Major technical issues of Future Vehicle

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- Understanding of Auto business
- Recent hot news in the Auto Industries
- Introduction of Major researches at ACE Lab
- What is the most important technology for future car
- Summary
Understanding of Automotive Business

Regulations

- Environment: CO, HC, NO\textsubscript{X}
- Energy: CO\textsubscript{2} (Fuel efficiency)
- Safety: LKA, LDW, FCW, BUA, BSD, AEB, },
What is the Future vehicle?

Future vehicle

Emission and Energy($\text{CO}_2$) Regulations create Green Car

Safety Regulations create Smart Car
Emission and CO$_2$ Regulations

\[ \downarrow \]

Green Car
(Clean Diesel, HEV, PHEV, EV)

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Emission regulation of Diesel Engine

<table>
<thead>
<tr>
<th>NO$_x$ [g/km]</th>
<th>PM [g/km]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>0.025</td>
</tr>
<tr>
<td>0.18</td>
<td>0.005</td>
</tr>
<tr>
<td>0.08</td>
<td>0.005</td>
</tr>
</tbody>
</table>

EURO-4(2005)
EURO-5(2009)
EURO-6(2014)
SCR for Passenger cars

- MY2014 VW Passat (35 mpg)
  - Achieving Bin4 or better with urea SCR
  - Rapid warm-up strategy with low engine-out hydrocarbons
Business update of Tesla

- 10,000 sold in the 1st quarter of 2015 → 50% ↑ compared to the 1st quarter of 2014
- Model 3 introduced the 1st quarter of 2016 → 370,000 will be delivered in 2017+
- 500,000 Production plan of 2020 → exceed Volvo
- Autopilot will be introduced in 2016(?)
Safety Regulations

→

Autonomous car (Smart car)

Background

- Worldwide traffic accidents
  - Distracted or inattentive driving → 90 percent of accidents

Death of 1.3 Million people

Deaths for road traffic accidents

Causes of road accidents

1) “WHO Disease and injury country estimates”. World Health Organization. 2004
Recent hot news in the Auto Industries
Introduction of Major researches by ACE Lab

Development of Diesel EMS for Post EURO6
Diesel EMS for Post EURO 6 Regulation

**Fuel control**
- Common-rail
- HP-pump
- LP-pump
- Fuel filter
- Fuel tank

**Int/Exh control**
- Int/Exh control
- Turbo-charger
- LP-EGR valve
- EGR valve
- Intercooler
- HP-EGR valve
- HP-EGR cooler
- LP-EGR cooler
- Dosing injector

**After treatment**
- DPF
- SCR/LNT

WLTC: Worldwide Harmonized Light-duty Test Cycle
RDE-LDV: Real Driving Emissions-Light Duty Vehicles

EMS Development project for Clean Diesel

Vehicle configuration
- Engine control system and monitoring system

Monitoring system of engine and driving status
Development of Autonomous car A1

Autonomous Vehicle A1 - 1st Generation

Laser scanner: 장애물, 도로경계
DGPS: 차량위치
Camera: 차선, 횡단보도
Autonomous Vehicle A1 - 1st Generation

Camera
User Interface
ECUs

DGPS Receiver
ECUs

A1 and Stanley

A1 - Hanyang University
Stanley - Stanford University
Autonomous vehicle A1 - 2nd Generation

Distributed ECUs for Autonomous Driving

Design of Distributed control system

- Task oriented SW architecture in A1
What is the most important technology for Future car?
Major challenging works

- Continuous adaptation
- Cybersecurity
- Core sensors
- 
- Reliable SW and Contents

Future vehicle will be led by Electronics, IT & SW
Mathworks
A good platform to develop all control algorithms
For Future vehicle

Thank you for your attention