MIOVISION

V2X SERVICES


470 mi
002: Hits 1
Traffic signs
SPEED LIMIT 30
33 s
893 mi
20.2 mi
5:12 PM
61 °F
MPH
READY
OFF
AUTO
1/min x 1000

TABLE OF CONTENTS

ABOUT US

In 2005, Miovision® set out to change the way traffic data was collected. By integrating real-time and historical traffic data with advanced analytics, it has become a leading provider of intelligent traffic management solutions. It empowers cities and transportation agencies to make data-driven decisions, implement intelligent traffic signals and improve overall mobility for pedestrians, cyclists, and motorists.

In 2024, Miovision acquired Traffic Technology Services (TTS), the industry-leading platform for connected vehicle environmental, safety, and mobility solutions worldwide. With the acquisition of TTS, Miovision redefines the landscape of telematics and shapes the future of V2X. Miovision's innovative connected vehicle technologies, such as Personal Signal Assistant®, support the groundbreaking (TLI) ADAS feature from Volkswagen Group, in service since 2016 and available in all VW brands.

10 Trillion+
SPAT Delivered

70,000+
V2X Service Intersections

1.5 Million+
Vehicles Equipped

SAE J2735

SAE J2735 is the industry standard for vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communications. Understanding this standard is important to understanding the value that Miovision V2X services provides.

The Society of Automotive Engineers (SAE) has developed this standard message set dictionary, Dedicated Short Range Communication (DSRC) Message Set Dictionary, to achieve the interoperability between vehicles and the driving environment.

While the standard was intended to utilize the 5.9 GHz DSRC for Wireless Access in Vehicular Environments (WAVE) communications systems, the message set, and its data frames and data elements, have been designed for connected vehicle applications that may be deployed in conjunction with other wireless communications technologies as well.

When it comes to signalized intersections, the essential message includes the intersection geometry (MAP) and Signal Phase and Timing (SPAT). The MAP message defines static information regarding the detailed intersection approach and lane alignment, the signal grouping, right-of-way allocations, topological relations to adjacent intersections and other traffic rules. The SPAT message is a collection of data frames and data elements that reflect the dynamic and predictive aspects of the signal operations as well as the time-dependent part of the traffic control at the intersection. Different data elements and data frames enable various applications for the in-vehicle human-machine-interface (HMI) or onboard computers and algorithms to control the vehicle operation, as needed for autonomous or highly automated driving.

It is anticipated that any connected vehicle application using these messages will develop a different internal data model optimized for the user needs. Said another way, the messages are not intended to be used "as transmitted" but to be translated into whatever local data model the end device application requires.

Miovision continues to build upon the Personal Signal Assistant® product by supporting the SAE J2735 standard, while also understanding the use cases and applications that require additional information not included in the SAE standard. The Personal Signal Assistant® incorporates all of the necessary information needed to translate hardware focused information into information used in today's connected vehicle applications for safety, mobility, and the environment.

