Data on the Move: The State of Data in Ground Transportation of Freight

Amie Davis
Bellevue University
Bellevue, NE 68005, USA
amodavis@my365.bellevue.edu

Abstract

The ground transportation industry has been collecting data for safety and inventory for over 20 years, paving the way for big data collection strategies. Companies tracked their trucks with rooftop Global Positioning Systems (GPS) long before the technology was available on cell phones. Transporters have been tracking locations of freight with Radio-Frequency Identification (RFID) tags to manage inventories.

The transportation community already has established collections of data. The question posed is what else can they do with all that data? How can they optimize costs by reviewing data elements they already have and previously thought were useless? The focus has turned from inventory tracking to data-driven decision making.

This poster identifies historic transportation data sources, as well as publicly-available data sources, and points out the benefits of consolidating the data.

Author Keywords

Data; Transportation; Logistics; Big Data; Freight; Supply Chain; GPS; RFID.

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ACM Classification Keywords

B.4.1 Data Communications Devices; C.2.0 General Computer-Communication Networks; H.3.5 Online Information Services.

Introduction

Data continues to evolve in the transportation industry. Transporters were at the forefront of data collections and have paved the way for location tracking. This impacts everyone today with location settings on their phones, increasing our everyday sense of security.

Current data analysis includes fleet and inventory tracking, analysis of maintenance records, route and capacity planning, and safety compliance. It is time to turn the analysis into predictive and prescriptive analytics and realize the true business value of the data collected.

During this project, I will determine additional public data sources available and point out the benefits of collecting and consolidating the data. I will suppose how this information can be used to anticipate requirements and locations to better optimize the fleet.

For simplification, the scope of this project is limited to the ground transportation of freight, both truck and rail.

I intend to submit a corresponding white paper to members of the National Defense Transportation Association (NDTA) encouraging the sharing, collection, and analysis of big data. The intent is to impact priorities of Information Technology (IT) in transportation logistics, enabling Big Data.

Why is this Data Science?

This project involved several stages of the CRISP-DM life-cycle. Research on this topic involved gathering information on the transportation industry to acquire domain knowledge, discussion of data gathering techniques, envisioning aggregation of data from different sources, and determining the analysis and visualization capabilities to enable decision making.

Evolution of Data Technologies

Trucking and rail fleet management systems have been collecting data for safety and inventory tracking for decades. Large Global Positioning Systems (GPS) were placed atop the cab roof. Positioning contracts were put in place with satellite companies. Rail cars and containers were affixed with Radio-Frequency Identification (RFID) tags. Freight tracking posed a special challenge when trailers were transferred to ship or rail. RFID tags are used to track what is being shipped in-transit, as well as inventory in the warehouse. For the most part, these tracking systems were put in place to report by exception. The data was gathered but only looked at when something went missing.

For years, transportation companies have used telemetric sensors to monitor mechanics on trucks to send maintenance alerts, and to assist driver performance monitoring and safety. This was also an alert-driven process. An alert would start a maintenance action such as a part replacement.

Discussion

The transportation community has established environments of data collection. The big data question posed is what else can they do with all that data? The

data is already there. How can they improve the business by taking a look at data elements they already have that they previously thought was useless? The focus has turned to data-driven decision making.

Moving real-time decision-making from headquarters into the truck will decrease the adjustment time for routes, improving reaction time, and increasing driver satisfaction.

Fleet maintenance has transformed from observing Mean Time to Failure (MTTF) and increasing Mean Time to Repair (MTTR) by retaining appropriate inventory in stock. The vast amount of telemetric data collected can now provide predictive analysis by running the data through machine learning algorithms. Recommendations from these algorithms could be brought straight to the truck, empowering drivers to make decisions from the cab.

Driver shortages are a great impact to the trucking industry at present. Predictive analytics can not only observe driver habits to increase safety, they can help with driver retention and service hours by watching patterns and making recommendations to help drivers.

The greatest challenge today remains in optimizing the fleet by planning routes to maximize capacity and minimizing out of the way diversions. Route optimization and increased capacity planning will save costs in trailers, drivers, and fuel.

In addition to the vast amount of data already being collected, there are several sources of publicly available data that will be useful when combined with the existing collection. For example, fuel, traffic and weather can be combined with company data to create a holistic picture. Routes can be altered from a planned route, in real-time.

Conclusions

For several years, data has been collected from inventory, trucks, trailers, Global Positioning Systems (GPS), Radio-Frequency Identification (RFID) tags, and other sources. Adding publicly available information, such as fuel, traffic, and weather, along with analyzing unused data already collected, will improve delivery times, route planning, and safety, resulting in more reliable services at lower costs. Moving real-time decision-making from headquarters into the truck will decrease the adjustment time for routes, improving reaction time, and increasing driver satisfaction.

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