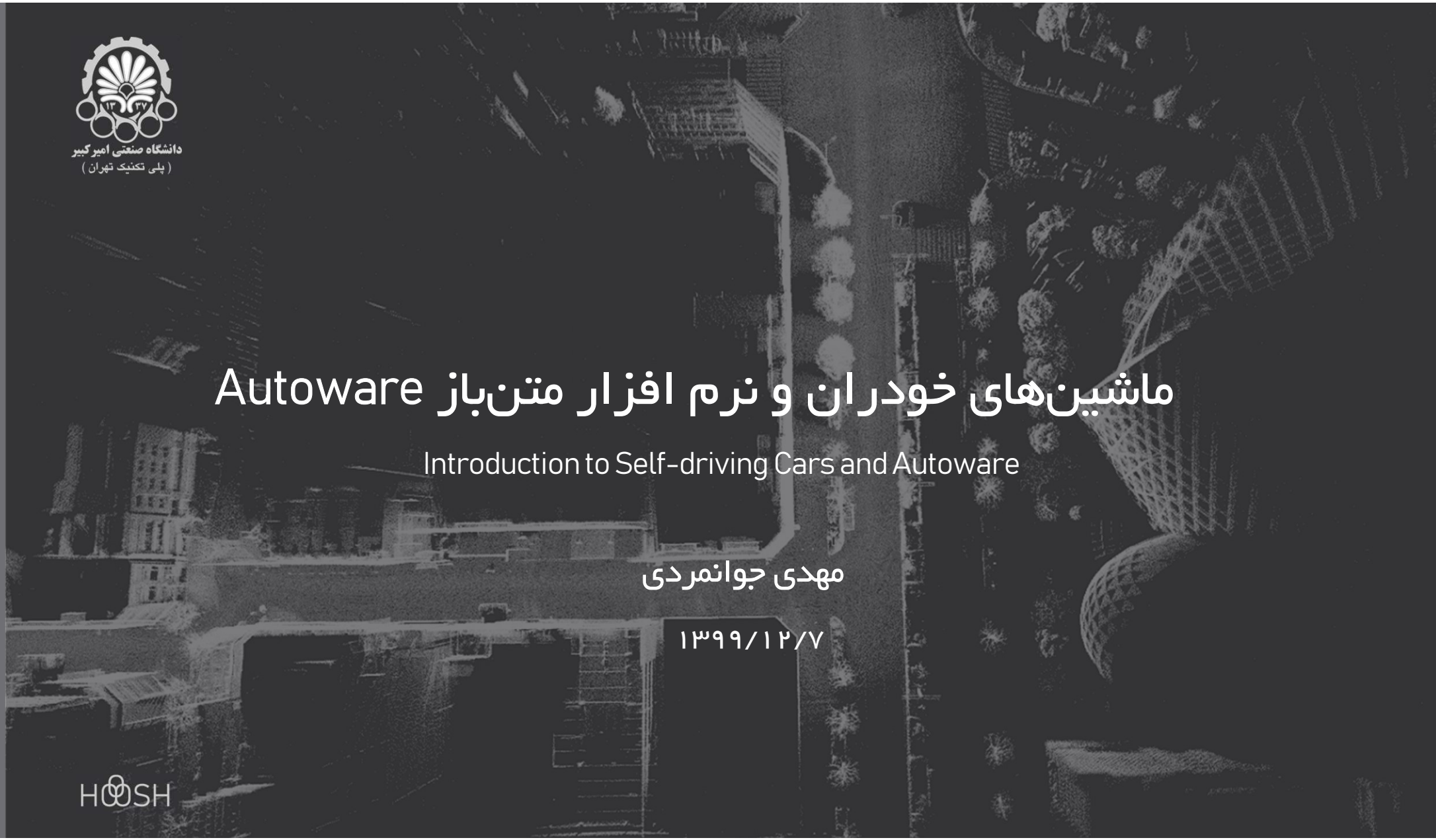
دانشگاه صنعتی امیرکبیر
(پلی تکنیک تهران)
ماشین‌های خودران و نرم افزار متن‌باز Autoware
Introduction to Self-driving Cars and Autoware
مهدی جوانمردی
۱۳۹۹/۱۲/۷
HOOSH

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دانشگاه صنعتی امیرکبیر
(پلی تکنیک تهران)
نرم افزار متن‌باز Autoware
All-in-one Open-source Autonomous Driving Software
Autoware
HOOSH