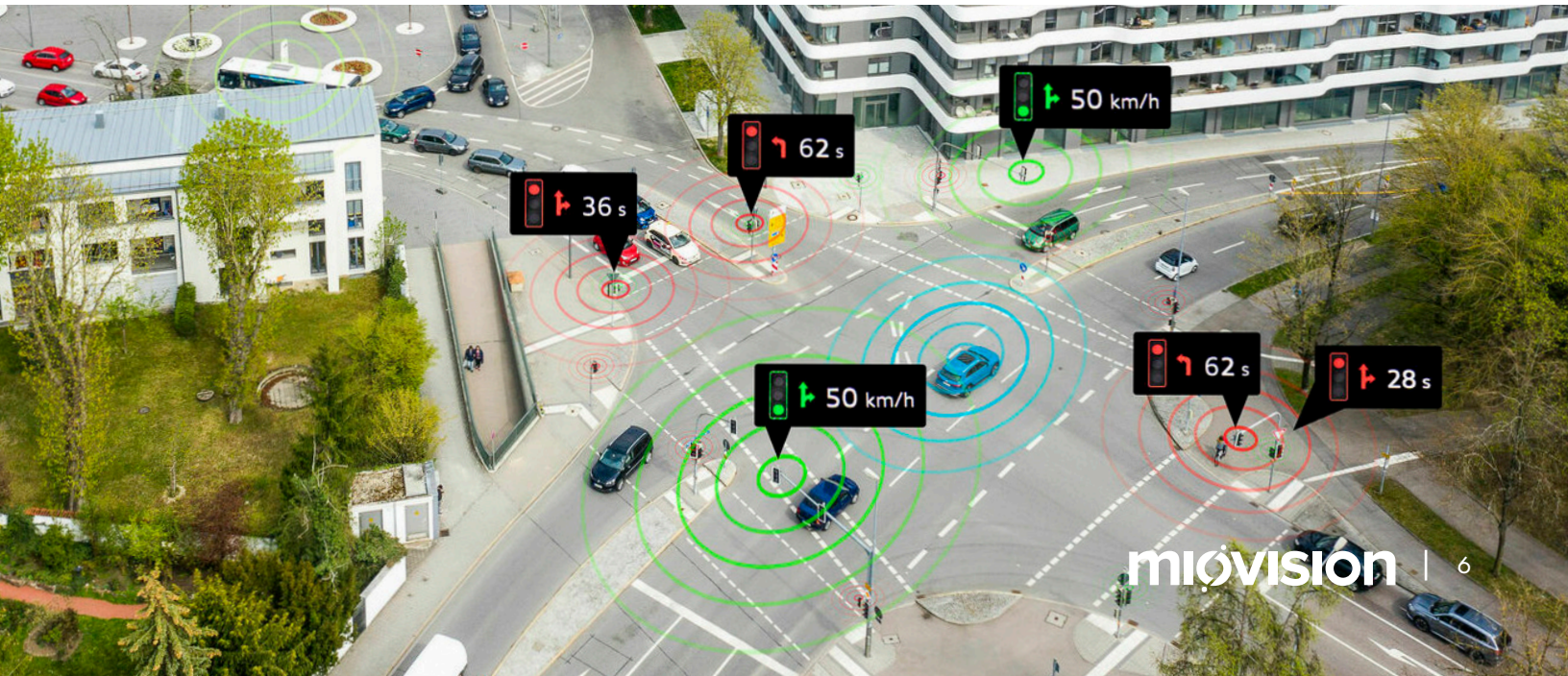
PERSONAL SIGNAL ASSISTANT

The core product of Miovision V2X, Personal Signal Assistant® is an information service. This cloud-based software solution, combined with industry standard products and wide-spread deployment in North America and Europe, allows for immediate V2X integration using available communications to the vehicle.

The Need for Prediction

Traffic signal controllers focus on the immediate requests from the intersection traffic flow, through detection or configured parameters. By design, the controller will only understand the immediate switch points within the next 10–20 seconds; past this point the controller does not have confidence on the next switch points. To gain the full potential for connected vehicle applications, additional levels of prediction are required. The Personal Signal Assistant® provides predictions up to several traffic signal cycles or approximately four minutes into the future. These predictions are included in the SPAT message along with confidence of the prediction based on historical information. These are optional elements of the SAE J2735 protocol, not standard from traditional roadside units.

Simulation is in our culture. Our team includes some of the pioneers of traffic flow simulation, having established the market and contributed to various research and high-profile projects throughout the world. That background is a significant part of our patented technology.



Messaging Delivery Architecture

The Personal Signal Assistant® provides multiple delivery architectures and Application Programming Interfaces (APIs) to best suit the customer infrastructure and end user applications. Where needed, our V2X services can also handle geolocation tasks to ensure the proper portion of the message set is used by the applicaiton. The following delivery architectures have been validated for over a decade.

Prediction Relay API

SPAT messaging with Prediction Relay API allows for seamless integration with the customer's user interface using RESTful messaging over HTTP/HTTPS protocols. Geolocation tasks can be handled by Miovision or by the customer if a navigation map is available, with very lightweight client implementation. This V2X service is the most common integration, allowing for immediate implementation without additional backend infrastructure required by the customer.

