SIP Automated driving systems
— Mobility bringing everyone a smile —

July 13, 2017
Sub Program Director of SIP-adus
Yoichi SUGIMOTO
Outline of SIP

- **Intensive R&D program**
  -✓ promote 5-years R&D (FY2014 - FY2018)
  -✓ enhancing **cross-ministerial cooperation**

- **11 research themes**
  From societal issues such as Energy, Next-Generation Infrastructures and Local Resources, including R&D for AD

- **Leadership and total Budget**
  CSTI appointed Program Directors and allocates the budget for each research theme.
  
  *\50bil in total per year (65% for SIP 11 themes, 35% for medical R&D)

  adus: Automated driving systems for universal service
1. Ensuring safety and traffic jam reduction on the road
2. Realization and spread of Automated Driving System
3. Realization of advanced next generation public bus service for vulnerable people.

**Goal & Exit Strategy**

- Realization of Level 2 on highway by 2020
- Prioritization for next step:
  - Level 2 on regular road
Technologies for Automated driving systems

Vehicle
- Recognition: Sensor, Map, ITS info.
- Judgment: Artificial intelligence
- Operation: Actuator

HMI
- HMI: Human Machine Interface
- Cooperation with Human

Dynamic Map
- A highly self-position estimation
- Neighboring environmental cognition

High-definition digital map
- ITS Anticipative Information

Onboard sensor
- GSP
- Camera
- Radar

In red: Area of Cooperation ⇒ Main Area of SIP

Basic Tech.
- Security, Simulation, Database, etc.

SIP focus on the R&D in Cooperative area with Industry, Academia and Government
Use Dynamic Map as an advanced traffic info. database for all vehicles, not only as a precise map for automated driving vehicle.

Dynamic Info. (<1 sec)
- ITS anticipative Info.
  - V2V, V2P, traffic signal, etc.

Semi-dynamic Info. (<1 min)
- Accident, Congestion, Local weather etc.

Semi-static info. (<1 hour)
- Traffic control, Road construction, Weather forecast, etc.

Static Info. (<1 month)
- Road shape, Topological data, etc.

Dynamic Map Planning Co., Ltd. was established as a result of 2 years SIP activity.
Establishment of Dynamic map database

Dynamic map

【Required condition】
・Freshness of data/Easiness of data updating
・Scalability
・Low cost
・Security etc.

・Data commoditizing
・Utilization of probe data

Public–Private Partnership

Data construction/data collection

Dynamic data

Semi-dynamic common data

Semi-static common data

Digital road map

Lane level map

Point cloud data

Data marge/generation

Additional data

Common (Basic) data

Utilization of probe data

Probe data

・Automated driving systems
・Driver support systems

Camera・Laser etc. + Data communication module

Public–Private Partnership

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① インフラのクラウド化
② インフラのプライバシー
③ サービスのプライバシー
1) To investigate effects of system information on drivers’ behavior.
2) To investigate effects of driver state on his/her behavior in transition.
3) To investigate effective ways to functionalize AV to be communicative

**Driver state**
- Cognitively distracted
- Physically distracted
- Low arousal
- Lack of SA
- Out of position

**Readiness**
- Head orientation and visual performance
- Heart rate and blood pressure
- Body temperature
- Skin conductance
- EEG
- Posture and body

**Performance at the event**
- Longitudinal and lateral control of the vehicle
- Minimum distance and minimum TTC to the hazard
- Time spent to regain control

**Correlation**

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**Controlled**

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Pedestrian collision reduction

Vehicle-to-Pedestrian (V2P) Communication

700MHz Direct Wireless Communication
- 700MHz band communication
- High-precision positioning
- Danger identification and pedestrian safety support

Infrastructure radar with V2I communication

79GHz band radar from roadside of intersection
Next generation Transport

ART information center

Application Service Provider

Related Agency

Road maintenance company

Railway company

Bus service company

Application Examples
* Congestion Prediction
* Dynamic Connection Guidance
* Remote Diagnostics

Information Open Platform for ART related applications

Public Transportation Priority System

Operational Info. Delivery

Operational Info. Delivery

Information

Info. Center

SIP

Fixed route bus

On-time operation of ART

Congestion Required time Etc.

Priority order delivery

Open data

Safe, Friendly, Smooth Transportation

Seamless transits with minimum waiting time

Congestion Required time Etc.
Field Operational Test (FOT)

«Purpose»
1. To activate the R&D
2. To prove each elemental technology
3. To enhance international cooperation and harmonization
4. To Build Social acceptance

«Participant»
- OEM/Supplier
- University/Research organization
- Ministries, government officers
- Foreign OEM/supplier
- Journalist

«Period»
Autumn 2017 ~ beginning of 2019

«Main themes»
- Dynamic map
- Cross subject for each themes
- Next generation urban transportation
- Pedestrian accident reduction
- Social acceptability promotion event
- HMI
- Information security
Field Operational Test (FOT)

Utilize the part of the following expressway.
Total: app.300km.

Test facility
JARI* Test course; New test facility for ADS evaluation (Apr.17 open)

Arterial roads
Tokyo waterfront city area

(*JARI: Japan Automotive Research Institute)
Field Operational Test (FOT)

Dynamic Map (Example)

- To validate 3D high-resolution digital map data
- To validate data collection and distribution method
- To verify the utility of semi dynamic information

✓ The map data is provided by SIP-adus.

Semi dynamic map data utility
- Traffic control
- Congestion
- Construction
- Dropping etc.

Dynamic Map Center
- Public info.
- ITS info of Dynamic map

Map data
Spec. and Accuracy

GNSS
Lidar
Camera
Millimeter wave Radar

Data revision and distribution
Field Operational Test (FOT)

HMI (Example)
- To collect and analyze the driver state data
- To define driving readiness status and driver
- Verification of HMI methods and devices.

Cyber Security (Example)
- To validate the evaluation method
- Inspect defense functions of ADV

Layer 1: Communication of Out Car
Layer 2: E/E Architecture
Layer 3: In Car Bus Protocol
Layer 4: ECU Software Structure
Automobile Society

1886 BENZ Patent Motorwagen

(Toyota Automobile Museum)

1907 Piccadilly Circus, London

(Alpshima; sohske.cocolog-nifty.com)
A common base platform (map, rule etc.) is necessary for keeping safety and the social order.

⇒ Promoting harmonization and standardization
International Cooperation activities

- Experts assigned in Focused areas

1. Dynamic Map
2. Connected Vehicle
3. Human Factors
4. Impact Assessment
5. Next Generation Transport
6. Security

SIP-adus Workshop
Recognized as a specialized international conference on automated driving, participants from all over the world increased. Sharing latest information, building friendship among experts, were highly evaluated by the participants.

- **Organizer**: Cross-Ministerial Strategic Innovation Promotion Program, Council for Science, Technology and Innovation, Cabinet Office, Government of Japan
- **Date**: November 15-17, 2016
- **Venue**: Tokyo International Exchange Center
  [http://www.jasso.go.jp/tiec/index_e.html](http://www.jasso.go.jp/tiec/index_e.html)
- **Attendees**: 425 from 17 countries
- **Speakers**: 61 includes 34 speakers and moderators from overseas

Snapshot with speakers from overseas after Minister Tsuruho
Thank you for kind attention!