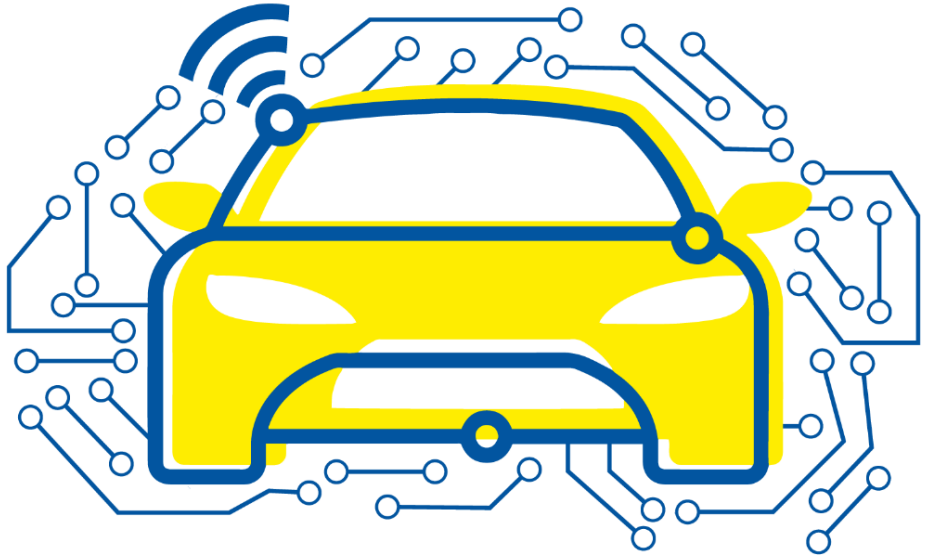
# Automated and Connected Driving Challenges

Section 1 – Introduction & Tools

## Introduction

## Topics



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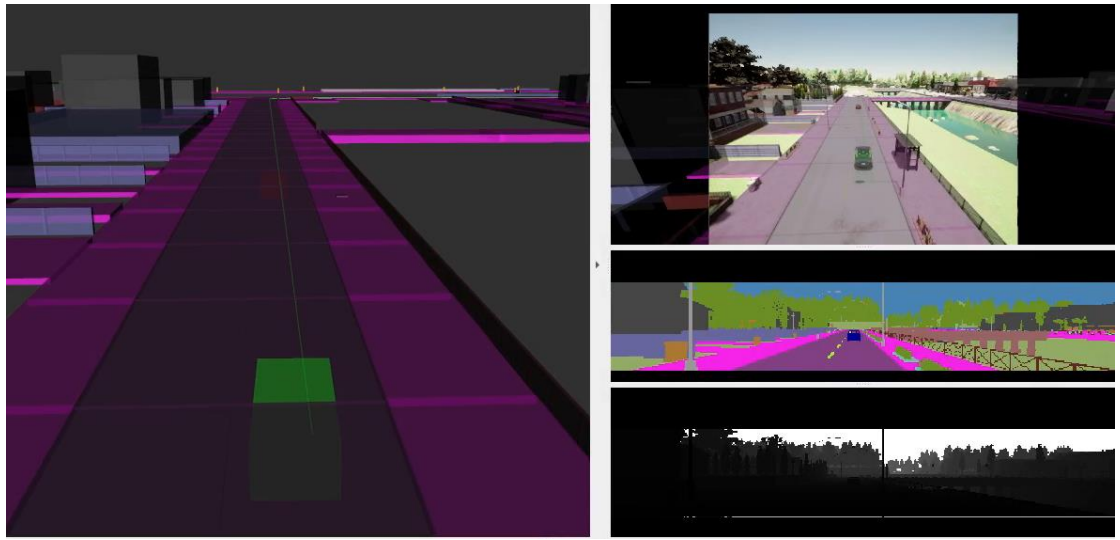
# Introduction – Topics