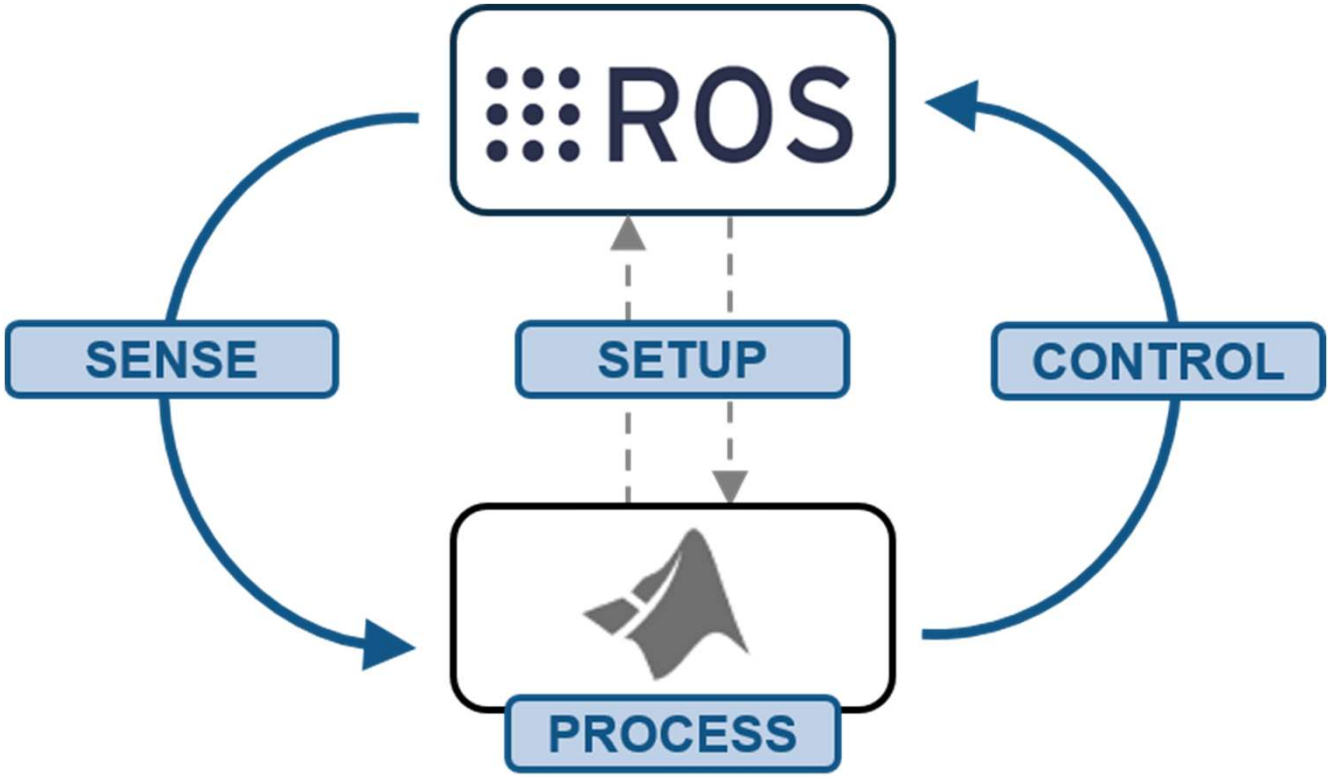
AutoWare Autoware.AI

- Autoware.AI was started in 2015 by Shinpei Kato at Nagoya University.
- Today, Autoware.AI is supported by the largest autonomous driving open source community with 2300+ stars on GitHub and 500+ accounts on Slack.
- Autoware.AI has found widespread and international adoption as it is used by more than 100 companies and runs on more than 30 vehicles in more than 20 different countries.
- Courses using Autoware are offered in 5 countries.
- Automotive OEMs are using Autoware for Mobility as a Service (MaaS) development.
- Autoware is qualified to run on driverless vehicles on public roads in Japan since 2017.

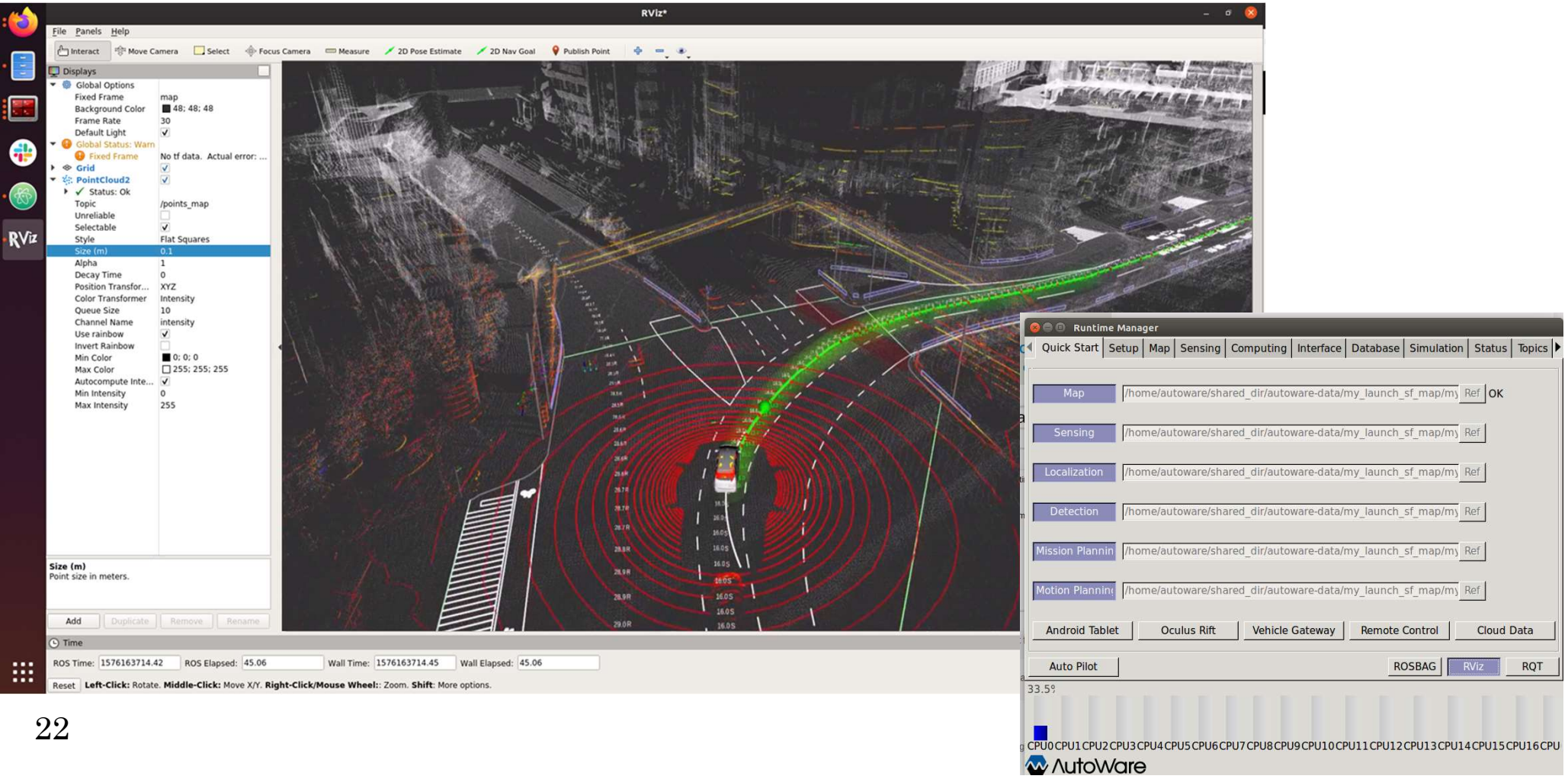
AutoWare Autoware.AI

- Developed in ROS 1 and available under the Apache 2 license.
- Presented at ROSCon 2017.
- Used for Research and Development applications.
- First "All-in-One" open source software for autonomous driving technology.
- Contains the following modules:
  - **Localization**: achieved by 3D maps and SLAM algorithms combined with GNSS/INS sensors.
  - **Object Detection**: camera and LiDAR data used for sensor fusion algorithms and deep neural networks.
  - **Prediction** and **Planning**: based on probabilistic robotics and rule-based systems.
  - **Control and actuation**: path following such as pure-pursuit or MPC and vehicle-dependent actuation.

