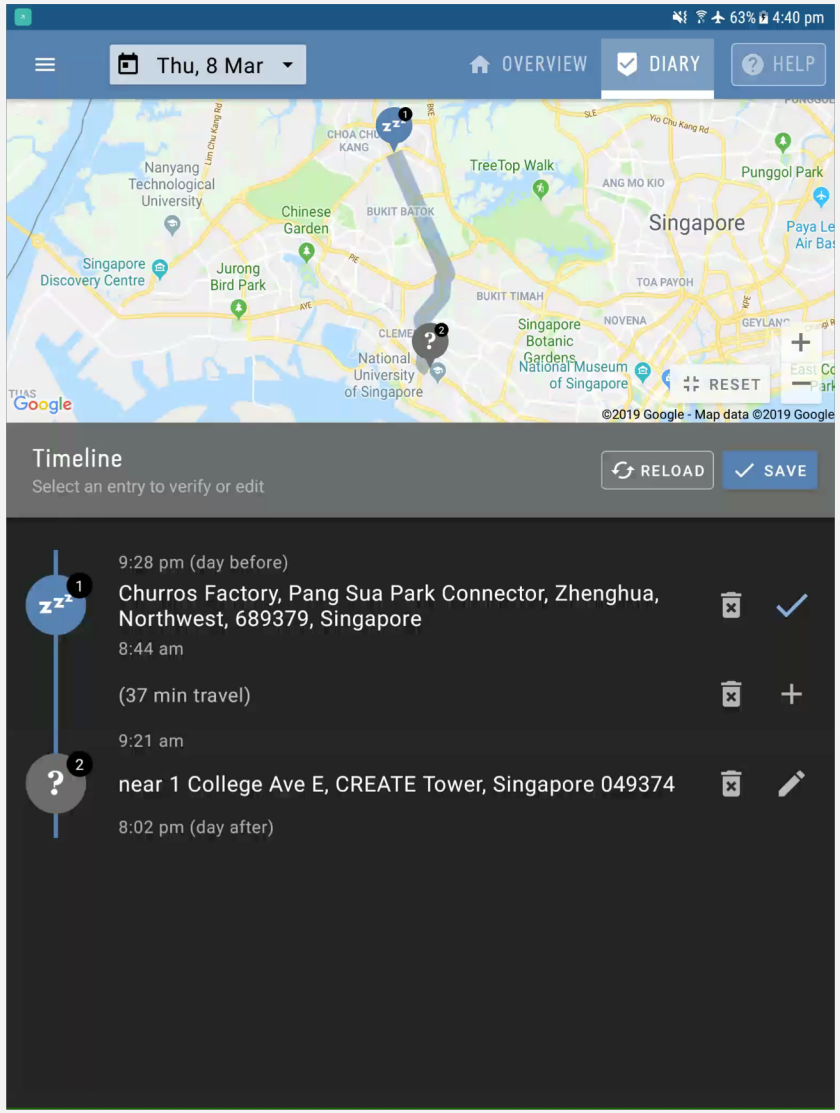


Fig 5: Vehicle Stop Questionnaire

FMS Freight App Demo

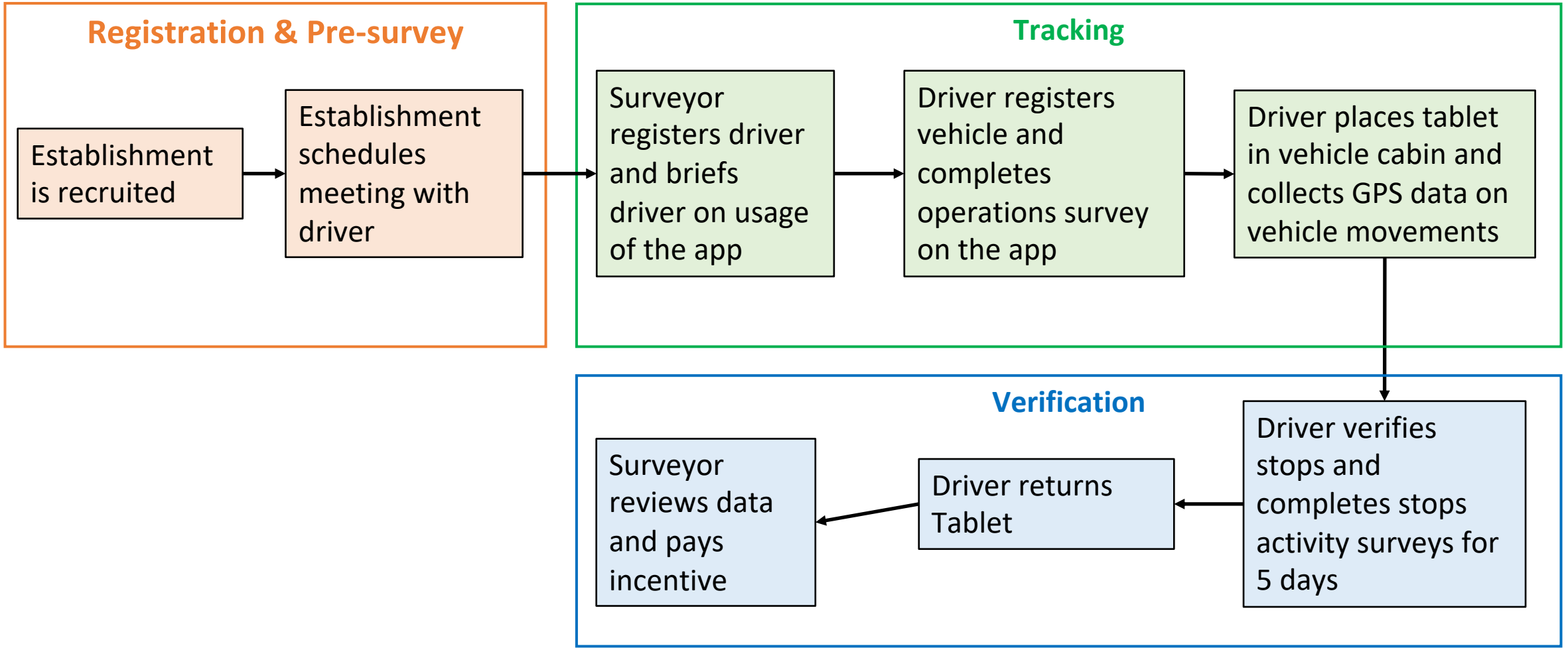


Tablet



Freight Vehicle Survey Supported

Freight Vehicle Survey Process Flow



Freight Vehicle Survey Incentives

Monetary Incentives (for Driver):