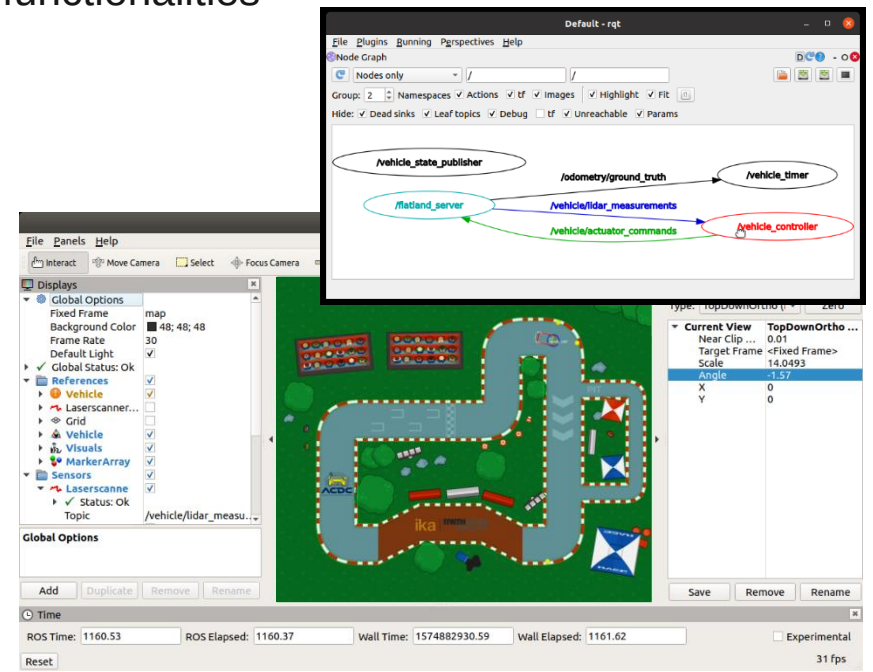
## *Section 1 – Introduction & Tools*

### The Robot Operating System (ROS)

- Learn fundamentals about the Robot Operating System
- Explore communication strategies within the ROS framework
- Visualize data and results together with the provided ROS GUI functionalities
- Integrate a simple vehicle controller into an AD software stack



Video: ika




Images: ika

# Introduction – Topics

## *Section 2 – Sensor Data Processing*

### Semantic Segmentation

- Learn foundations about segmentation as part of computer vision
- Analyze general model architecture for segmentation tasks
- Apply 2D segmentation for camera images
- Extend approach to 3D point cloud segmentation

