SIP-adus: Cross-Ministerial Strategic Innovation Promotion Program
Innovation of Automated Driving for Universal Services

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Technologies for Automated Driving Systems

Vehicle

- **Recognition**
  - Map, ITS info., Sensor
- **Judgement**
  - AI
- **Operation**
  - Actuator

HMI

- Human Machine Interface
- Cooperation w/Human

Important Technologies
- Self-position estimation
- Neighboring environmental recognition

Dynamic Map

Onboard Sensors

- GNSS
- Laser Scanner (LiDAR)
- Camera
- Radar

High Definition 3D Map

ITS Predictive Information

Basic Tech.

- Security, Simulation, Database, etc.

SIP-adus focus on R&D in Cooperative area with Industry, Academia and Government

In red: Area of Cooperation ⇒ Main Area of SIP-adus
Objectives of Field Operational Tests

Verification of research results in 5 integrated themes
- Dynamic Map
- Human Machine Interface (HMI)
- Cyber Security
- Pedestrian Accident Reduction
- Next Generation Transport

International cooperation sharing the test fields and the data sets
- International participants signed up (OEMs, suppliers and research institutes)
- Concrete evidence acquired through the tests on the common grounds
- In-depth discussions on the specific research topics
- Identification of shared challenges and direction to overcome them

Business model investigation
Field Operational Tests: Test Sites

Expressway
300 km stretch in Tokyo Area
  • Joban expressway
  • Tokyo Metropolitan expressway
  • Tomei expressway
  • Shin-Tomei expressway

Test facility
Japan Automobile Research Institute

Arterial roads
Tokyo waterfront city area
Field Operational Tests: Participants

Alphabetical order
Vehicle Position Detection using Dynamic Map

Sensed Data

Compare to estimate the position

High Definition 3D Map

GNSS

Laser Scanner (LiDAR)

Radar

Camera

Traffic Signs

Carriageway

Carriageway Line

Road Shoulder

Estimate the position of the vehicle
Evaluation of 3D Map Data

Prototype 3D Map
- Delivered to 19 participants
  - October 2017

Evaluation
- Basic data elements
- Optional data elements
- Update frequency

Consensus building

(3D map data)
...living driving environment...
Electronic Toll Collection and Connected Services

**Equipment**

- **Roadside**
  - DSRC Unit
  - Toll Collection

- **On-board**
  - Navigation
  - Dynamic Route Guidance
  - Traffic Information
  - Safety Assistance

3,600 as of Oct. 2016

2.42 million as of Jan. 2018

**Basic Services**

- **Toll Collection**
- **Safety Assistance**
- **Traffic Information**
- **Dynamic Route Guidance**

Nationwide operation since 2011.

Source: Ministry of Land Infrastructure, Transport and Tourism
Traffic Signal Prediction Systems (TSPS)

Roadside Beacon

Traffic Management Center

Green Signal Timing Advisory
Timing of green light to move.

Red Signal Timing Advisory
Timing to decelerate to stop at red signal.

Speed Harmonization
Speed suggestion to pass intersections without stopping

Source: National Police Agency
### Right Turn Collision Warning

<table>
<thead>
<tr>
<th>Display</th>
<th>Sound</th>
<th>Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Clear</td>
</tr>
<tr>
<td>B</td>
<td>-</td>
<td>In coming vehicle/s detected</td>
</tr>
<tr>
<td>C</td>
<td>beep</td>
<td>Turning against in coming vehicle/s</td>
</tr>
</tbody>
</table>

Source: National Police Agency
Dynamic Map Evaluation with Connected Features

Signal Phase and Timing

Probe data

DSRC
760 MHz (DSSS)
Infrared (TSPS)

Cellular

DSRC
5.8 GHz (ETC2.0)