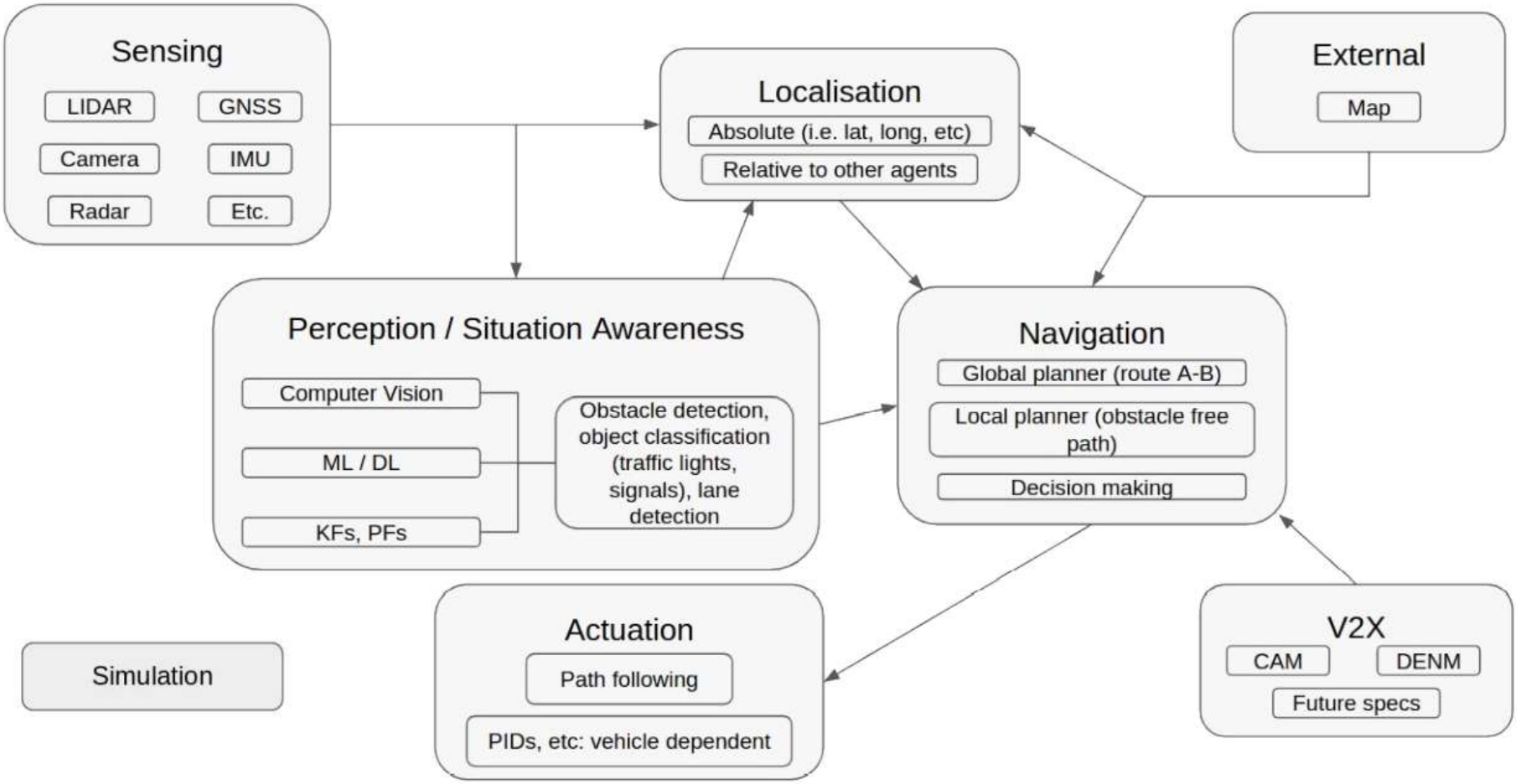
ROS: Robot Operating System



محیط کاربری Autoware



معماری Autoware



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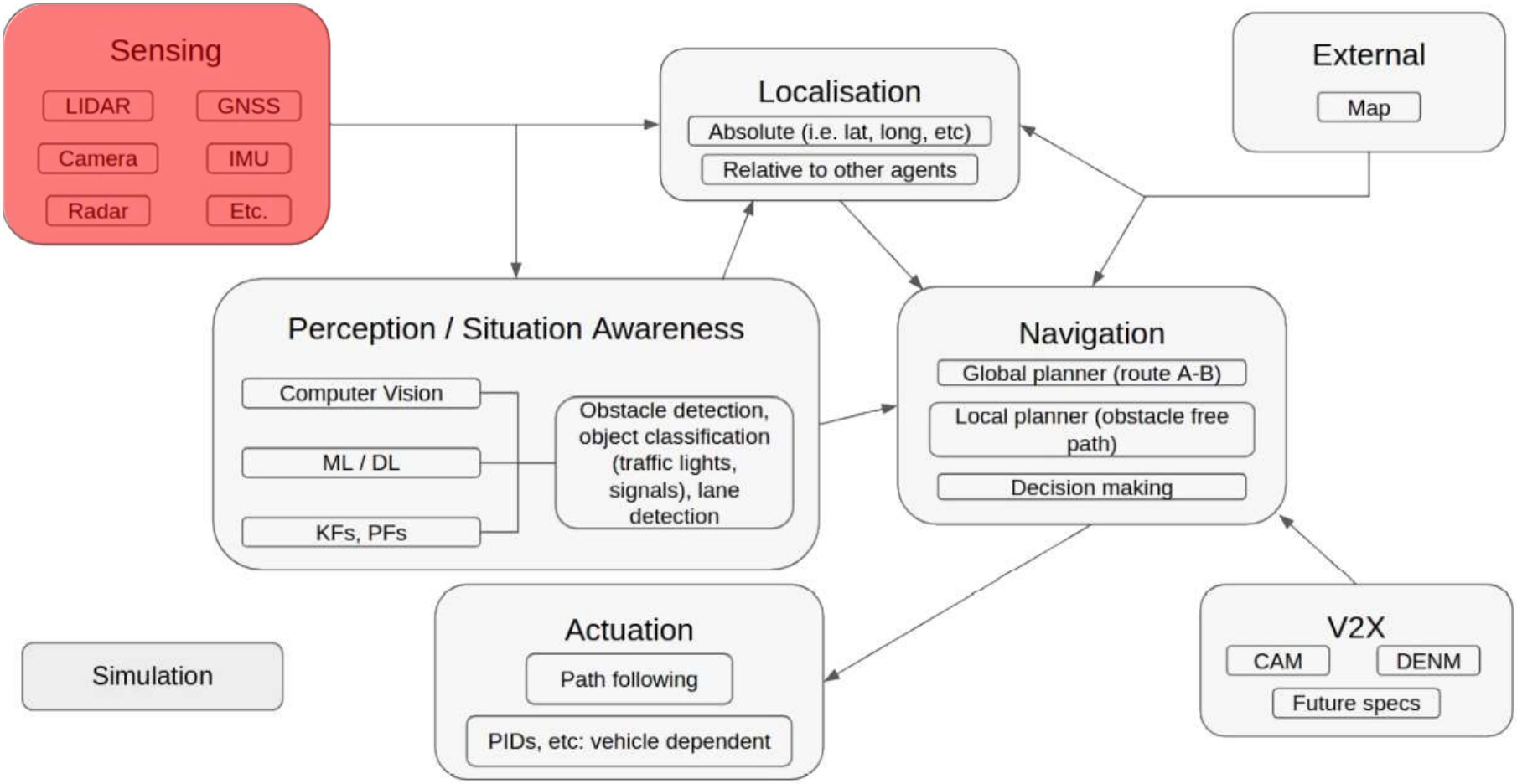


