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The emergence of In-Vehicle OS

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Key takeaway

- Paradigm shift in automotive industry
- Ongoing autonomous vehicle projects
- The community response and contribution in openpilot project
- Opportunities and challenges in the automotive sector
- Emergence of in-vehicle OS
- Important industry standards and certifications required for vendors
- How you can involve in this technology through various opensource projects and SIGs

Shift in automotive industry

Electric vehicles (EV): Battery, Energy source

Advanced driver-assistance systems (ADAS)/autopilot concept:

- Assist drivers in driving and parking functions
- Increase car and road safety

Autonomous vehicle (AV):

- Also self-driving cars/driver-less car/robotic car
- Vehicular automation

Autonomous Vehicle (AV)

Who are in Autonomous vehicle (AV) market?

- Technology/Cloud companies
- Mobile manufacturers
- Car manufacturers

Zoox

Autonomous vehicle

- Develops all electric autonomous vehicles
- Provides Mobility-as-a-Service (MaaS)
- Main target is robo-taxi market
- On-demand autonomous ride-hailing

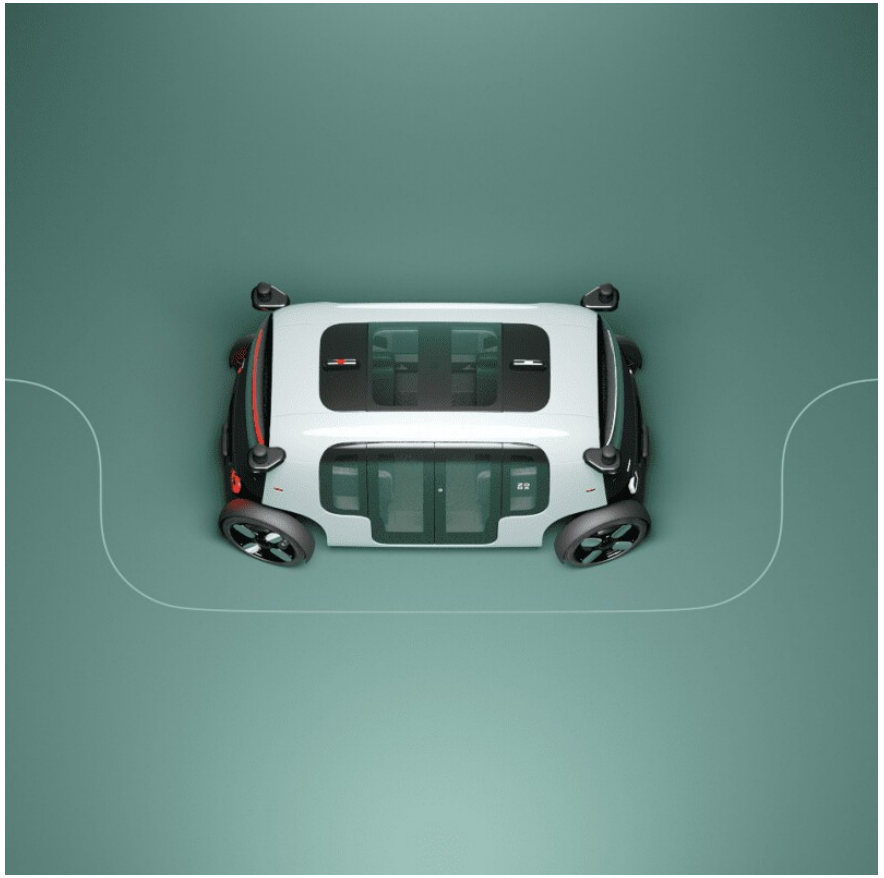

Image source: https://zoox.com/vehicle/

Waymo

Autonomous driving technology

- Autonomous driving technology development company
- Waymo Driver
- Waymo One: Autonomous drive-hailing service
- Waymo Via: Autonomous trucking and local delivery solutions

Image source: https://waymo.com/waymo-one/

Tesla Autopilot

Advanced driver-assistance system (ADAS)

- Advanced hardware capable of providing Autopilot features
- Full self-driving capabilities through software updates
- Features: Lane centering, traffic-aware cruise control, automatic lane changes, self parking, over the air updates etc.

