

RESEARCH BRIEF

Developing Interface Specifications for Mobile Data Platforms

Many winter maintenance fleets have computer-based Automatic Vehicle Location systems that use Global Positioning systems or other technology to measure vehicle location and relay that location to a control center. AVL/GPS technology is often used in conjunction with in-vehicle sensors to create a mobile data platform that collects data on plow up/down, material spread rate, pavement temperature as well as oil pressure and other aspects of vehicle health. This data helps winter maintenance staff monitor material spreading in real time and track storm and season totals.

Today's mobile data platform components use proprietary communication protocols and data formats. Using proprietary protocols rather than a generic set of specifications means that there is no uniform way to connect components to a data collection system, and operating more than one vendor system can be problematic when trying to collect data in a single database. Currently, most maintenance fleets use a one-vendor system—limiting upgrades to the current vendor's components or investing in an entirely new system when the current vendor cannot provide the needed technology.

Need for Research

Adopting standards or specifications for sensors and other devices used in maintenance fleets, and the Web interfaces into which the data output from these devices feeds, ensures competition among equipment vendors, simplifies the process of adding new components, allows users to build on existing equipment inventories and reduces the overall cost to develop and maintain a mobile data platform.

Objectives and Methodology

The project's goal was to develop specifications to seamlessly integrate sensors and other devices used in a maintenance fleet's mobile data platform. Researchers' tasks included:

- Conducting a literature search to leverage previous research that addressed the development of specifications.
- Developing and administering a survey of stakeholders in three communities—government agencies, vendors and manufacturers, and researchers.
- Developing a common set of standards or specifications.
- Proposing a plan to take the specifications from a proposal to a nationally accepted standard.

Results

The literature search netted no single document that directly addressed specifications for mobile data platforms. However, the project's survey of key stakeholders indicated significant interest—80 percent of survey respondents advocated the development of specifications and identified interoperability and interchangeability as very important.

Results of both the literature search and the stakeholder survey demonstrated that it is not feasible to create a single set of specifications that will encompass all vehicles, foresee future technology developments or retrofit existing systems. Researchers concluded that the best approach is to build on previous standardization efforts by the Society of Automotive Engineers and National Transportation Communications for ITS Protocol, allowing for customization and expansion.

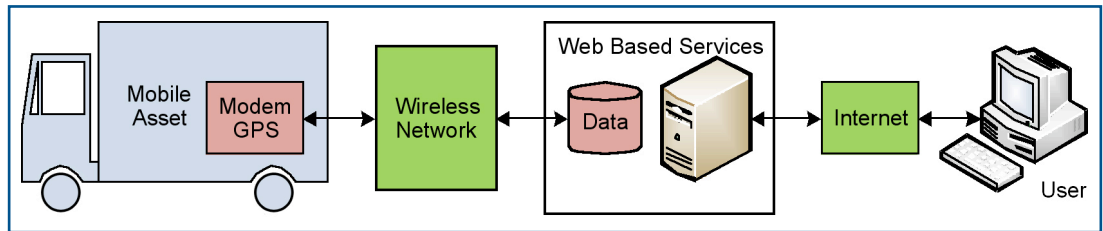
The proposed specifications build upon an existing standard—SAE J1939, Recommended Practice

Investigator

"This project developed standard specifications for in-vehicle data collection equipment and a recommended implementation plan for nationwide adoption. Our novel approach included common wireless, engine bus and sensor connections."

—Gregory
Thompson

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A mobile data platform and data collection system includes the vehicle's on-board modem/GPS unit, which exports data collected from the vehicle's sensors through a wireless network to a Web-based service that receives and organizes data for display to users.

Project Champion

"We recognized a need in the winter maintenance community for a 'plug-and-play' approach for connecting the sensors used on snowplows to a data collection system. This project represents the first step toward developing a nationwide standard for interface specifications."

—Dennis

Burkheimer

Iowa Department of
Transportation (retired)

for a Serial Control and Communications Vehicle Network—which is used for commercial vehicles manufactured after 2007. Using the J1939 standard as a starting point capitalizes on the growing use of the engine bus—a specialized internal communications network that interconnects components inside a vehicle—as the central point in a vehicle to gather data. First, the proposed specifications standardize 200 of the most common J1939 engine parameters that track vehicle health. Then, the proposal defines almost 100 new sensor-related parameters that can be collected from the engine bus, including data field placeholders for specific manufacturers and auxiliary sensors that track pavement temperature and the salt spreader controller.

The proposed mobile data platform includes multiple components:

- Two types of wireless connectivity—Wi-Fi and cellular—link the vehicle to existing networks using a store-and-forward communication method.
- All sensors are connected to the engine side of the engine bus.
- The in-vehicle modem/GPS unit connects to the output side of the engine bus via a standard J1939 connector, providing a single source for the data gathered by the vehicle. The modem/GPS unit must possess sufficient intelligence to be remotely controlled to allow customization in the type, quantity and frequency of data collected.
- The modem/GPS unit is programmed to "listen" for desired data on the engine bus; extract it; tag it with date, time and other sensor information; and then package it for transmission or on-board storage.
- Data transmitted from the modem/GPS unit populates a standard Web-based graphical interface for a database that receives and displays data from the vehicle's mobile data platform. Data can be sent in real-time or as specified by the user in modem settings.

Benefits and Further Research

The proposed specifications are a significant first step toward establishing a national interface specification for winter maintenance vehicles equipped with mobile data platforms, but more work must be done. To ensure broad acceptance and application of the proposed specifications, Clear Roads partners are considering the implementation plan recommended by the project team:

- Seek a sponsoring organization at the national level to champion the effort and serve as a clearinghouse of new ideas and emerging technologies.
- Develop common specifications using the NTCIP format for related systems such as the database, Web interface and database query methodology.
- Convene a technical standardizing committee composed of stakeholders.
- Petition existing standardization agencies such as SAE for inclusion of the proposed specifications in existing standards.
- Conduct testing, gain final approval and begin implementation.

This brief summarizes project CR2008-02, "Development of Interface Specifications for Mobile Data Platforms on DOT Vehicles," produced through the Clear Roads winter maintenance pooled fund project, #TPF-5(092). Clear Roads' lead state for this research project is Wisconsin DOT, 4802 Sheboygan Ave., Madison, WI 53707. (In early 2010, Minnesota DOT took over as the lead state for the Clear Roads winter maintenance pooled fund project under TPF-5(218).) Paul Brown of Massachusetts Highway Department is the Clear Roads Technical Advisory Committee Chair (paul.brown@state.ma.us).

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