- S$50 for the driver for completing the verification and stop activity survey for 5 working days.

Informational Incentives (for Company or Vehicle owner):

- Following the survey, a dashboard shows a summary of vehicle activities

Freight Vehicle Survey Incentives

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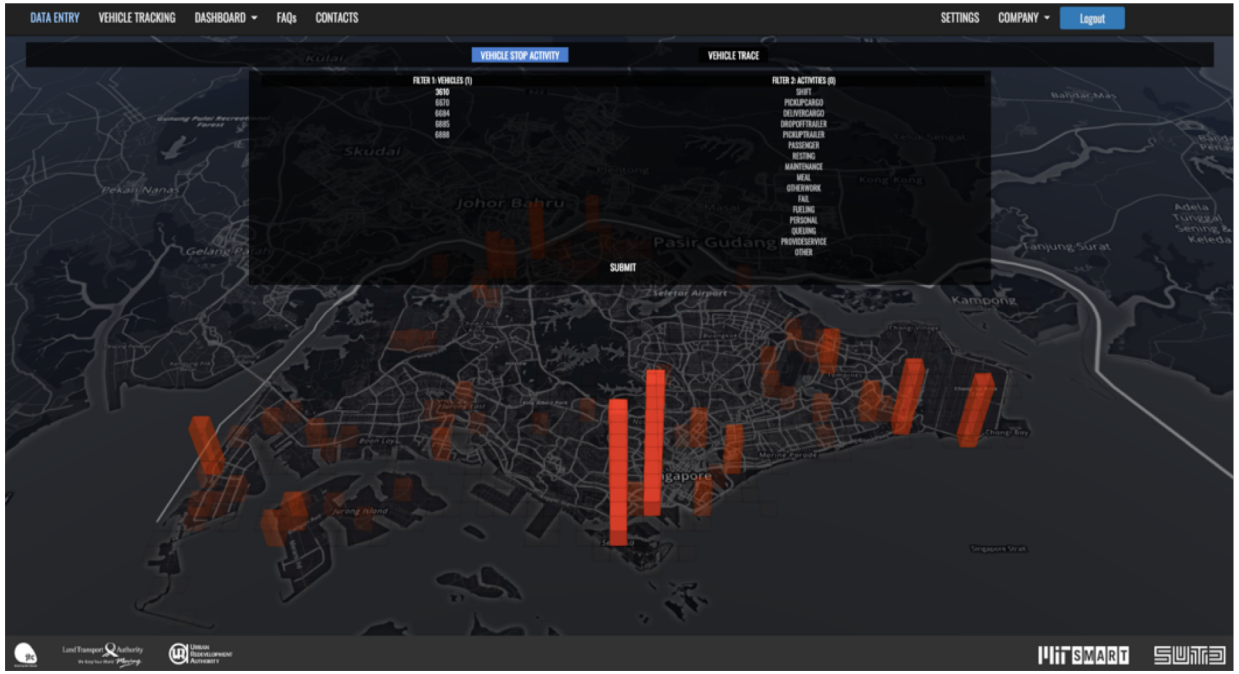

