Roadside-assisted V2V messaging with 5G mobile edge computing

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Outline

1. Autonomous vehicles (Our activity)
2. Communication for Autonomous vehicles (Our research proposal)
Autonomous Vehicle
Mobile Unit for Smart Campus Transportation

• Ph.D Education Program
• Beyond road mobility
• Harmonization of human and mobility device in the life
• Focus on mobility service constricted upon autonomous driving but not autonomous driving it self
Next Generation Mobility Platform

- Validations, experiments, and demonstrations
- Of each GCL course students,
- On common mobility platform,

Social Innovation Projects in GCL

Medical care
Environment Sensing
Business model
regional Community
Big data
Control Systems
Augmented Reality
Smart City
Machine Learning

Collaboration of each project in the mobility platform
Field Test
System Configuration

Acceleration
Braking
Steering

Controller

Ethernet

CAN

Velodyne VLP-16

Stereo camera

Sensing
Detection

Localisation
Planning

3D map (Point Cloud & Vector data)

USB

Ethernet

System Configuration

Controller

Sensing
Detection

Localisation
Planning

3D map (Point Cloud & Vector data)
• Open-source software for urban autonomous driving
• Providing basic autonomous driving function based on ROS
• [https://github.com/CPFL/Autoware](https://github.com/CPFL/Autoware)
MUSCAT Workshop
MUSCAT Workshop
Cooperative Intelligent Transportation Systems

Cooperative Systems
Systems where multiple entities share information and tasks to achieve common objectives.

Intelligent Transportation Systems
Systems that realize safe, efficient and comfortable human mobility.

• **Cooperative Intelligent Transportation Systems**
  – Systems where multiple ITS Stations share information to achieve better road safety, traffic efficiency and comfort
V2V Messaging

• Standards
  – **EU**: Cooperative Awareness Message (CAM) - IEEE802.11p
  – **Japan**: Advance Safety Vehicle Message (ASV) – IEEE802.11p
  – **US**: Basic Safety Message (BSM) – 760Mhz

• Issues
  1. Mixed Environment
  2. Obstacles
  3. Wireless range
  4. Malicious message
Proxy CAM

- Object detection by the road side sensor
- Proxy message transmission on behalf of the object

Diagram:
- Database
  - Data
  - Data
  - Data
  - 3. Message information
- V2V message generation
  - CAM
  - BSM
  - ASV
- 2. Sensor data
- Obstacle
  - Roadside sensor
  - 1. detection
- Transmitter
  - 4. Proxy V2V message
Proxy CAM

Tomoya Kitazato, Manabu Tsukada, Hideya Ochiai, Hiroshi Esaki,
Proposed system

Conclusion

• Roadside-Assisted V2V Messaging
  – a real-time cyber-physical system that integrates sensing technology with V2V and V2I networks and combines ITS and cellular media with IPv6
  – a common solution for different standards in the EU, US, and Japan

• Future works
  – field operational tests
  – large-scale performance evaluation of the system using simulation
  – high technical compatibility needed to co-locate with 5G mobile edge stations
Thanks

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