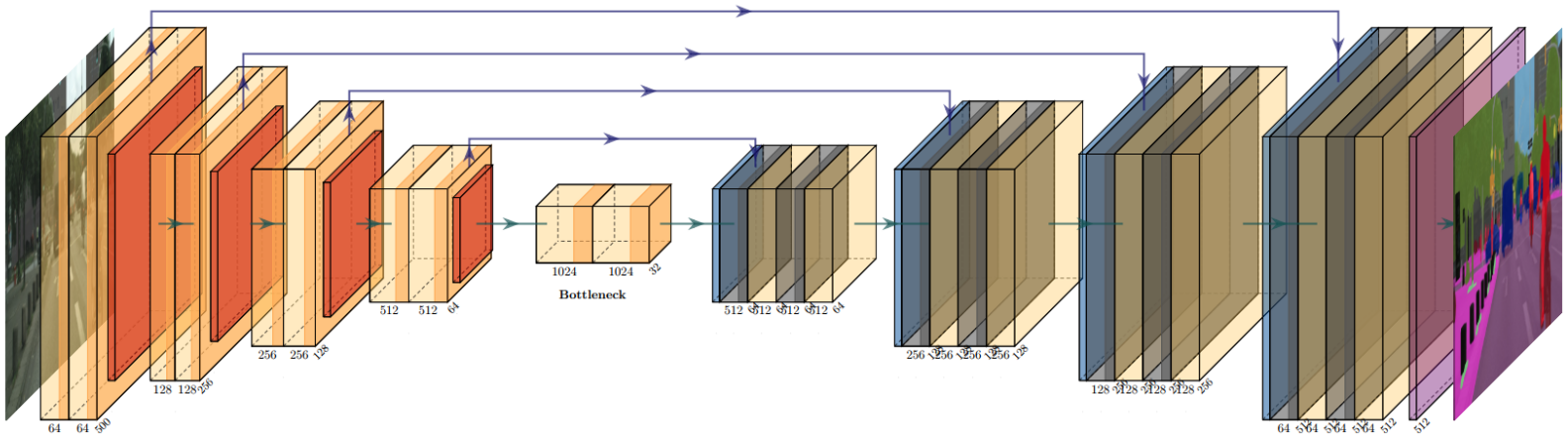



Image: ika, PlotNeuralNet

Image: Cityscapes

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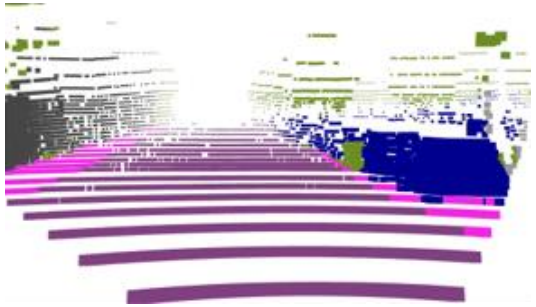


Image: ika

# Introduction – Topics

## *Section 2 – Sensor Data Processing*

### Object Detection

- Derive fundamentals about 2D and 3D object detection
- Analyze different object detection approaches using deep learning
- Apply learned concepts in own object detection training
- Integration of real-world inference in ROS framework

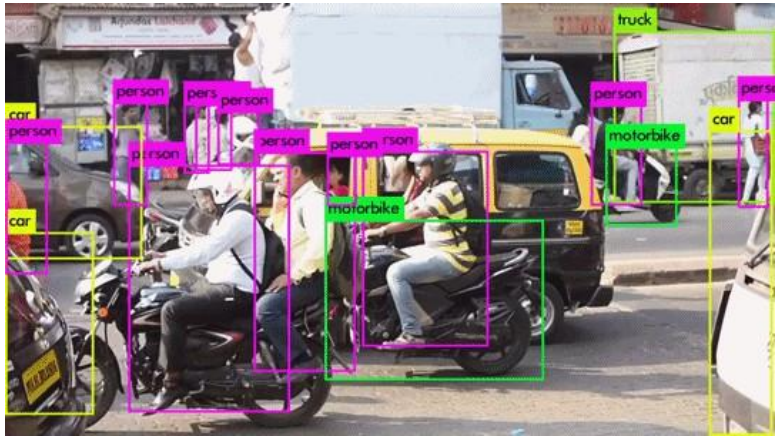
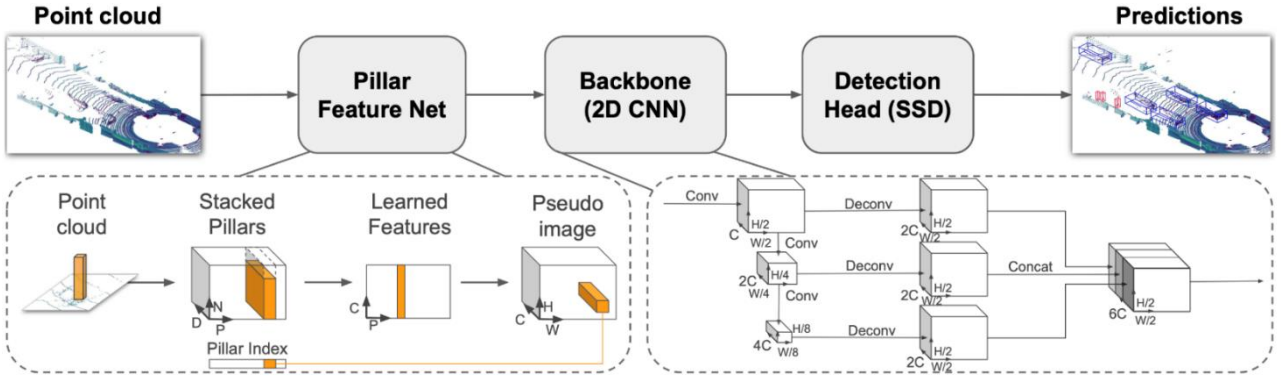