AutoWare Autoware.AI: sensors

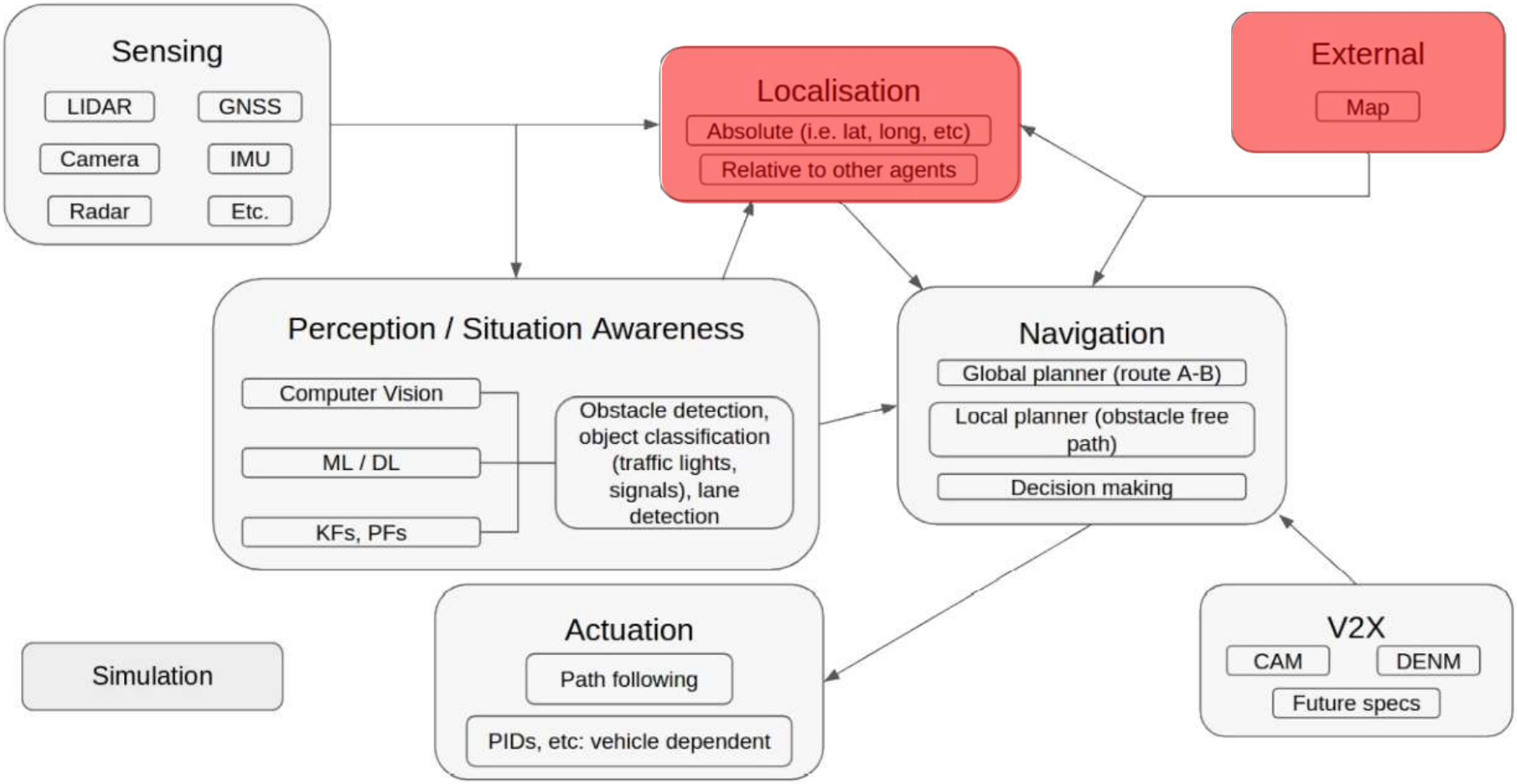
Velodyne LiDAR®

OUSTER

POINT GREY
Innovation in Imaging

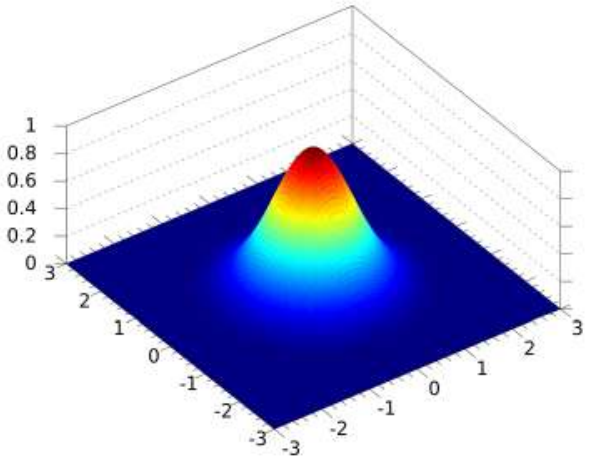
robosense

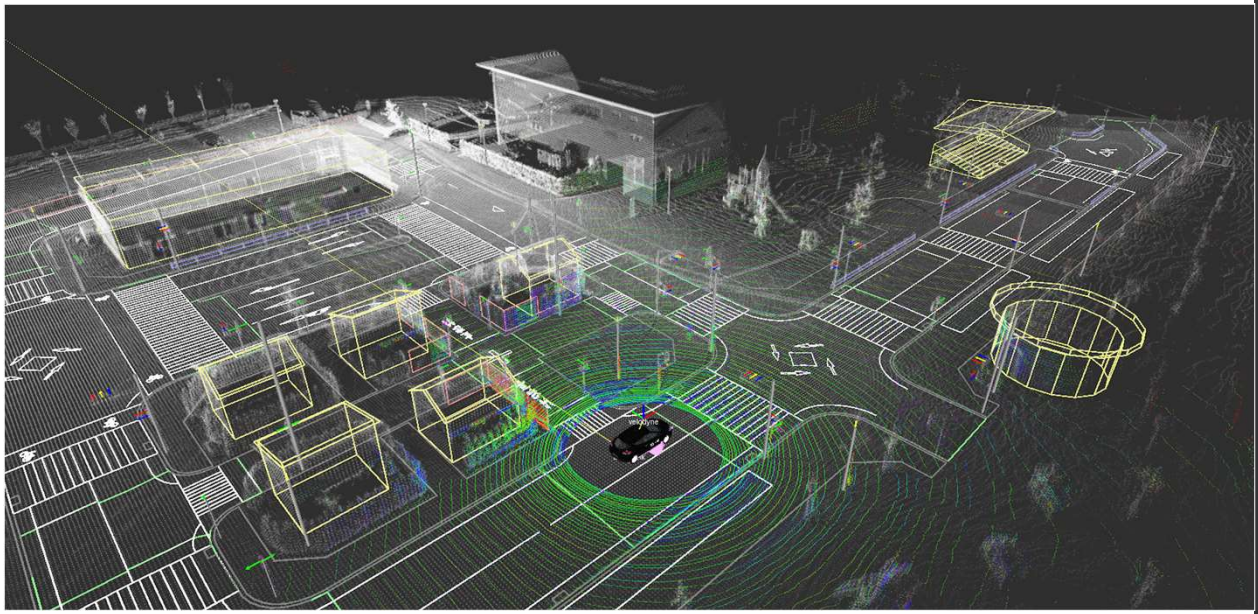
معماری Autoware



Autoware.AI - Localisation

- Mainly LiDAR based and 3D pointcloud maps.
- Based on NDT matching (ICP also implemented).
- GPU and CPU implementation of ROS nodes.





