Use Cases - Connected (V2V) and AUTOWARE SW #3662

Unanswered davidc0619 asked this question in **Ideas**

davidc0619 on Jul 13, 2023

Here are the few initial use cases to consider as the interfaces between Connected (V2V) and AUTOWARE SW are being created

1. Co-operative lane following
2. Platooning
3. Speed optimization at traffic signals
4. Safety of VRUs
5. Sharing Sensor data between Autonomous Vehicles
6. Sharing Sensor date between Autonomous Vehicle and Non Autonomous Vehicle

Feel free to add/append/comment.

↑ 2   👍 5

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mitsudome-r on Jul 26, 2023 Maintainer

Here are some of additional use cases for V2X that I can think of:

- For cargo delivery use cases, we had situation where we want the vehicle to communicate with infrastructure to open a roller shutter to enter a warehouse.
- For Autoware installed mobile robot use case, we had situation where we wanted to communicate with evaluators to go to different floor. (This is a rare use case for a vehicle so we could perhaps ignore this, but I'm sharing it just in case)

↑ 2   1 reply

isamu-takagi on Jul 26, 2023 Maintainer

These use cases were discussed in this issue, but now I think it's better to unify the V2X discussion. In this proposal, an ID is assigned to the entry and exit lanes. I think it can be applied to elevators by assigning this ID to the floor.

yuasabe on Aug 9, 2023 Collaborator

The [Strategic Innovation Promotion Program (SIP) and its division on Autonomous Driving (SIP Automated Driving for Universal Services)](#) in Japan has previously compiled a list of use-cases for Cooperative-ITS.
The whole document is [provided here](#), but a list of the considered use cases is presented below.

The use cases were first categorized into three groups based on what kind of information must be shared.

1. Use cases in which information outside the detection range of on-board sensors must be obtained

- Merging assistance by preliminary acceleration and deceleration
- Merging assistance by targeting the gap on the main lane
- Driving assistance by using traffic signal information (V2I)
- Driving assistance by using traffic signal information (V2N)
- Collision avoidance assistance when a vehicle ahead stops or decelerates suddenly
- Driving assistance based on intersection information (V2V)
- Driving assistance based on intersection information (V2I)
- Collision avoidance assistance by using hazard information
- Driving assistance by notification of abnormal vehicles
- Driving assistance by notification of wrong-way vehicles
- Driving assistance based on traffic congestion information
- Traffic congestion assistance at branches and exits
- Driving assistance based on hazard information
- Driving assistance based on emergency vehicle information

2. Use cases in which information about the ego-vehicle must be provided

- Request for rescue (e-Call)
- Collection of information to optimize the traffic flow
- Update and automatic generation of maps
- Distribution of dynamic map information

3. Use cases in which intention-sharing based on V2V and V2I must be ensured

- Cooperative merging assistance with vehicles on the main lane by roadside control
- Merging assistance based on negotiations between vehicles
- Lane change assistance when the traffic is heavy
- Entry assistance from non-priority roads to priority roads during traffic congestion
- Unmanned platooning of following vehicles by electronic towbar
- Adaptive cruise control and manned platooning of following vehicles using adaptive cruise control

- [Teleoperation] Operation and management of mobility service cars

I think many of the use cases we consider for V2X applications can be categorized into the above use cases.
What is important is that the use cases of C-ITS need to provide additional value (safety, efficiency, convenience, cost-performance, etc.) to conventional standalone autonomous driving systems in order for them to be considered worthwhile for investigation.

↑ 1   0 replies

mitsudome-r on Aug 9, 2023   Maintainer

Maybe for each use cases, it would be nice to draw a sequence diagram to show a communication between each component and Autoware, just like in this diagram.