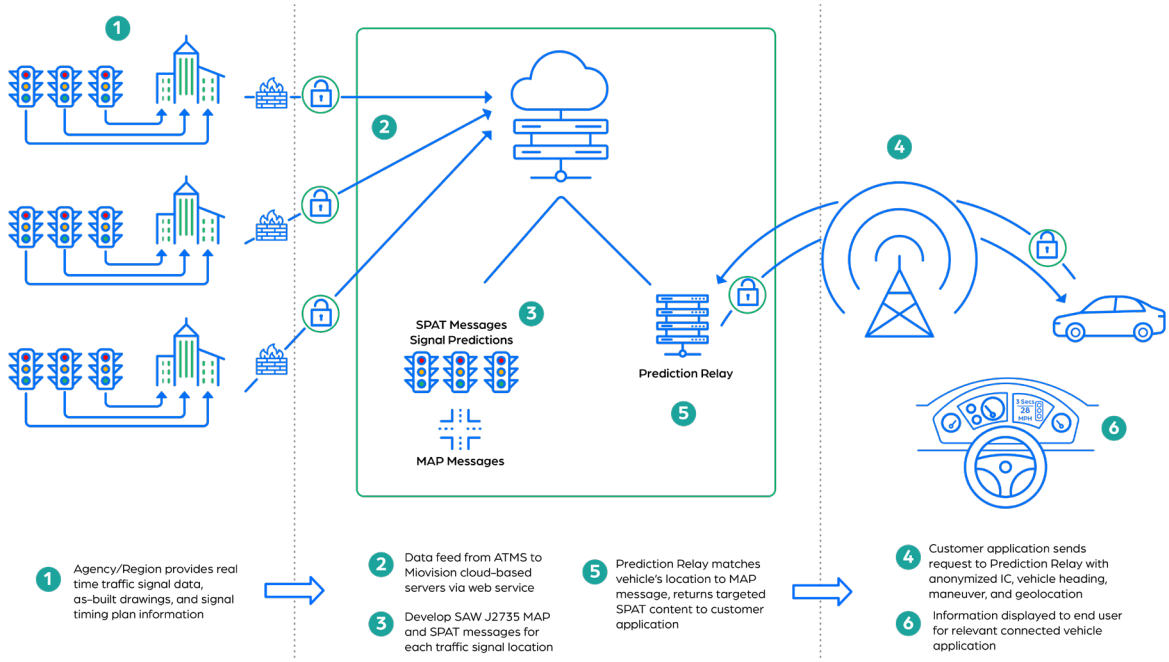


Figure 1: ITS Messaging with prediction relay

Localized Server API

SPAT messaging with a Localized Server API allows the customer to develop the vehicle to be communication agnostic where it can utilize MAP/SPAT received via the Miovision cloud or via local roadside units. A customer vehicle sends a Basic Safety Message (BSM) to Miovision localized server, where Miovision identifies signal(s) in the vicinity of the vehicle. Miovision then sends complete or reduced MAP and SPAT data sets (SAE J2735 or China YD/T 3709–2020 etc.) for those signals back to customer with messaging over UDP.

