V2X communication for Cooperative Driving Automation

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1. SIP-adus Initiative

**ADS** (Automated Driving Systems)

Safe and secure mobility for all

- **Competition**
- **Cooperation**

**SIP**

- **FOTs** (Tokyo waterfront area etc.)
- **Technology**
  - Establishment of digital infrastructure
  - Unification of data format and interface
  - Safety assurance and cybersecurity etc.
- **Public acceptance**
- **International cooperation/Standardization**

SIP; Strategic Innovation Promotion Program
adus; Automated driving system for universal service
Current status and challenges of Cooperative Driving Automation (CDA)

◆ **Current status of ITS wireless communication in Japan**
  - ETC / ETC2.0 (DSRC): Toll collection and Expressway information since 2000
  - ITS Connect (DSRC): Support for safe driving at general road intersections since 2015

◆ **Challenges for realizing CDA**
  - Can ITS communication, which has already been put into practical use, be used for CDA?
  - What kind of communication method is needed in the era of automated driving?
  - TF on V2X communication for CDA has been established in SIP-adus since 2019

Started researching communication methods for CDA
3. Activities of TF on V2X Communication for CDA

◆ Activities of TF on V2X Communication for CDA

- Define CDA
- Develop CDA use cases based on the definition

- Define communication requirements based on use cases
- Examination of applicability of existing ITS communication

- Technology verification for Communication methods (frequency / bandwidth) for CDA
- Proposal of communication method and the roadmap
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Cooperative automated driving system definition

Cooperative automated driving system is that enables safer and smoother automated driving control based on the autonomous driving system, by obtaining the information not detected by the in-vehicle sensor, by providing the information possessed by the vehicles, and by communicating mutually by using V2I and V2V.

- Communication reliability cannot be guaranteed 100%
- Automated Driving control must be done by in-vehicle sensors
- Support on autonomous driving by communication
- Utilize communication to enable safer and smoother automated driving
5. V2X communication and Roadmap for CDA

Selected 25 feasible use cases

1. Obtaining the information not detected by the in-vehicle sensor (14)

2. Providing the information possessed by the vehicles (4)

3. Communicating mutually by using V2I and V2V (7)

Study communication method based on the use case

Communication requirements for CDA

Proposal for V2X communication method
5. V2X communication and Roadmap for CDA

Merging and lane change support

- Preliminary acceleration and deceleration support
- Main line gap aiming merge support
- Merging control by infrastructure
- Merging by negotiation between cars
- Negotiation between cars

Complexity of traffic environment

- Traffic flow sensing by spot
- Traffic flow sensing by area
- Traffic flow sensing by area

Difficulty of communication

- SIP FOT in Tokyo

Free flow

Penetration of CDA

2020

20XX
6. Next step

- Define CDA
- Develop CDA use cases based on the definition

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Phase 1
- Done

Phase 2
- FY2020

Phase 3
- FY2021
6. Next step

◆ Organization

Phase 1
- TF on V2X communication for CDA
- ITS-related ministries
- Academic experts
- Japan Automobile Manufacturers Association

Phase 2/Phase 3
- National Institute for Land and Infrastructure Management
- UTMS Society of Japan
- Japan Electronics and Information Technology Industries Association
- ITS Info-communications Forum
- Society Automotive Engineers of Japan
7. Summary

- Studying communication methods for CDA in SIP-adus
- Completed the development of use cases to be the basis for the next research
- Use cases opened to the public
- Started to define the communication requirements based on the use cases and the applicability to existing ITS communication.
- If it is not applicable to existing ITS wireless communication, a new communication method to be considered
- Provide the proposal of communication method for CDA and roadmap by the end of FY2021
Thank you