↑ 1   0 replies

yuasabe on Sep 7, 2023   Collaborator

I've added some sequence diagrams here for the following use cases:
https://tlab-wide.github.io/AutowareV2X/pr-48/design/use-cases/

- Blindspot VRU Detection using Collective Perception
- CAMs betweens CAVs
- I2V Traffic Light Information (TLI) Sharing

While making these sequence diagrams, it became tricky to determine how specific or detailed they should be. Since our final goal would be to define the interfaces between Autoware and standard-specific adapters, I believe the diagrams should be as specific as possible on the Autoware-side, but that would make it overly complicated. It would be nice if we can discuss more in the next meeting!

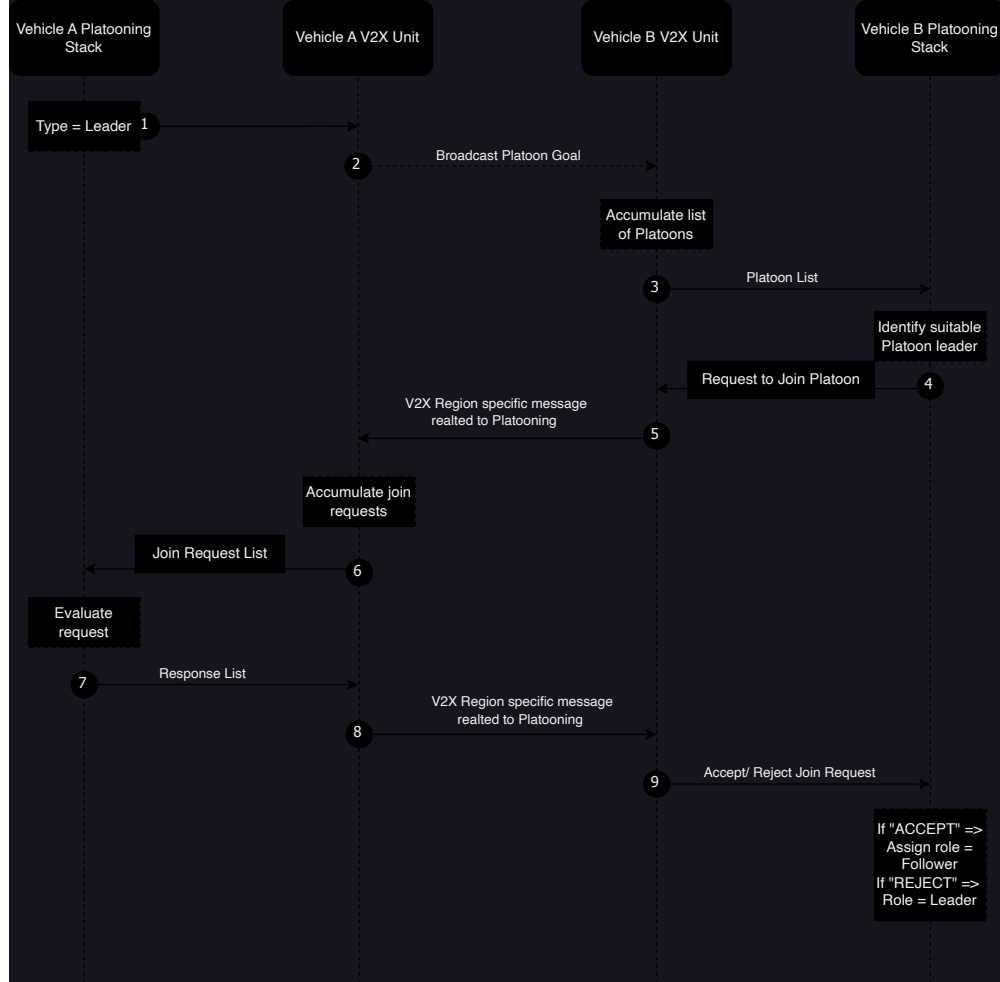↑ 2   👀 1   0 replies

damodarRohit on Sep 20, 2023   edited ▼

I am adding another sequence diagram here on the handshaking required for Platooning using V2V communication. I was not able to find specific messages related to Platooning in the V2X standards, so these are kept generic. It would be great to have inputs on this and the sequence diagram in general.