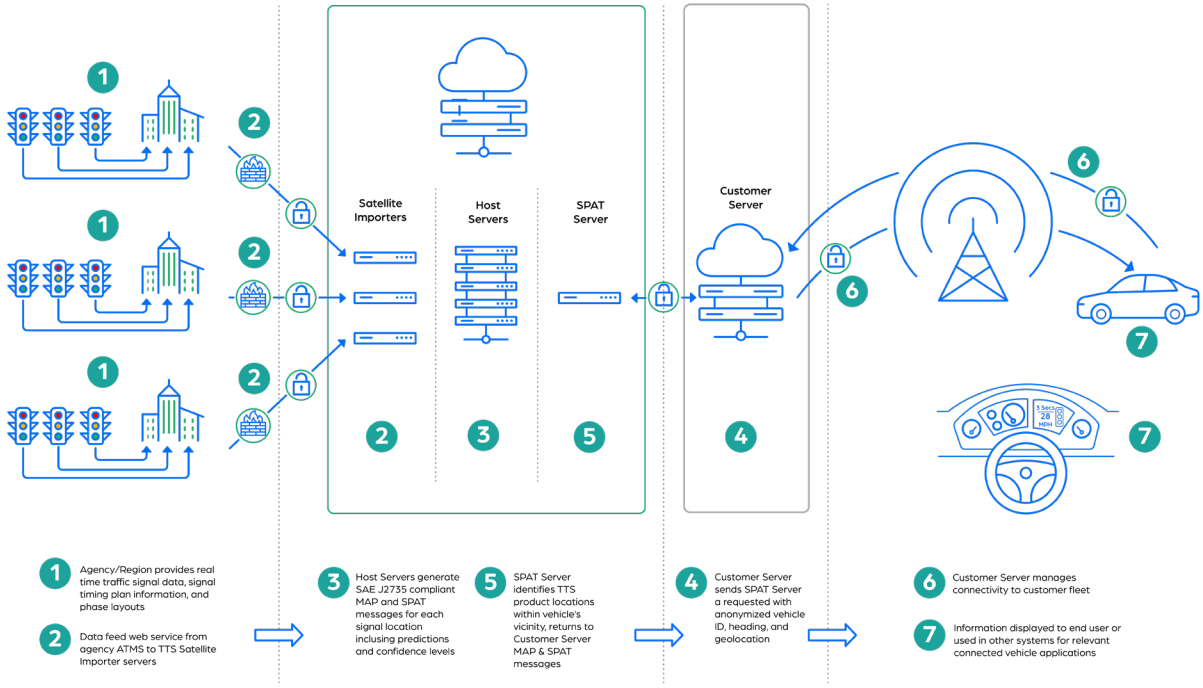


Figure 2: ITS Messaging with a localized server

SPAT Fidelity

SPAT messages can be created and transmitted from the intersection to the vehicle in multiple ways, each of which results in a different fidelity level. As such, Miovision has created three distinct categories, labeled SD, HD and UD. The V2X use cases presented later in this document have different SPAT fidelity requirements.

	SD-SPAT	HD-SPAT	UD-SPAT
ITS Equivalent	Virtual Signal	Centrally Networked Signal	Locally Networked Signal
Source	Crowdsourced	ATMS Network Miovision Connect	Device Miovision CORE
Delivery	Cloud + LTE/4G	Cloud + LTE/4G	MEC + 5G PCS
End-to-End Transmission Latency	N/A	<2s	<100ms
Update Frequency	N/A	1-5s	100ms
Timing Precision	+/-3s	+/-1s	10ms
Reliability	Up to 75%	80% - 99.9x%	99.9x%
MEC/RSU Required	N/A	N/A	Required

CONNECTED VEHICLE APPLICATIONS

The USDOT has classified connected vehicle applications into three main categories: environment, safety, and mobility. In addition, autonomous operations are also a category where an application can be associated. Many connected vehicle applications are supported and enhanced by a network based solution, as opposed to a peer-to-peer delivery. Talk to our experts to learn why today's traffic signal controller infrastructure falls short of providing the necessary information for consumer ready applications.

Personal Signal Assistant Application Layer

Each application, or use case, is supported by the Personal Signal Assistant® product and web services or APIs. Within the Personal Signal Assistant®, there are multiple data sources and SPAT fidelity, as outlined earlier, supporting the various connected vehicle applications.

The following table summarizes the use cases into the possible categories and data source:

Connected Vehicle Application	Support SPAT	Environment	Safety	Mobility	Autonomous
GLOSA	SD, HD, UD	•	•		•
Time-to-green	SD, HD, UD	•	•		•
Dilemma zone assist	HD, UD		•		•
Green request confirmation	HD, UD			•	•
Personalized green light / Signal traverse optimization	HD, UD			•	•
Traffic light informed routing	SD, HD, UD			•	•
Signal prioritization	HD, UD		•	•	•
Red-light violation warning	UD		•		•
White alert	HD, UD		•		•
Left-turn assist	HD, UD		•		•
Emergency vehicle locator	HD, UD		•		•
True real-time signal state	UD		•		•
True real-time intersection proxy	UD		•		•

Example Customer Applications

Time–To–Green

This application provides information to the driver about the remaining time while waiting for a red light and notifies the driver when they will not be able to cross the intersection safely, essentially addressing dilemma zones.

