Efforts in Advanced R&D Fields

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Changes in mobility by CASE

Autonomous × Electric

Technology innovation × Social change

Connected Shared & Services

DENSO Crafting the Core
Overview of efforts in the CASE field

Future of mobility
- Lv.4 AD
- MaaS platform
  - Digital twin
  - Cyber-physical cooperation

AD/ADAS systems
- Active safety
  - AD/ADAS

Cockpit systems
- E-cockpit
- i-cabin

Energy management
- HEV/FCEV/BEV
  - Various modes of mobility

Connected  Autonomous  Shared & Services  Electric
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Connected Autonomous Shared & Services Electric
## Efforts to achieve automated driving systems

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<th>Active safety</th>
<th>ADAS/AD Lv.2/3</th>
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<td><strong>Passenger cars</strong></td>
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<td>Lv. 2/3 on limited highways Diffusion period: From 2020</td>
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<td>Fully automated valet parking Diffusion period: From 2020</td>
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<td>Autonomous emergency braking</td>
<td>Lv. 2/3 on general roads Diffusion period: From the first half of 2020s</td>
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<td>Lane departure prevention support</td>
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<td>Traffic-sign recognition</td>
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<td><strong>Shared &amp; services (taxis/small buses)</strong></td>
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<td>Lv. 4 in limited areas</td>
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**Introduction period:**
- **Passenger cars**: From 2018
- **Commercial vehicles (trucks)**: From 2020
- **Shared & services (taxis/small buses)**: From 2020s
Example of cooperation with partners

- Established J-QuAD DYNAMICS, a joint venture (April 2019)
  Development of integrated control software for automated driving

- Invested in the Uber Advanced Technologies Group (April 2019)
  Collaboration to develop and deploy hardware for automated driving and ride-sharing services

Establishment of a joint venture to develop integrated ECU software

- Joint venture to develop integrated ECU software
- Commission development of integrated ECU software
- Supply integrated ECU software
- Sensor
- Brake
- Steering wheel
- System specifications (e.g., automated driving)
- Level 4 in limited areas, etc.
- Control software

The joint venture will help bring about automated driving that ensures safe and secure travel for everyone.
Efforts to achieve the MaaS platform

Achieve mobility services by creating a digital replica of a physical entity in cyberspace (digital twin)

Example of cyber mobi-Crews

Example of physical Mobility IoT Core
Example of a physical solution – Mobility IoT Core –

In-vehicle edge computer to achieve the MaaS platform

Incorporating a communication function, processor, and server function

Collect various kinds of mobility data
  Process data as much as possible on the edge (vehicle) side instead of transmitting large amounts of unprocessed data
  Process data before transmission to facilitate handling on the cloud side

Transmit commands from the cloud to the vehicle

Give the processing capability to the edge side so that services can be maintained even if communication is interrupted temporarily
Example of a cyber solution – mobi-Crews –

Increase efficiency of fleet management by utilizing the MaaS platform to support safe driving

Communication-enabled drive recorder

In-vehicle terminal
- Telematics terminal
- Communication-enabled drive recorder

Vehicle position information
- Videos of dangerous driving, etc.

Manager of company-owned vehicles

Manager of company-owned vehicles

1. Near-miss due to sudden braking
2. The image is sent to the manager in real time.
3. The driver’s driving status and driving assessment results can be checked.
4. The data can be used to give guidance on safe driving.

Manager of company-owned vehicles

Near-miss

Near-miss

I will focus on safety.

Good work! Please avoid speeding

Work management

Vehicle management
- Maintenance management based on mileage

Reservation for each vehicle
- Automatic creation of an operation management record

Operation results
- Notification of arrival at the registered point by email

Vehicle management
- Dynamic indication on the map
- Automatic creation of daily/monthly driving report

Eco-friendliness & safety
- Safe driving support
- Receipt of videos
- Driving analysis by situation

Creation of driving assessment based on fuel economy

Optional
- NFC reader*
- Second camera
Agile development – Strengthening profitability to support future growth –

- Define the requirements and fix the specifications at the beginning
- Based on the assumption that the plan is followed
- Attach importance to documents (deliverables)
- Create working software in the final stage

- Prioritize the requirements depending on the level of importance in business, and develop necessary functions in stages
- Promote communication and dialog
- Place importance on software (code) that works properly
Development of innovative technologies to achieve CASE

Take on challenges to achieve fundamental innovation in materials, semiconductors, human characteristics, and AI
Satellite R&D activities – Taking on challenges to create new value –

Utilize the best brains in the world (industry-government-academia cooperation) +
Demonstrate in optimal locations by utilizing regional characteristics

Promote hypothesis demonstration-type agile development at the innovation epicenters around the world
To achieve sustainable mobility for the next generation