Image: pinterest




Source: Lang et al. 2019

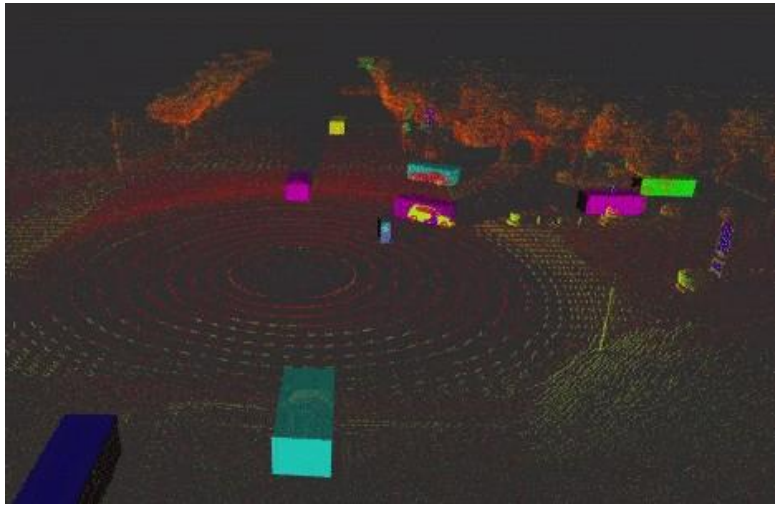


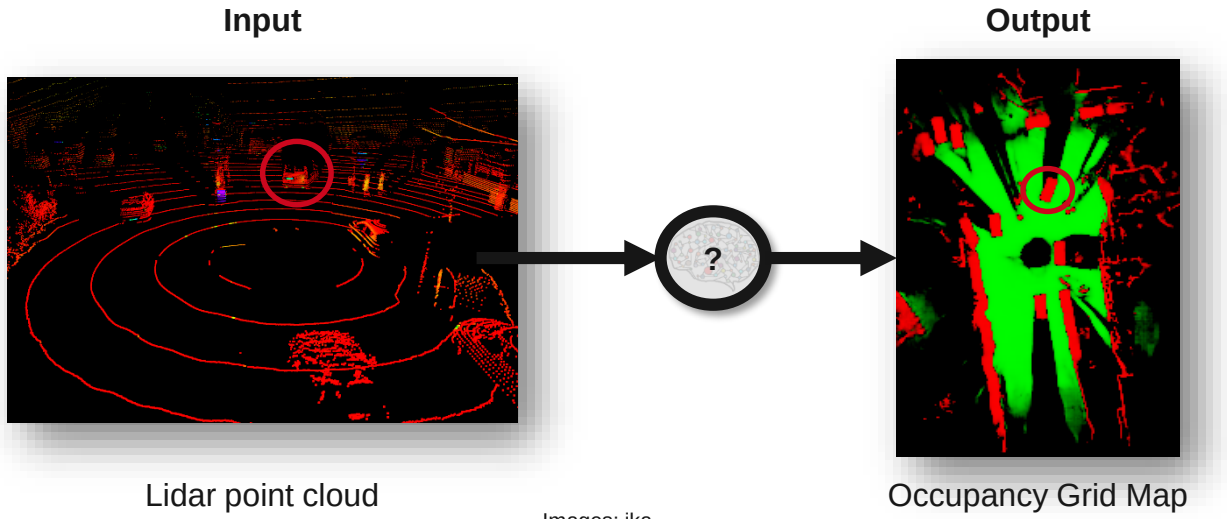
Image: shangzhouye

# Introduction – Topics

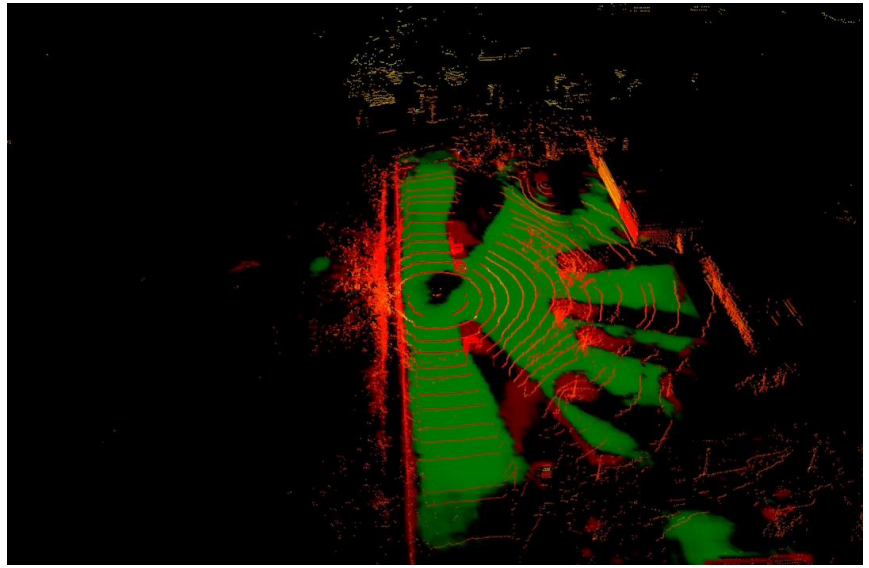
## *Section 2 – Sensor Data Processing*

### Occupancy Grid Mapping

- Understand benefits of a grid-based environment representation
- Implement a simple geometric algorithm to solve the grid mapping task
- Learn how to use a deep learning-based approach instead