Green Light Optimized speed Advisory (GLOSA)

GLOSA provides a reduced speed recommendation to arrive on green at the intersection, preserving momentum and providing additional benefits. GLOSA can provide 2–10% fuel savings and provide substantial benefits to the end user or consumer.

Highlighted Customer Platforms

Ford China

The Ford V2I Lite system, launched in 2022 through major China metropolitan areas following the Chinese YD/T 3709–2020 standard[1]. The applications supported include TTG, GLOSA, Time To Red, and Red Light Warning.

Mercedes–Benz

Mercedes Benz Traffic Light Information launched in 2021 as part of the Mercedes me connect services in MY 2022 models[2]. The system supports the TTG feature.

Volkswagen Group

Audi connect® Traffic Light Information, as an ADAS, is the first automotive OEM system to bring V2I technology to the market[3]. This feature, available on all Audi models since 2017, includes connected vehicle applications TTG and GLOSA, while also having the ability to expand the system for additional applications. This system has been expanded into other VW Group brands such as Bentley, Lamborghini, Porsche, and Volkswagen.

[1] https://www.ford.com.cn/newsroom/2022/20221226/
[2] https://www.meglc.net/mercedes_benz_glc_overview_of_the_traffic_light_data_service-295.html
[3] https://media.audiusa.com/releases/92

Performance Metrics

Connected vehicles have the potential to generate data about the transportation system with precision that has not been easily attainable. While travel time measurement have been a norm for many years, a direct connection to the infrastructure has been a missing component for many. With GPS equipped vehicles and the Personal Signal Assistant® message sets, we can now take accurate measurements of a vehicle approaching, crossing, and exiting a signalized intersection; these measurements were only previously obtainable from simulation models or very complex monitoring systems requiring a lot of hardware.

Through an agreement with Miovision V2X services, a data partnership is established that allows Miovision access to real-time and static traffic signal control data and in return the agency receives vehicle performance metrics for the networked signalized intersection operation. Traffic engineers are now able to quantify the extent of "split failures" and "delay" based on the Miovision sample sizes, which quickly grow into the millions of probe measurements. A specific set of signal performance metrics, such as number of preemptions and pedestrian calls, is also available.

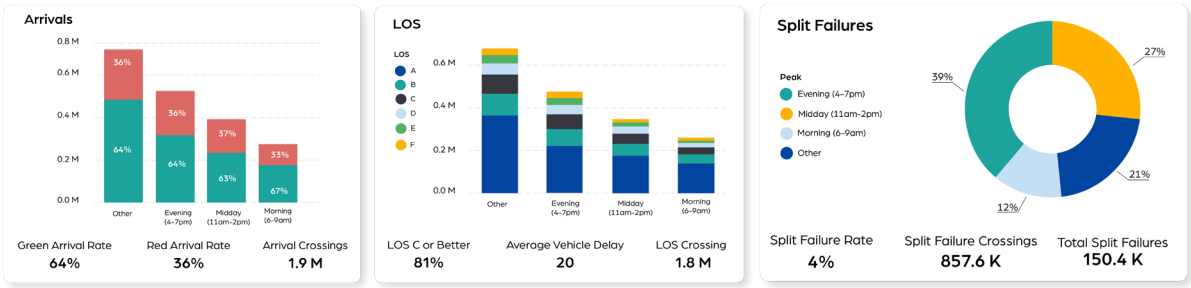


Figure 3: Example of Vehicle-Based Signal Performance Measures

Coverage

Miovision V2X services solutions are utilized across North America and Europe, with over 70,000 intersections in eight countries.