Traffic Regulations
Devices to interface participants' test vehicles with those data are provided.
**Objectives:** transition from the 1st phase to the 2nd phase
1) Extension of operational domain from the highways to the arterial and general public roads
2) More focus on mobility services including public transportation and logistic operations
3) Pursuit of societal benefits for safety, efficiency, inclusive society and enhanced economy

**Deployment Goals:**
1) Tokyo Olympic and Paralympic Games
2) Public transportation by local government
3) Mobility service businesses by private sector

**Research Topics:**
1) Validation of integrated automated driving systems through field operations
2) Foundation for roadworthiness testing: data collection, modeling and simulation
3) Quantitative impact assessment to foster social acceptance
4) International collaboration for harmonization
“The Charter for improvement of legal system and driving environment for automated driving systems”

Collectively attainable level of safety

- Human intervention
- Restriction domain of operating
- Automated vehicle technologies
- Infrastructure applicable to both human drivers and automated driving

Advancement of technologies

Source: National Strategy Office of Information and Communications Technology
Vehicle safety regulations and conformance testing for type approval
- Safety guidelines for automated driving (by summer 2018)
- Vehicle safety regulations for automated driving vehicles

Road traffic rules
- Revision of road traffic rules in line with technology development and international discussion
- Necessary measures for automated driving systems to comply with the traffic rules
- Unmanned operation of automated vehicles with remote monitoring
- Rules for platoon operation of automated vehicles

Liability
- Application of Japanese mandatory automobile liability insurance for immediate relief of victims and their families
- Criminal responsibility based on clearly defined responsibilities of diverse entities involved
- Installation of event data recorder on-board the vehicle and requirements of recorded data specifications and their submission

Regulations for public transportation and freight operators

Source: National Strategy Office of Information and Communications Technology
What is automated driving for?

Societal benefits of deployment for mobility to sustain daily life and vitalization of economic activities.

Achieved only if integrated with social innovations.
Ageing and Declining Population in Japan

Population in 2050 compared with that of 2010

Projected population decrease 2010 to 2050

Source: Ministry of Land Infrastructure, Transport and Tourism
"Grand Design of National Spatial Development"

Source: ITS Japan based on 'Grand Design of National Spatial Development towards 2050'
People Mobility

Local community

Service Hub

Goods Delivery

Photo: Ministry of Land Infrastructure, Transport and Tourism
Vision: Integrated Mobility for Inclusive Society

Mobility services for ageing population and their products

Opportunities for small scale farmers or traditional craftsmen/women

Consumers keen on specialized products

Residential and visitors

Diversity in workstyle satellite office and migration of young generation

Better living environment

Source: ITS Japan
Sustainable Economic Development

Strategic integration of economic activities with networked transportation

**Super Mega Region:**
- highly concentrated mega-cities connected by high speed trains

**Nationwide integration:**
- vitalization of regional economies

Source: Grand Design of National Spatial Development towards 2050
FOT: Truck Platooning

Fully automated platoon
(Unopened section of highway, 2012)

CACC platoon
(Mixed traffic on highway, January 2018)

Photo: Japan Automobile Research Institute

Photo: Toyota Tsusho Corporation
Vision: Integrated Freight Operations

Connected and Automated Driving for LEAN, AGILE and RESILIENT operation

Source: ITS Japan
Cross-Ministerial Strategic Innovation Promotion program
Innovation of Automated Driving for Universal Services

“SIP- adus”

- Mobility Bringing Everyone a Smile -

Inclusive society, where diverse people in diverse communities actively participate in generating values, will enhance both wellness of individuals and economic development. Automated driving technologies integrated with social innovations should provide everyone with mobility to fully exercise his or her capacity, enabling sustainable development of the society.
5th SIP-adus Workshop

Date: November 13 – 15, 2018
Venue: Tokyo International Exchange Center
Topics:
1. Regional Activities and Field Operational Tests
2. Report Session from SIP-adus Activities
3. Dynamic Map
4. Connected Vehicles
5. Human Factors
6. Impact Assessment
7. Security
8. Next Generation Transport