- Understand advantages and disadvantages of both approaches




Images: ika

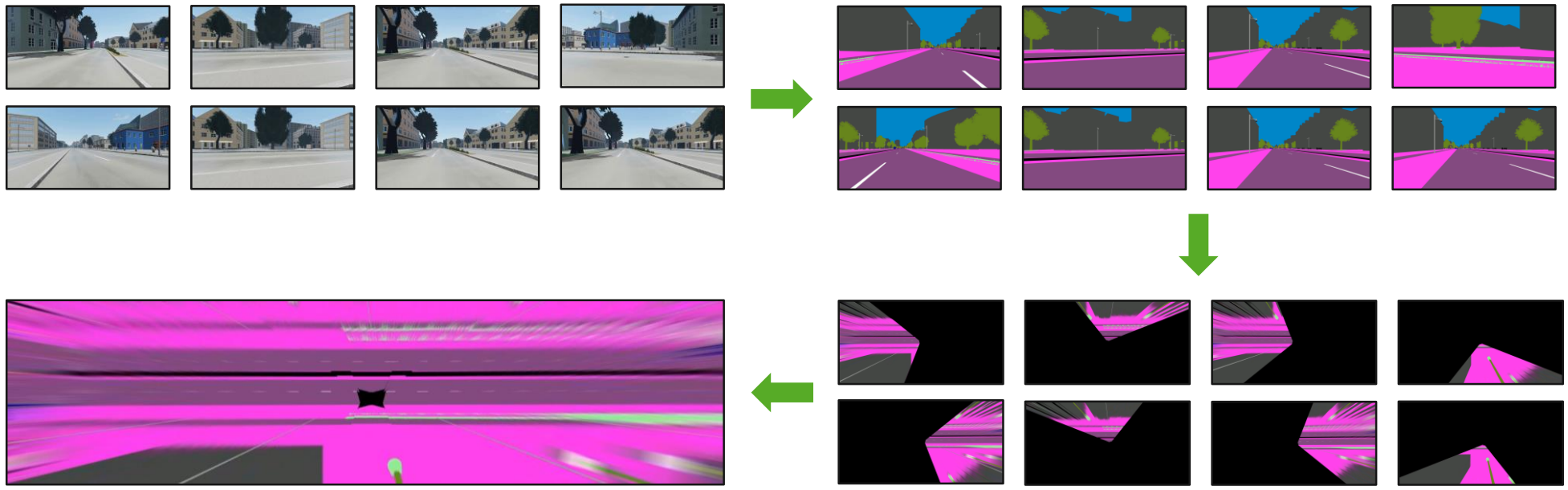


Video: ika

# Introduction – Topics

## *Section 2 – Camera-based Semantic Grid Mapping*

- **Create** a 360° surround view from multiple cameras
- **Compute** image transformations based on calibrated cameras
- **Apply** transformations to segmented images
- **Integrate** Inverse Perspective Mapping into a ROS Node
- **Generate** live semantic grid maps