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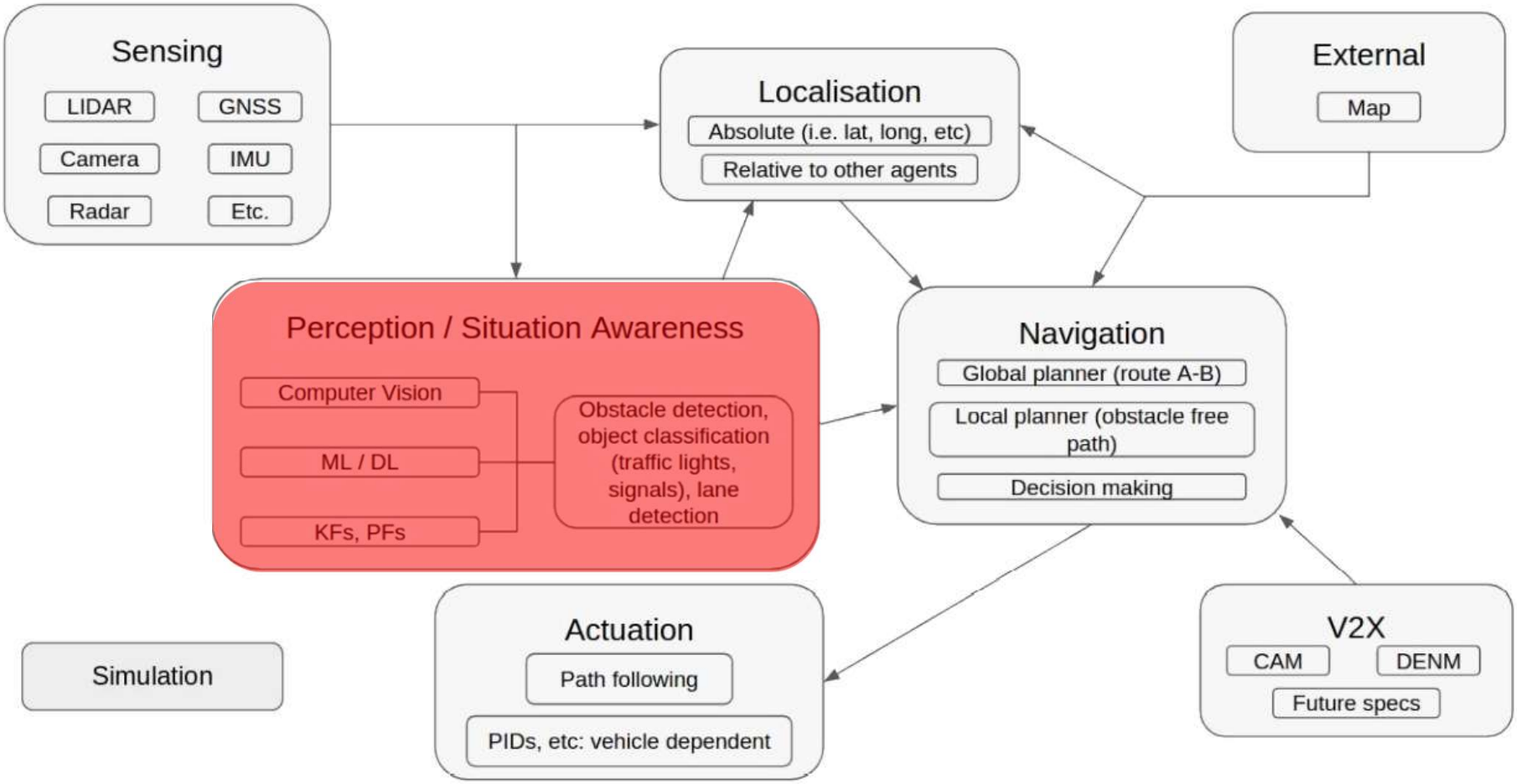
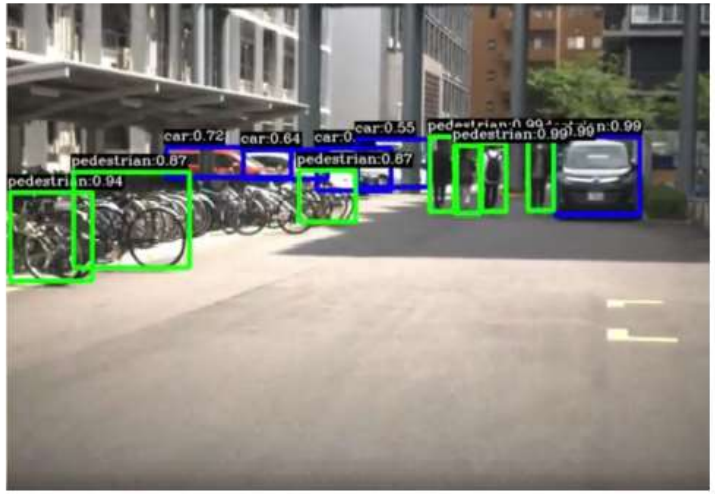
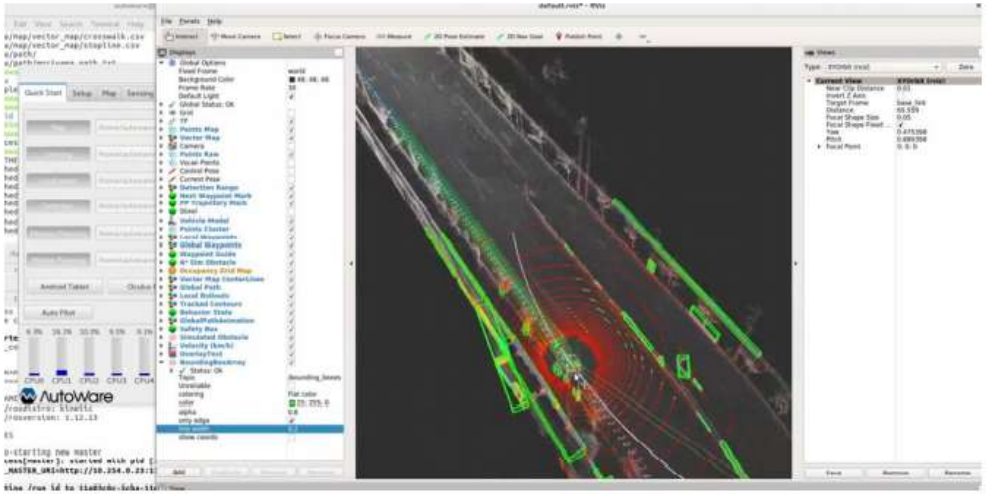


Autoware.AI - Object Detection

- Object detection via:
  - Euclidean Clustering for LiDAR pointclouds and DNN algorithms for cluster classification.
  - DNN, such as SSD and YOLO, for real time performance on camera data.
- Object tracking using Kalman filters or Particle filters.





