RESEARCH SPOTLIGHT

MDOT Project Manager

Collin Castle, P.E.

ITS Program Manager
Transportation Systems
Management and Operations

CastleC@Michigan.gov
517-636-0715

RESEARCH ADVISORY PANEL MEMBERS:

André Clover, Steve Cook, Janine Cooper and Michele Mueller.

DUAP system creates framework for sharing data throughout MDOT

Data from connected vehicles holds the promise of reshaping how transportation agencies manage traffic, improve roadway safety and manage pavement assets. MDOT's Data Use Analysis and Processing (DUAP) initiative is building on that concept by integrating data from connected vehicles in MDOT's fleet with other data sets from across the department so that all areas – as well as the traveling public – can use and benefit from them.

PROBLEM

Throughout MDOT, new tools and technology collect more data than ever before. But the applications that process and display that data are typically built for a single specific purpose. Data collected by one division may be useful to other areas, or to the traveling public, but there is often no easy way to translate it from one format to another.

In 2006, MDOT initiated the DUAP project to address a new data integration opportunity: connected vehicles. The initial phase of DUAP, complementing similar initiatives at the national and regional levels, investigated how data from connected vehicles could help MDOT manage traffic, improve roadway safety and manage pavement assets.
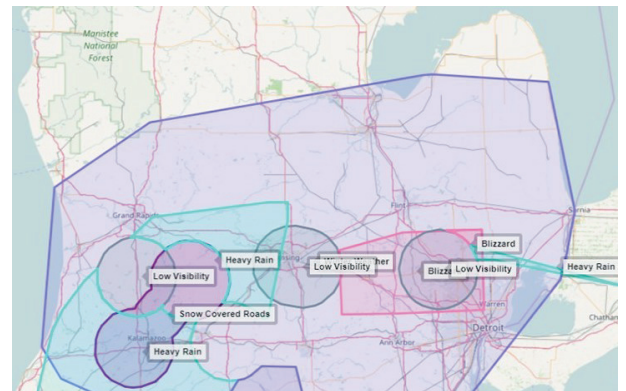
DUAP's weather application uses aggregated weather data to generate alerts like "Snow Covered Roads" and "Low Visibility" that can be shared with motorists via Mi Drive and dynamic message signs.

However, large-scale data from connected vehicles didn't become available as quickly as expected. More research was needed to examine how additional data sources could be integrated with data from connected vehicles to help MDOT achieve the same benefits.

RESEARCH

In a follow-up project (DUAP2), researchers expanded the DUAP system to include a variety of internal and external data sources in addition to connected vehicle data. The project's goal was to allow data from various sources to be shared and used by all of MDOT's functional areas.

With input from staff across MDOT and key partner organizations, researchers developed a concept of operations for the expanded DUAP system, laying out capabilities, features and future system operations. For maximum flexibility, researchers constructed the system using a foundation of modular computing blocks. Data collection modules gather data in a wide range of formats and extract it for standardized storage and retrieval by front-end applications.

Researchers integrated data from multiple sources into the DUAP system, including connected vehicle data, weather observations from the department's Road Weather Information Service sensors and the National Weather Service, traffic signal phase data, automatic vehicle location data from maintenance vehicles, and dynamic message sign data. The researchers designed a user interface with a map view as its primary screen.

RESULTS

The DUAP system was developed concurrently with other connected vehicle initiatives at MDOT, including the Weather Response Traffic Information System (Wx-TINFO), the Vehicle-Based Information and Data Acquisition System (VIDAS), and Integrated Mobile Observations (IMO). The applications developed through these projects served as the first demonstrations of DUAP's capabilities, including:

Weather alert system: Wx-TINFO brings together near-time environmental and weather-related data collected from both fixed and mobile data sources. DUAP aggregates and processes this data and provides automated weather alerts and recommended messages to MDOT Transportation Operations Center operators, who make the information available to the traveling public through roadside dynamic message signs and the Mi Drive website.

Traffic flow restrictions: DUAP compiles work zone lane closure and lane restriction data from MDOT construction and maintenance systems and displays it for MDOT users. Through DUAP, portions of this previously internal data can also now be shared with the public via Mi Drive and other traveler applications.

Pavement condition monitoring: DUAP can be used to aggregate, analyze and display pavement condition data collected by MDOT fleet vehicles equipped with sensors. Vehicle accelerometers and distance sensors can be used to track road roughness and identify locations of defects, like potholes.

Traffic condition monitoring: DUAP unlocks the possibilities of combining traditional traffic detection data (gathered by detectors at fixed locations) with connected vehicle data to provide a more accurate and complete view of traffic speed, flow and density. As the amount of connected vehicle data expands, the value of this information will continue to increase.

In addition, the DUAP system provides support for connected vehicle infrastructure implementations.

IMPLEMENTATION

MDOT staff and the traveling public are already experiencing the benefits of the first group of applications to use the DUAP system. Going forward, MDOT will continue to develop new DUAP applications and refine existing ones, with each functional area taking the lead in developing new applications that meet its needs. DUAP will be enhanced as needed to support the connected vehicle program as it develops. Finally, the DUAP system will be part of data-related research projects, such as an upcoming phase of MDOT's ongoing effort to evaluate the use of unmanned aerial vehicles, or drones, to assess transportation infrastructure.