Videos: ika

# Introduction – Topics

## *Section 3 – Object Fusion & Tracking*

### Object Prediction, Association and Fusion

- Learn fundamentals about object tracking
- Understand mathematical background of tracking algorithms
- Apply learned concepts in own multi-object tracker
- Integration of full object fusion and tracking in ROS

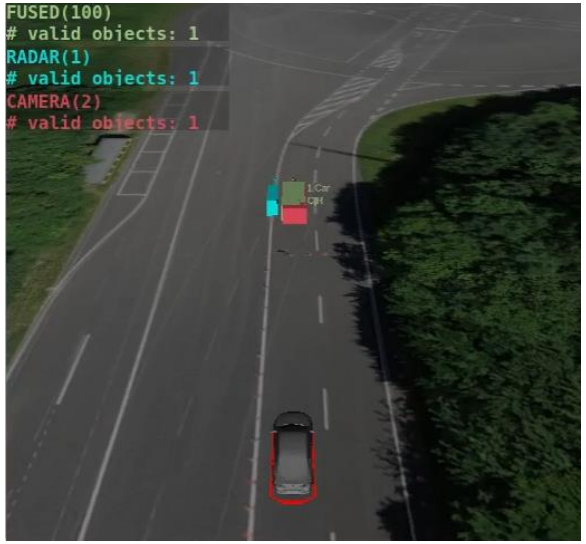
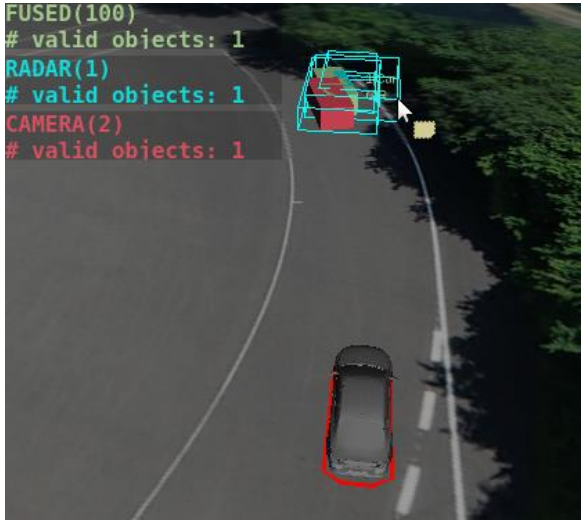