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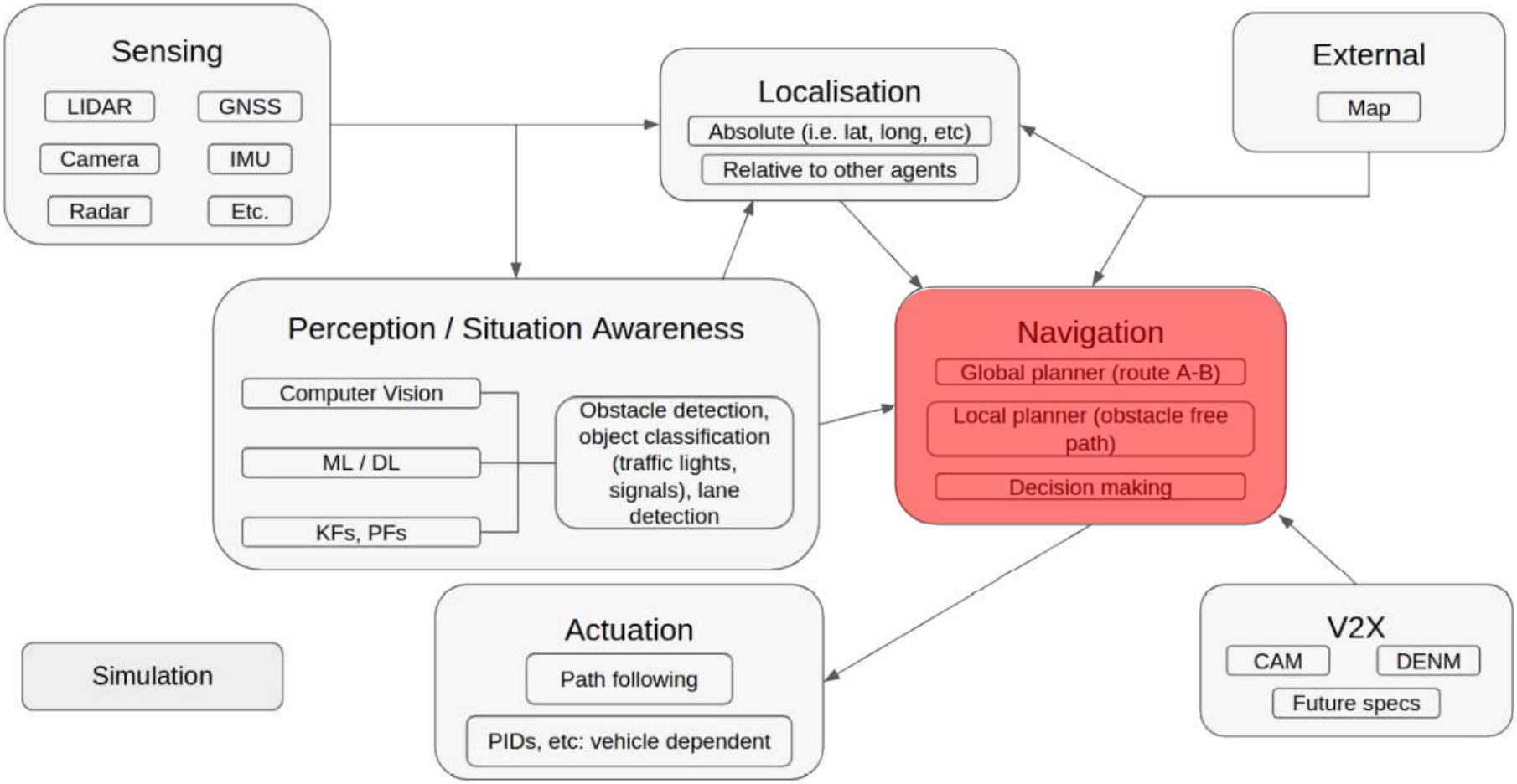
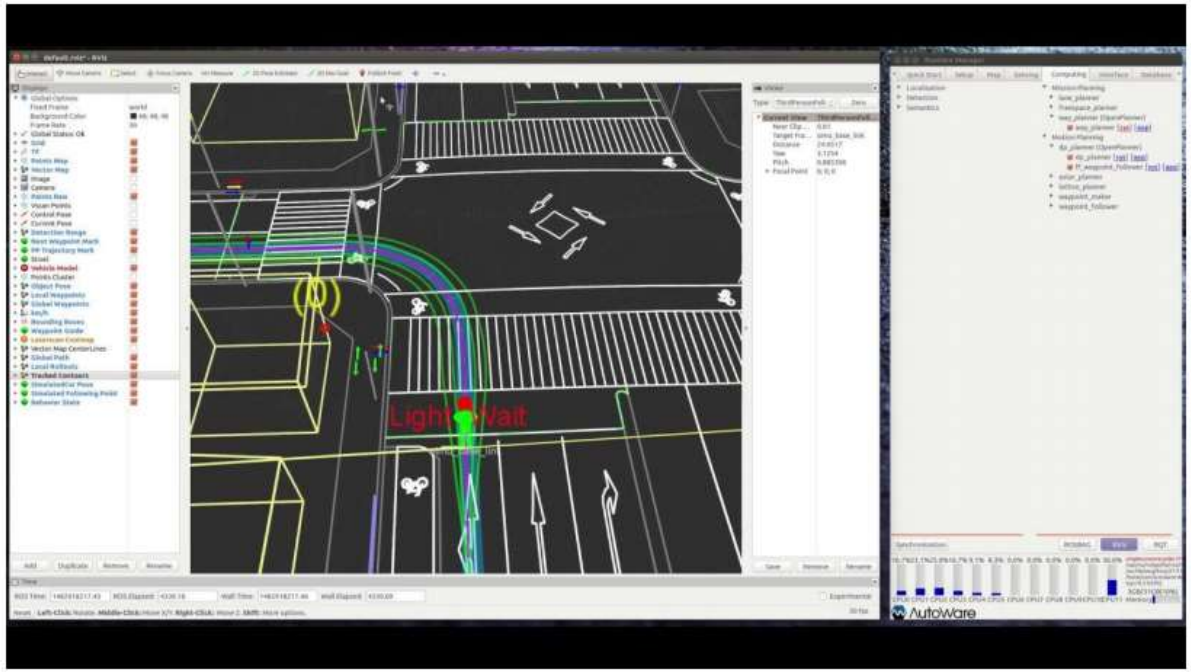
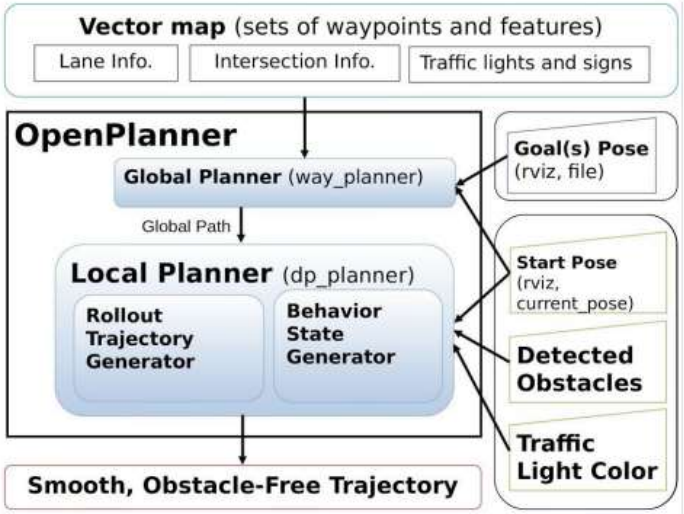