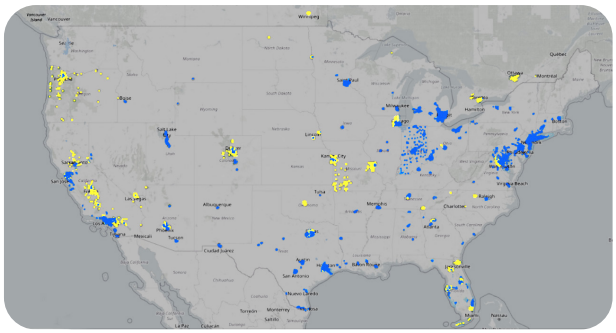


Figure 4: North American coverage. HD signals are indicated in yellow, SD Signals are indicated in blue.

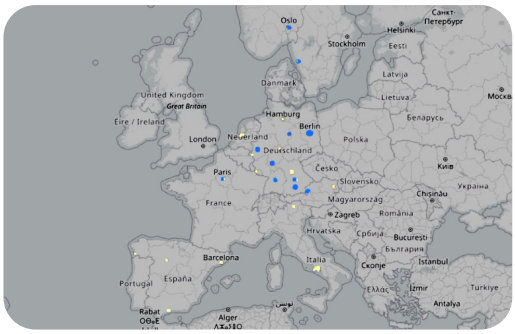


Figure 5: European coverage. Live signals are indicated in blue, signals coming soon in yellow.

MIOVISION VRU ALERT

The Miovision VRU Alert system is a multi-channel, collaborative response to the critical intersection safety emergency. The system is inspired by lessons learned from the AMBER Alert program, which leverages a multi-channel strategy to automatically send alerts to mobile phones in specific geographic areas to assist in recovering abducted children in North America.

The VRU Alert system is designed to prevent crashes through a hierarchy of interventions ranging from a Pre-VRU Alert dynamic traffic control, to Level 1 VRU Alerts warning of conflicting demand for the same space, all the way up to Level 2 VRU Alerts warning of an imminent collision. Level 1 and Level 2 alerts are designed for both connected and nonconnected road users.

The Pre-VRU Alert dynamic traffic control is designed as a call for an actuated leading pedestrian interval. This call may not be feasible in all locations or be declined by the controller for various reasons, or the vehicle may violate the signal, in which case the system activates Level 1 VRU Alerts.

Level 1 VRU Alerts provide a steady white warning of a potential conflict almost everywhere the involved road users could be looking. The steady white perimeter theme would be distributed through multiple channels, comprising: (1) physical hardware installed at the intersection; (2) a white perimeter, haptic feedback, and an audible tone delivered through the phones of conflict-relevant road users as determined through hyper-precise location technologies; and (3) a message delivered to connected vehicles.

If Level 1 Alerts do not resolve the potential conflict, and the road users progress to the point where kinetic risk models indicate that a serious injury crash is likely and imminent, the system escalates to Level 2. Level 2 VRU Alerts are communicated using the same channels as Level 1 Alerts, except that the information delivered through the various feedback channels escalate in intensity.

The VRU Alert system is built on four foundational principles. The first is Safe Systems Alignment, which is founded on a world-class kinetic energy and biomechanics approach to risk measurement proven to predict injury crashes at a 94% accuracy level and reduce risk by 85%. This principle also aligns with the USDOT National Roadway Safety Strategy. The second principle is Resilience, which is founded on a multi-channel sensing strategy that uses four sources of road user location and late fusion to build a comprehensive and accurate live object list that remains functional under individual sensor failure and across weather conditions. The third principle is Inclusiveness which is founded on auditable, bias-free computer vision models, and on a multichannel warning delivery system covering non-connected, connected, and disabled road users.

The fourth principle is Scalability which is founded on open digital standards and a cost-effective bill of materials for system installation. Miovision is currently live-testing an initial version of VRU Alert which detects pedestrians within a conflict zone and alerts approaching motorists. This initial version will be ready for deployment by the end of 2024.

Figure 7: The White Alert Concept in action

CONTACT

To contact a representative for more information on what Miovision V2X services can do for you, visit miovision.com or email us at support@miovision.com.

Miovision
137 Glasgow St., Suite 110
Kitchener, Ontario
Canada N2G 4X8
+1-877-646-8476

Miovision GmbH
Thalkirchener Str. 56
80337 Munich
Germany
T +49 89 92131426-1

miovision