Image: ika

Image: Zoox Youtube



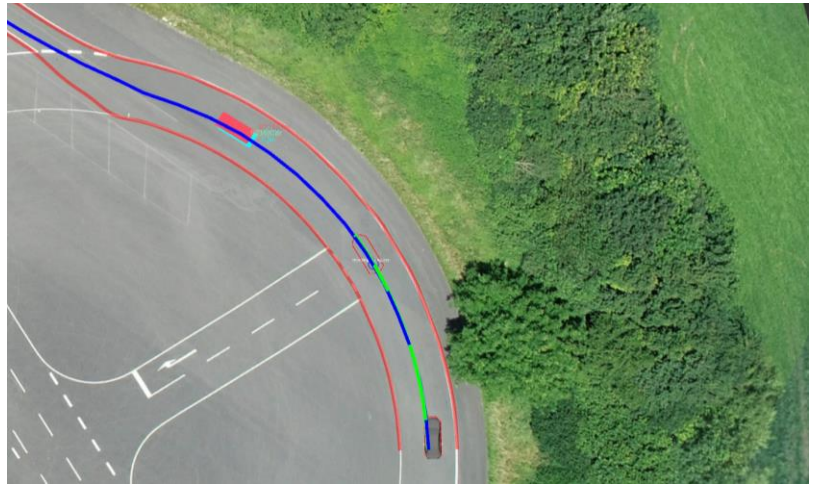

Images ika

# Introduction – Topics

## *Section 4 – Vehicle Guidance*

### Navigation, Guidance, and Control

- Get an insight into the different levels of vehicle guidance
- Derive the challenges and requirements on each level
- Understand different methods for automated vehicle guidance
- Application of the introduced concepts in different algorithms for vehicle guidance



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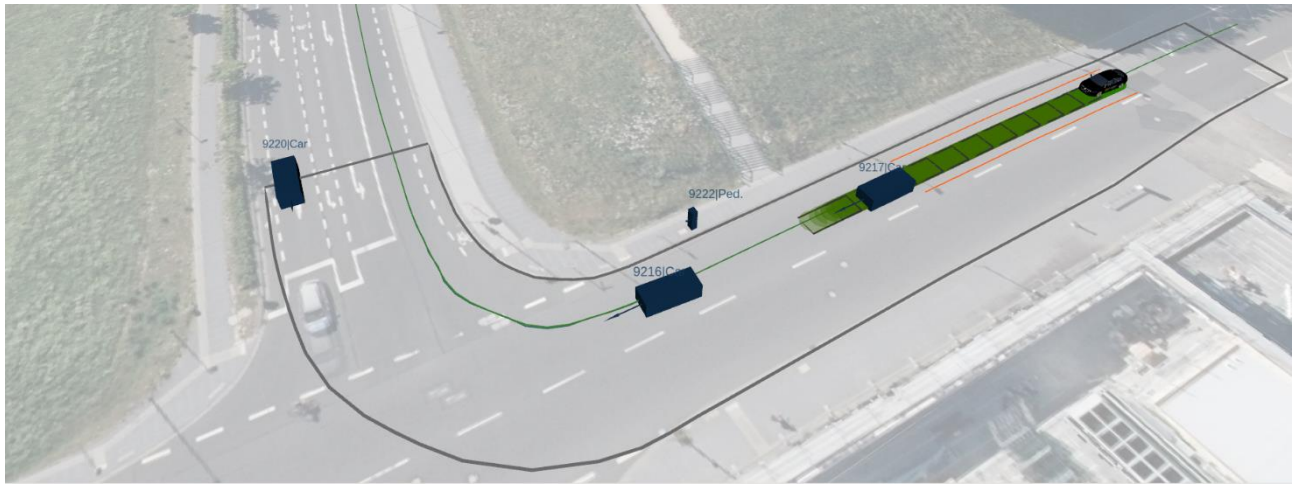


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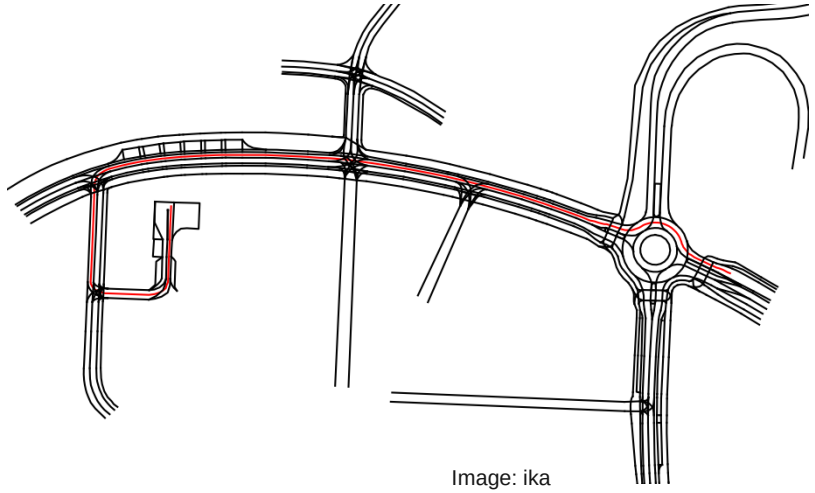


