How to build a self-driving autonomous vehicle using ROS?
✓ In urban city areas.
✓ Up to 40 mph velocity.
✓ Safety not certified.
Velodyne HDL-64e (3D LiDAR)

Velodyne HDL-32e (3D LiDAR)

Velodyne VLP-16 (3D LiDAR)

IBEO LUX 8L (3D LiDAR)

Point Grey Ladybug 5 (Camera)

Point Grey Grasshopper3 (Camera)

JAVAD RTK-GNSS (GNSS/GPS)
Torque Sensor
Gas Pedal Position Sensor
Shift Position Sensor
Brake Stroke Sensor
Oil Pressure Sensor

3D LiDARs
Cameras
GNSS/GPS

Computing Unit
AutoWare

Direct signals to ECUs bypassing CAN.

CAN I/F

Control Box
Status Monitor

Emergency Button

EPS ECU
Hybrid ECU
Skid Control ECU
Other ECUs
Torque Sensor
Gas Pedal Position Sensor
Shift Position Sensor
Brake Stroke Sensor
Oil Pressure Sensor

Reconnected wires.

Car interior monitors.
Accessories.
Aisan Technology’s Minivan (ZMP RoboCar)
Public road demonstration
Yamaha Motor’s Golf Cart
Yamaha Motor’s Baggy
31 miles along the El Camino Real in the Bay Area along 140 traffic signals and crosswalks during regular traffic over a period of an hour-and-a-half.
Aisan Technology (Partner Company)
High-Definition 3D Mapping
High-Definition 3D Mapping
Normal Transform Distributions (NDT) for Localization

3D map data

Sensor scan data

Matching

Localization
Normal Transform Distributions (NDT) for Mapping
Euclidean Clustering for Detection
Convolutional Neural Networks (CNN) for Detection
Convolutional Neural Networks (CNN) for Detection

SSD

Yolo2
Convolutional Neural Networks (CNN) for Detection

- Depth Image
- Height Image
- Intensity Image
- CNN Segments
Camera-LiDAR Calibration and Sensor Fusion
Traffic Light Recognition using 3D Map Information

NO SIGNAL DETECTED

Traffic Signal

Ego Vehicle
A* Search for Path Planning (Trajectory Generation)
State Lattice for Path Planning (Trajectory Generation)
Pure Pursuit for Path (Waypoints) Following
Task Trace Tool (Ftrace)
Not to Brake? or Brake?

Driving School Teacher (details)
Driving School Teacher

DNN Prediction

https://www.automan.ai
NVIDIA – AutonomouStuff – Tier IV

- Sensing
  - Cameras
  - LiDARs
  - IMU
  - GPS

- Computing
  - Perception
    - Localization
    - Detection
    - Prediction
  - Planning
    - Mission
    - Motion
  - Decision
    - Intelligence
    - State

- Actuation
  - ZMP
  - YMC
  - TMC
  - AS
  - Data
  - Socket
  - System
  - Util

- NVIDIA Drive PX2
runtime manager @autoware

Quick Start  Setup  Map  Sensing  Computing  Interface  Database  Simulation  Status  Topics

Map

Sensing

Localization

Detection

Mission Planning

Motion Planning

Android Tablet  Oculus Rift  Vehicle Gateway  Cloud Data

Auto Pilot  ROSBAG  RViz  RQT

CPU0  CPU1  CPU2  CPU3  CPU4  CPU5  CPU6  CPU7
0.0%  0.0%  0.0%  0.0%  0.0%  0.0%  0.0%  0.0%

Memory
0.0%