AutoWare Autoware.AI - Pred. & Planning





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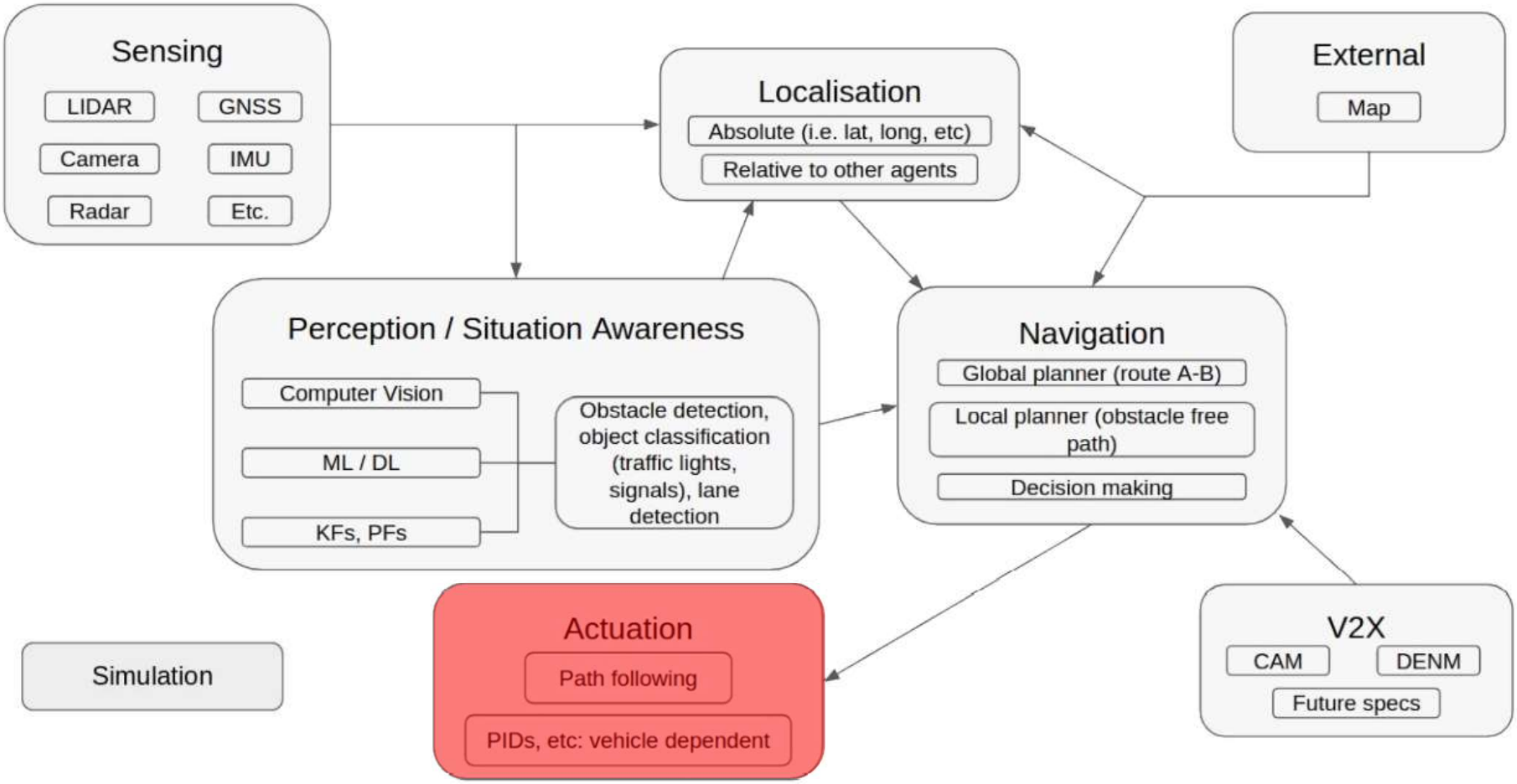
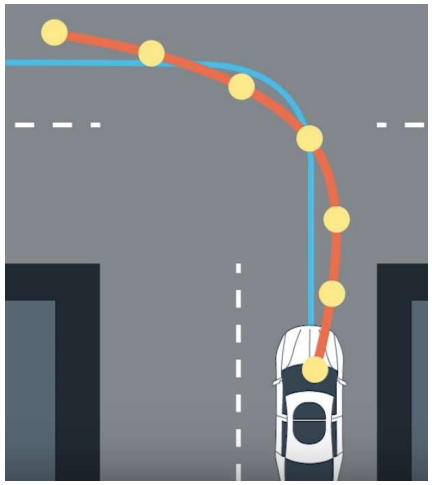
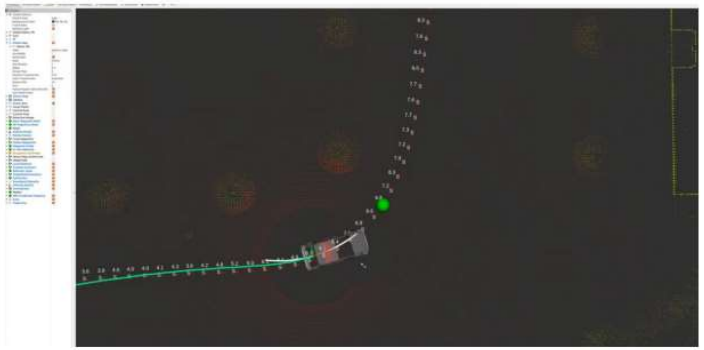


AutoWare Autoware.AI - Control & Act.