Fig 6: Vehicle Stop Activities: distribution and density of the different stop activities displayed on a 3D map

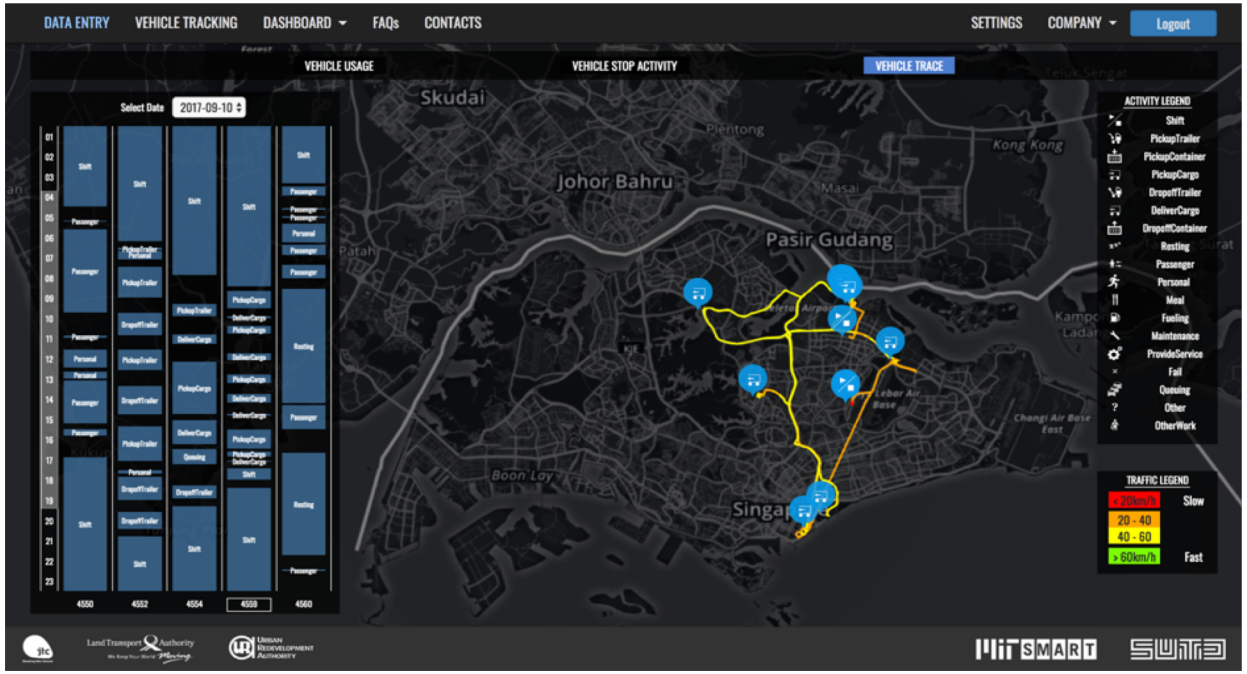

Fig 7: Vehicle Traces: routes, average speeds, and comparisons between vehicles

FMS Freight App Development Status

- Prototype developed. User testing ongoing

Driver recruitment:

- Based on initial recruitment of 4 drivers in Singapore, in March 2019
- Drivers prefer using the tablet as opposed to a GPS logger, and find using the app a less intimidating instrument and are more likely to agree
- Some drivers are required by their company to fill up a logbook and they find the freight app useful in helping them recollect their travels.

Future plans:

- Continue user acceptance testing phase in Singapore and US
- Consider using the app in upcoming freight vehicle surveys
  - Future Freight and Logistics Survey (carried out by MIT in USA)
  - Integrated Commodity Flow Survey (carried out by SUTD in Singapore)

Thank you !

Email: peiyu@mit.edu
Intelligent Transport Systems Lab, MIT

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