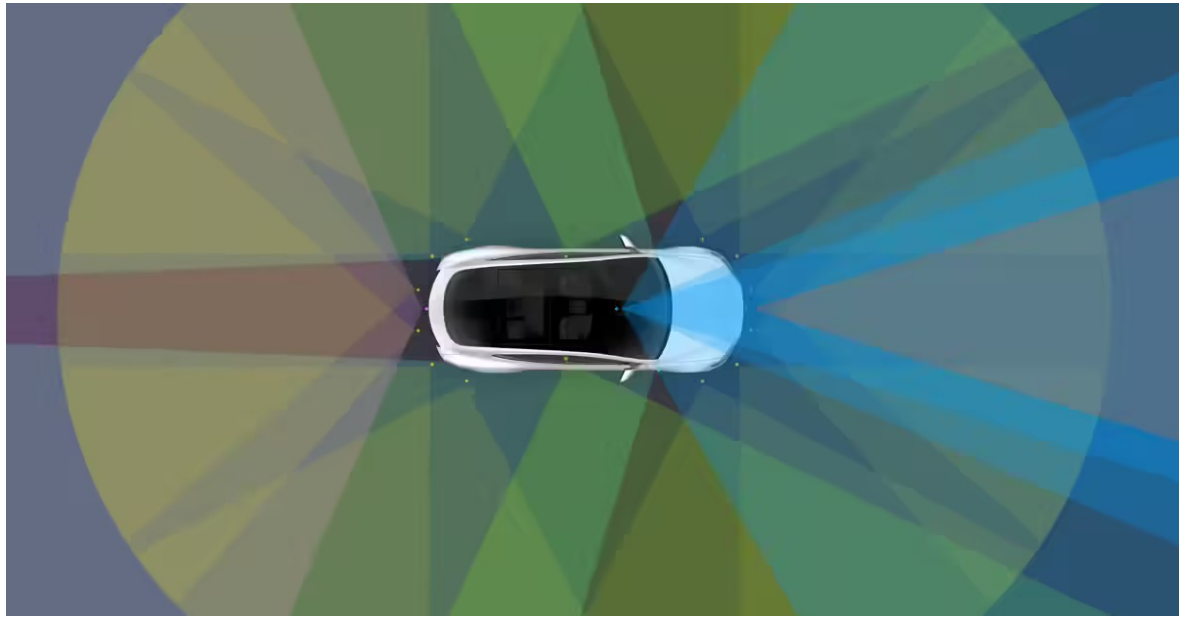

Image source: https://www.tesla.com/autopilot

openpilot project

Advanced driver-assistance system (ADAS)

Current automated driving system or ADAS is mostly proprietary in nature

Open source driver assistance system “openpilot” by comma.ai

- Modify existing car with increased computing power, enhanced sensors, and continuously updated driver assistance features
- Install openpilot on device called “comma three(latest)”

openpilot features

openpilot performs the functions of

- Adaptive Cruise Control (ACC)
- Automated Lane Centering (ALC)
- Forward Collision Warning (FCW)
- Lane Departure Warning (LDW)

While openpilot is engaged, a camera based Driver Monitoring (DM) feature alerts distracted and asleep drivers

Contribute to openpilot

Coordination of open source development activity: GitHub Discussions and Discord

Guide: How to contribute?

- Setup your development environment
- Join Discord
- Make sure you have a GitHub account
- Fork repositories on GitHub

Community guide will help you contribute to openpilot

Get help from other users/developers in case you have questions or need to share feedback via Discord

Report bugs as issues in GitHub than to post them on Discord

Add openpilot support for your car

Supported cars

Follow the guides: Brand and Model ports

Generic criteria: a car with adaptive cruise control and lane keep assist

In-Vehicle OS

What is in-vehicle OS?

A software platform for automotive applications

A bare metal or a virtual machine system: running customer applications as containers

The goal is to create an in-vehicle OS that incorporates

- modern ideas around workload orchestration,
- secure process isolation,
- consolidation of mixed-critical workloads,
- field-updatable, and
- continuously certified for functional safety

Challenges in automotive industry

Big auto manufacturers concern:

- The advanced innovation at big tech companies
- Best chips to innovate rapidly and effectively

Accumulate a massive amount of data associated with driver-less systems and process the data

Ensure the compatibility of all systems and software inside a smart car with other vehicles

Final cost of the car with ADAS and unmanned car

Decide how the safety of automated vehicles should be tested and by whom

Cyber breach activity

Opportunities in automotive industry

A way to compete tech-forward mindset

Create safer road for pedestrians, bicycles and two-wheelers

Driving automotive innovation through data

Quickly contextualize, correlate, and analyze hundreds of terabytes daily to extract value from data

Make the manufacturing process more efficient, consistent, and cost-effective

Improve driving experience with connected cars: consistent connections to data centers and public cloud providers

Open source projects

CentOS variant for Automotive

Automotive Grade Linux (AGL)

Connected Vehicle Systems Alliance (COVESA)

If you like remote control car then check this self driving car project: donkeycar

Standards and certifications

Functional safety - ISO 26262/ISO-PAS 8926 certification

Automotive Safety Integrity Level (ASIL)

Motor Industry Software Reliability Association (MISRA) guidelines for the creation and application of safe, reliable software within vehicles

ELISA (Enabling Linux in Safety Applications)

Special Interest Groups (SIGs)

CentOS Automotive SIG primary functions:

- Create open source software related to automotive
- Incorporate upstream projects related to automotive
- Build and curate a CentOS variant for Automotive as a proof of concept and reference design for an in-vehicle automotive OS

Automotive Grade Linux (AGL) goals:

- Build a single platform for the entire industry
- Develop 70 to 80% of the starting point for a production project
- Reduce fragmentation by combining the best of open source
- Develop an ecosystem of developers, suppliers, and expertise that all use a single platform

Events you can attend

AGL at Embedded World

Automotive Linux Summit

Consumer Electronic Show (CES)

References

- openpilot project
- comma.ai
- How can we make Linux functionally safe for automotive?
- CentOS variant for Automotive
- Automotive Grade Linux (AGL)
- Connected Vehicle Systems Alliance (COVESA) project

Thank You!