Design and Pilot of A Shipment Tracking Method to Supplement a Commodity Survey

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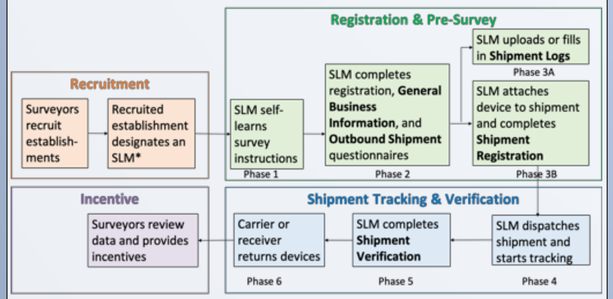
1. OVERVIEW

- Objectives: to develop and test a shipment-level data collection technology and methodology and demonstrate the feasibility to supplement the conventional commodity flow survey (CFS) for freight studies.
- Shortcomings of conventional CFS1: 1) lack of information on shipment transportation legs and transshipment locations, 2) incomplete responses (60%).
- Design objective: to allow for capturing shipment characteristics, GPS traces, and user-verified geolocation data (stop activities & travel modes) with high resolution and minimal human inputs.
- Evaluation: Pilot studies in the U.S. (completed) and Singapore (ongoing).

2. SURVEY FLOW

Captures characteristics of establishments and their shipments



* SLM: shipping and logistics manager

Fig 1: Survey Flow

1: Lawson, Catherine, et al. (2006) "Scope, Comparability, Shipment Characteristics, and Special Measurement Issues." Commodity Flow Survey Conference.

3. SURVEY PLATFORM

A web-based survey platform equipped with sensing technologies is designed for efficient, accurate, and manageable data collection.

Future Mobility Sensing (FMS) System:

- All data and processing tools are unified through the front end/back end server and data engine.

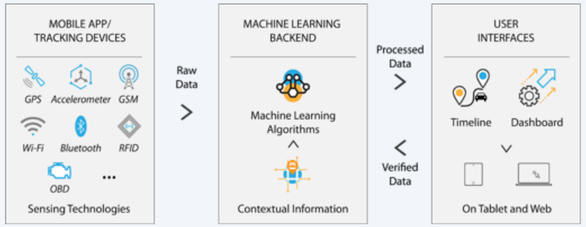


Fig 2: Future Mobility Sensing Platform Architecture[2]

- Backend machine learning algorithms process raw GPS data clusters:
  - Stop detection detects shipment stops
  - Mode detection detects transport modes
- Customized survey webpages (Fig 4):
  - Integration with GPS tracker CCTR-800G

Fig 3: GPS Tracker CCTR-800G

  - Generate timelines of shipments (Fig 5) via processing relatively low-frequency GPS data: cycle of 3 min ON (20 sec interval) & 12 min OFF, extending battery life

2: You, L., Zhao, F., Cheah, L., Jeong, K., Zegras, C. and Ben-Akiva, M., 2018, November. Future Mobility Sensing: An Intelligent Mobility Data Collection and Visualization Platform. In *2018 21st International Conference on Intelligent Transportation Systems (ITSC)* (pp. 2653-2658). IEEE.

Fig 4: Customized Survey Webpage

Fig 5: Shipment Timeline Verification Page

4. SURVEY INCENTIVES

Informational Incentives:

A customized dashboard showing a graphical summary of shipment statistics, benchmarked against other users (Fig 6 & 7):

- *Statistics and Performances*: number of shipments, value and weight shipments, geographical distribution of shipments, shipment transportation time, on-time delivery
- *Shipment Tracked:* shipment timelines

Monetary Incentives:

- A fixed amount to establishments per tracked and verified shipment
- A fixed amount (US) / a lucky draw (SG) to establishments that uploaded shipment logs
- A fixed amount to the carriers/receivers per returned device

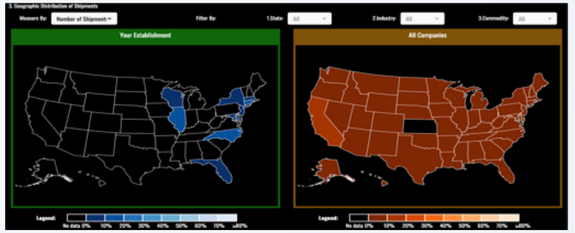


Fig 6: Geographical Distribution of Shipments

Fig 7: Shipments Tracked

5. CHALLENGES and CONTRIBUTIONS

Experience from the U.S. Pilot:

- In-person recruitment is more successful (10%) than via email or phone (0%)
- Tracked 84 shipments from 6 establishments and 45 devices were returned
- Participants found the platform easy to use and the dashboard informative

Contributions:

- Developed a web platform unifying shipment tracking, processing, and visualization, and demonstrated its feasibility in pilot studies.
- Fills the data gap, providing insights for disaggregate freight models (e.g., mode choice, route choice).
- Provided logistics performance information to business establishments, which contributes to the efficiency of operations.

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