Performance Evaluation of Iowa Truck Parking Information and Management System through Web Mapping

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Abstract:

Parking shortage has been one of the biggest challenges faced by truck drivers, fleet managers and owner operators for many years. The Truck Parking Information Management Systems (TPIMS) project is an innovative multistate effort undertaken by members of the Mid America Association of State Transportation Officials (MAASTO) to address critical truck parking issues affecting regional economic competitiveness and the national freight network's safety and efficiency. To evaluate the performance of the Iowa TPIMS, utilization, demand cycle and reliability are developed and visualized in a dashboard through multidimensional aggregation of parking flow data. Such intuitive tools and results can help agencies evaluate the system and better understand the large dataset to make informed decisions.

Overview:

There are 33 parking sites along the I80 corridor in Iowa participating in the TPIMS project. Among those, 12 are eastbound public rest areas, 11 are westbound public rest areas, and 10 are private truck stops that serve traffic from both directions. Capacities vary from 5 to 850. Pucks and in-and-out sensors are installed to monitor the occupancy and the recording interval is 5 minutes. To measure the performance of the TPIMS, some criteria are developed regarding utilization and system operation.

Low Duration:

When the number of available spots is below a certain threshold (usually 10% of the site's capacity), 'LOW' will be displayed on Iowa511 website instead of the actual available spaces. Double pointer method was applied to detect all the time intervals that 'LOW' was shown to truck drivers. Those intervals were then aggregated daily as a metric, defined as Daily Low Duration (DLD), to measure how busy a specific site is.

Demand cycle:

A typical demand cycle of a truck parking site is like this: parking availability starts increasing at around 5 a.m. as truck drivers start working every morning, then sites will become crowded at around 10 p.m. when truck drivers start searching for a place to recess. Those demand cycles may have some difference for different time (season, workday etc.). Also, utilization may have some spatial distributions.

System downtime:

The system downtime measure evaluates the percentage of time the system is not functioning as intended. The data for each site will be queried to determine if there are data records for at least each five-minute time period. The gap intervals were detected by the double-pointer method and then aggregated daily as a metric. It will be more stable to evaluate the operation of the system by taking a relatively long look; thus, system downtime may be aggregated at monthly and quarterly level.

Technology: Tableau dashboard, python and SQL

Data: Iowa TPIMS parking flow data, sensor location map

Inspiration: https://511ia.org/@-95.34482,42.22499,7?show=restAreas#restAreasHome?layers=restAreas&timeFrame=TODAY, https://community.tableau.com/s/

Potential Challenges: Preprocessing of parking flow data, designing interactive dashboard with selection button