AutowareV2X: V2X communication module to realize connected autonomous vehicles #3655

yuasabe started this conversation in **Show and tell**

yuasabe on Jul 12, 2023 Collaborator

Hi Autoware Community!

I'll like to introduce AutowareV2X, an implementation of a V2X communication module that can be integrated into Autoware.

AutowareV2X provides external connectivity to the entire AD stack, enabling the end-to-end (E2E) experimentation and evaluation of connected autonomous vehicles (CAV).

AutowareV2X Architecture

The system architecture for the implementation is shown below. AutowareV2X is based on the ETSI C-ITS protocol suite Vanetza, and it can be integrated into Autoware through an Ethernet interface. Any of the information provided by Autoware can be extracted and packed into packets that are transmitted in the form of V2X messages. Because both Autoware and AutowareV2X are loosely decoupled, the two components can be placed on separate hardware to accommodate more use cases.

V2XNode functions as the interface between the V2X communication stack and the ROS2-based Autoware, while *V2XApp* is responsible for common tasks necessary for V2X communication, cross-layer network configuration, and the management of various facilities such as CAM and CPM. The **Collective Perception Service (CPS)** is also implemented as an application to demonstrate the use case of AutowareV2X, and the dissemination and reception of Collective Perception Messages (CPMs) are made possible. The object information shared via CPMs can be immediately inputted into the perception or planning modules for Autoware, enabling the E2E experimentation and evaluation of CAVs.