Image: ika

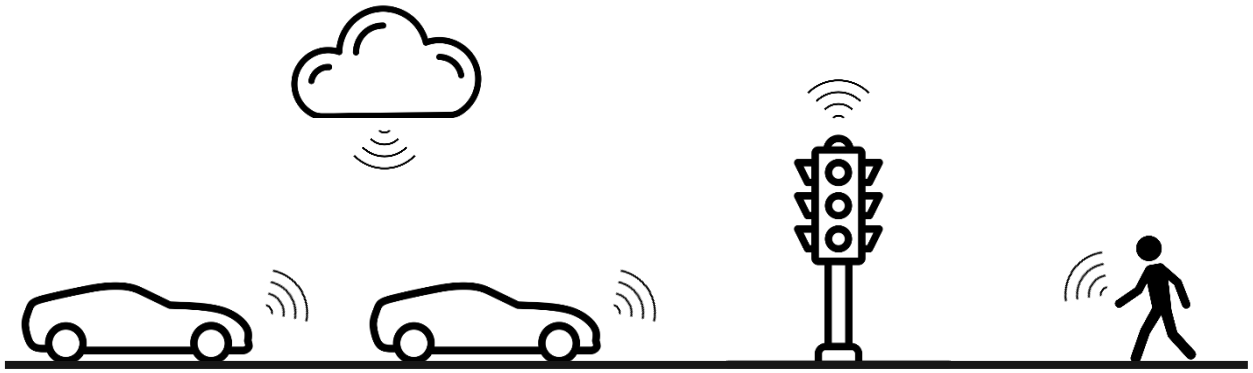
# Introduction – Topics

## *Section 5 – Connected Driving*

### Collective Cloud Functions and V2I Communication

- Learn the fundamentals and potential benefits of V2X communication
- Understand different architectures and technologies
- Analyze different standards and their message formats
- Apply your knowledge from previous sections

  → Integrate a cloud-based object fusion



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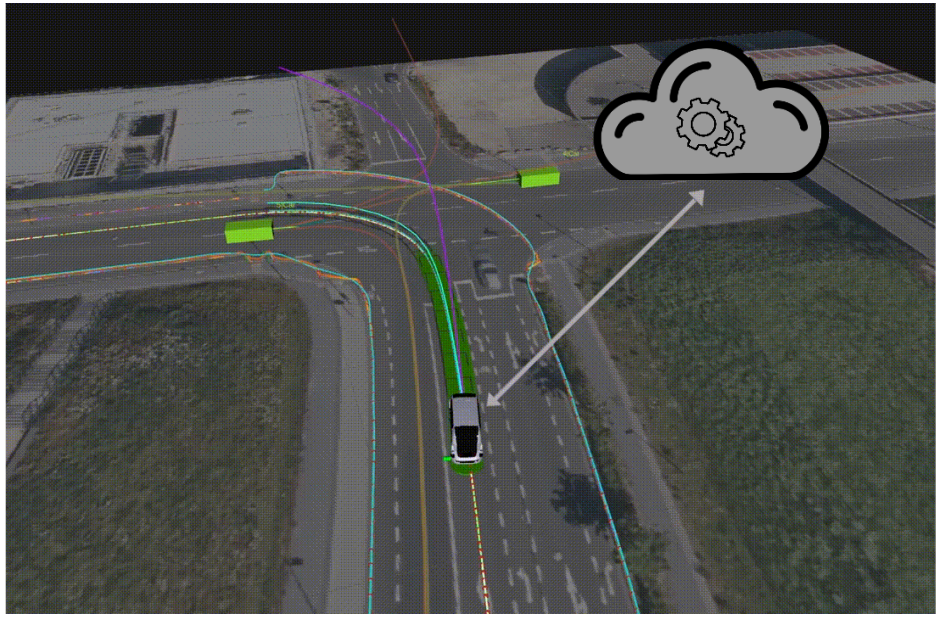

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