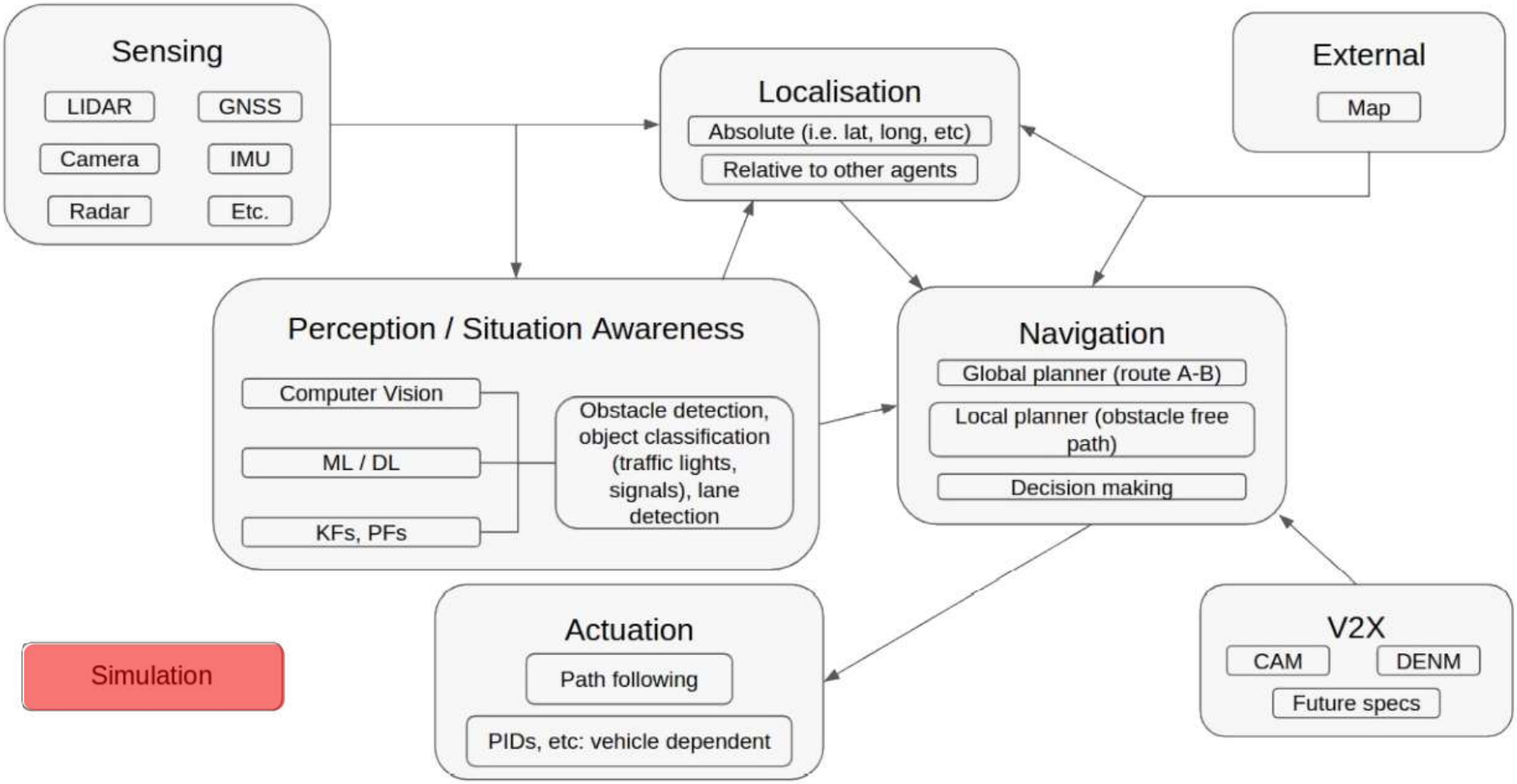




Pure pursuit and MPC

Vehicle controllers

معماری Autoware



Autoware.AI - Simulation

LGSVL Simulator

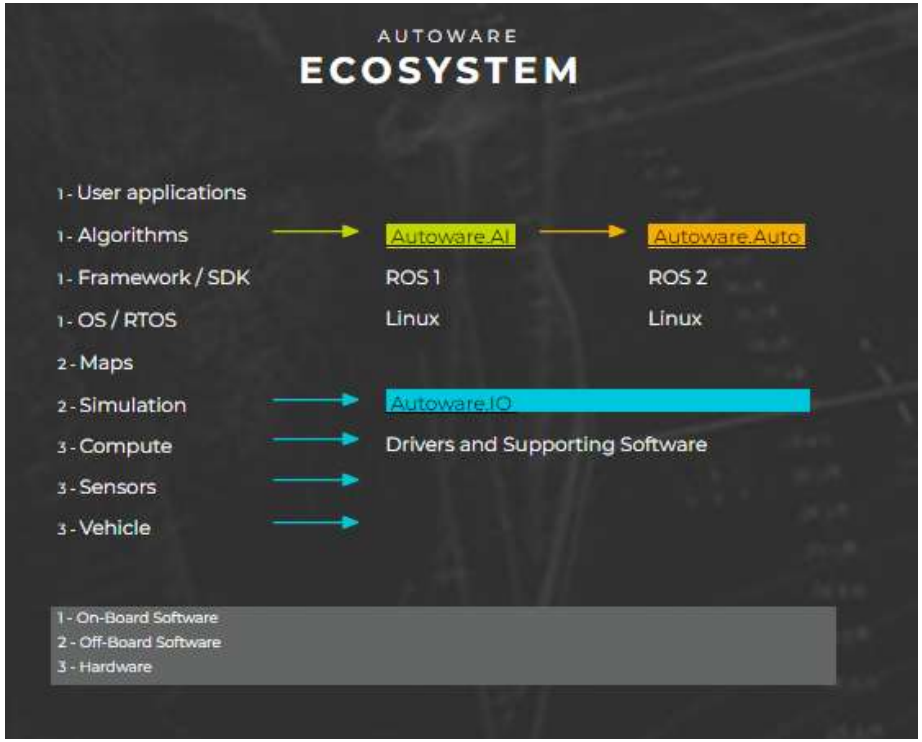
Autoware Foundation – بنیاد اتو-ویر

- Launched in December 2018.
- Aimed at supporting open source projects to enable self-driving mobility.
- Currently, three main projects:
  - Autoware.AI
  - Autoware.Auto
  - Autoware.IO
- Members:

Autoware.Auto

Autoware reimagined. Based on ROS 2. Autoware.Auto is managed by an open-source community manager, applies best-in-class software engineering practices, and is based on a redesigned architecture.

The next generation Autoware, built on ROS 2 and following best practices and standards to be high quality and easier to certify. The source code for Autoware.Auto currently lives here.



Autoware.IO

An interface project for Autoware to be extended with proprietary software and third-party libraries in a reliable manner. Examples include device drivers for sensors, by-wire controllers for vehicles, and hardware-dependent programs for SoC boards.

Heterogeneous hardware platforms → 1. 96Boards Automotive
2. Other development boards

Vehicle control → 1. Generic vehicle control interface
2. Testing framework & kit

Sensor and ECU integration → Generic vehicle control interface
1. Lidar GitHub
2. IMU GitHub
3. GNSS/RTK GitHub
4. Camera GitHub
5. Radar
6. CAN/CAN-FD
7. LIN

Simulation & Tools → 1. Simulator GitHub
2. Map construction and editing tool
3. Data storage and retrieval, web based GUI replacement for runtime_manager
4. Testing framework & kit (inc. HIL/SIL)

AutoWare Resources

- Autoware Foundation: https://www.autoware.org/
- Autoware.Ai Github repository: https://github.com/CPFL/Autoware
- Autoware.Ai Dockerhub repository: https://hub.docker.com/r/autoware/autoware/
- Join the Autoware community discussion forum on Slack: https://autoware.herokuapp.com
- Discourse - Autoware project specific discussions: https://discourse.ros.org/c/autoware/
- Linaro Autonomous Vehicles: https://www.linaro.org/engineering/incubators/autonomous-vehicles/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با تشکر از توجه شما
HOOSH هوش