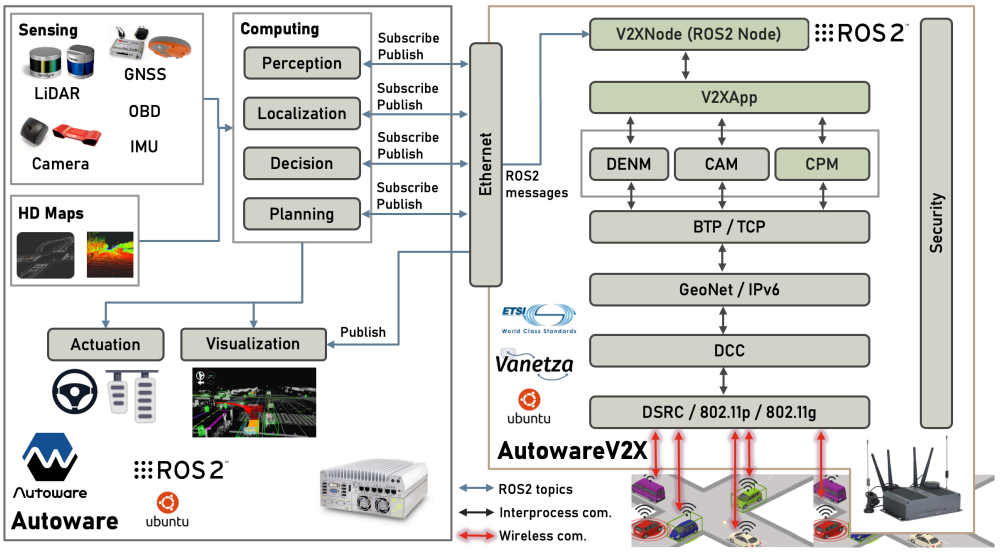
Category

Show and tell

Labels

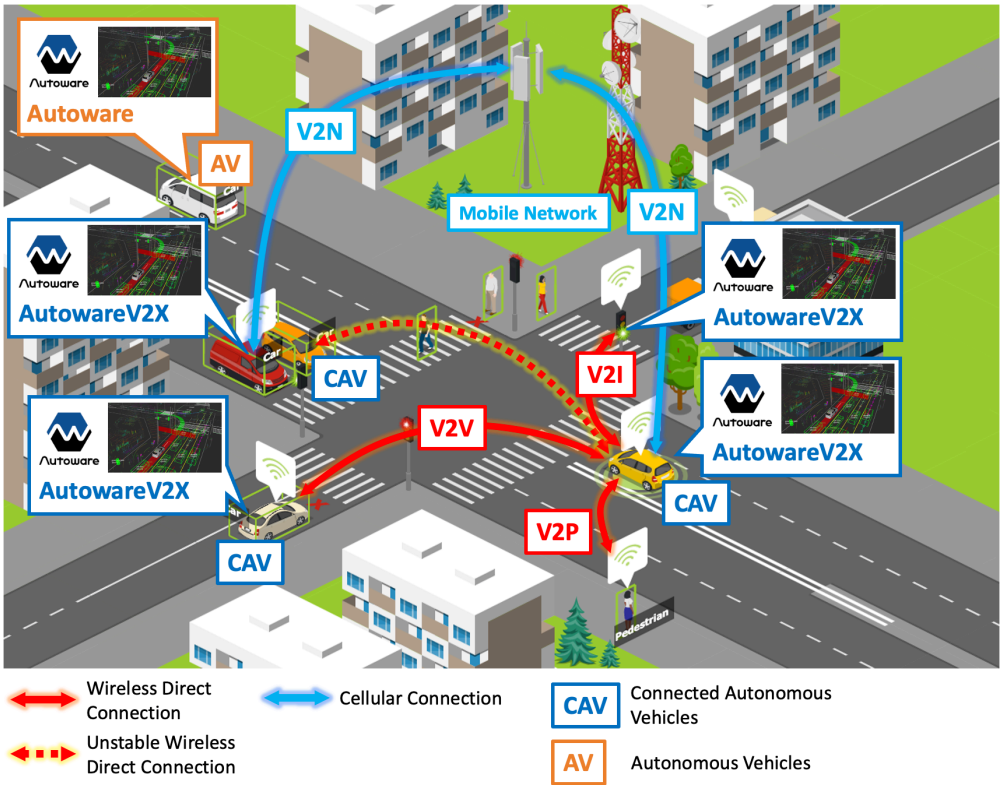
None yet

1 participant



How AutowareV2X can be used

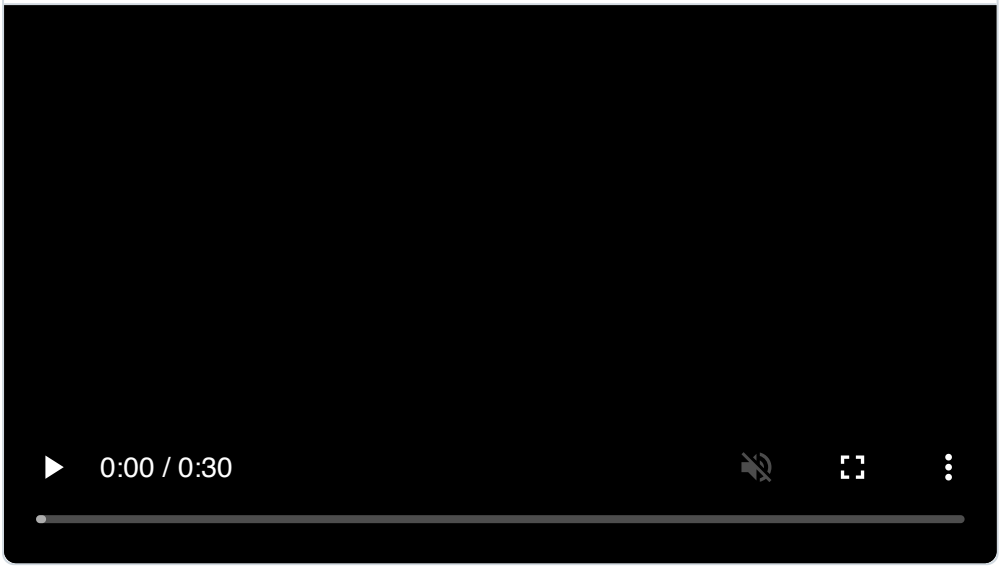
The figure below shows a high-level overview of how AutowareV2X can be used. AutowareV2X can be the V2X component that will enable Autoware-powered systems, both vehicles and infrastructure alike, to become connected to each other through a larger network. It can be the basis for V2V, V2P schemes, and also V2I and V2N applications. It can provide the basic functionalities and building blocks of V2X-enabled connected autonomous vehicles, and the user can combine them to create sophisticated cooperative applications.



Collective Perception Demo

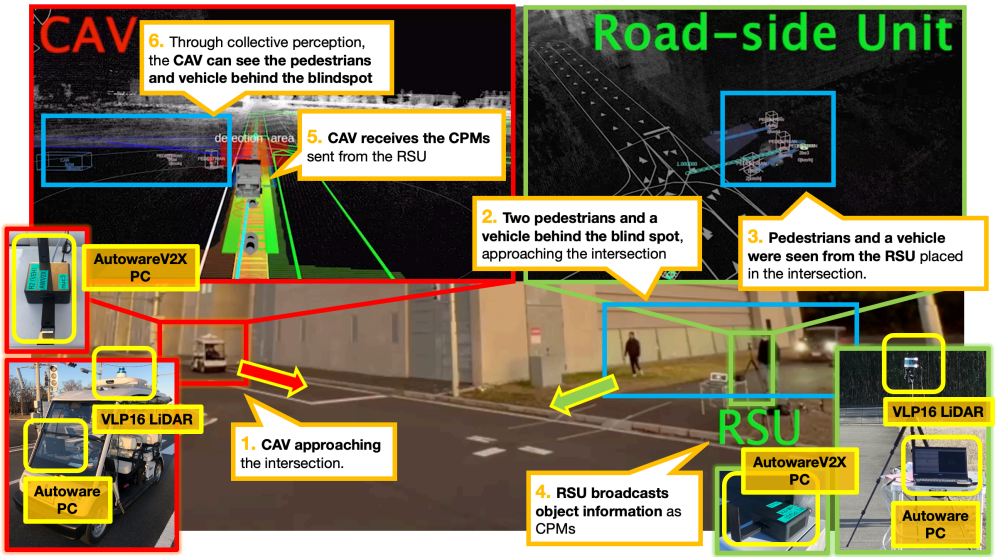
We also conducted a PoC demo of Collective Perception using an autonomous vehicle and a RSU.
In the video below, we consider a blindspot scenario where the ego-vehicle golf cart approaching from the left cannot directly perceive the pedestrians and the red vehicle coming from the right (the blindspot area). An RSU consisting of a LiDAR sensing component and an AutowareV2X component is placed in the middle of the intersection. This RSU senses the pedestrians and vehicles in the blindspot and sends their position information to the autonomous golf cart via Collective Perception Messages (CPMs). The ego-vehicle is then able to see beyond its local sensors and slow down before entering the intersection.

awv2x_demo_kashiwa.mp4



Youtube Link to the same video: https://youtu.be/57fx3-gUNxU

This figure also sums up the important bits of the demo.



Development

Currently, development is still ongoing, with many future updates planned. Please feel free to check out the Official Documentation and post new issues for any questions or bugs!

For more info (especially about collective perception work), refer to the following paper too!

```
@inproceedings{Asabe2023b,
    title = {AutowareV2X: Reliable V2X Communication and
Collective Perception for Autonomous Driving},
    author = {Yu Asabe and Ehsan Javanmardi and Jin Nakazato and
Manabu Tsukada and Hiroshi Esaki},
    year = {2023},
    date = {2023-06-20},
    booktitle = {The 2023 IEEE 97th Vehicular Technology
Conference (VTC2023-Spring)},
    address = {Florence, Italy},
}
```

Here is also the presentation slides that were presented at the IV2023 Autoware Workshop!
AutowareV2X for IV23.pdf

Thank you very much, and any form of feedback is greatly appreciated!

↑ 5 🚀 7

0 comments