Building Cooperative Automated Public Transportation System and HD map

New Mobility TF, ICT R&D Center
SK Telecom
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○ Other HD map projects in Korea
**Project Overview - Background**

- Autonomous driving for **Public Transportation**

<table>
<thead>
<tr>
<th>Private vehicles</th>
<th>Public Transportation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Something, Everywhere</td>
<td>Everything, Somewhere</td>
</tr>
<tr>
<td>Diversity in vehicle technology levels and road conditions</td>
<td>Homogeneous vehicles and restricted road conditions</td>
</tr>
<tr>
<td>Various requirements for infrastructure to deal with different types of vehicles</td>
<td>Fixed requirements for infrastructure, tightly coupled with the target vehicles</td>
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<tr>
<td>Individuals are responsible for maintenance and operation</td>
<td>TNC (Transportation and Network Company) is responsible for maintenance and operation</td>
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</tbody>
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-> *Autonomous driving will be commercialized sooner for public transportation.*
Project Overview – Target services

- 4 categories, 11 services

- Safety Services by Traffic Control Center
- Cooperative Autonomous Driving at Intersections
- Safety Services at Bus Stops
- Route Optimization Services
Project Overview - Organization

- Project of MOLIT  Ministry of Land, Infrastructure and Transport
- Period: 2018.5 ~ 2021.12
- Resource: $31M ($24M from gov)
- Organization

- KOTI (KORea Transport Institute)
- SNU (Seoul National University)
- SKT (SK Telecom)

Vehicle Platform
AD Algorithms
Object detections

Traffic Control Center
HD map
V2X infra

Services
Simulation
Validation

Service Area: SEJONG, the administrative capital

- Bus-only road, w/ existing C-ITS infra (5km)
- Normal road, w/ existing C-ITS infra (5km)
- Bus-only road, new infra to be installed (24km)
HD map service (1/3)

- Korean HD Map standard
  - Developed by ‘National Geographic Information Institute (NGII)’
  - Format: Shape (shp, shx, sbx, sbn, dbf, prj)
  - Data included: Lane, Stop, Link, Sign point, Signal point, Surface sign point, Surface sign line, Surface sign plan, No autonomous driving, etc
HD map service (2/3)

○ Korean HD Map standard – Issues
  • The standard does provide HD map features, but the focus is visualization
    — Not enough VOC from the users, such as OEM and tier-1
  • Missing concepts necessary for efficient processing in vehicle, such as
    — Tiling and versioning
    — Service interface
    — Efficient geometry encoding
    — Serialization framework
    — Attribute interoperability

• Solution – Two-phased database preparation

Existing HD map data (Shape) → NDS-convertible HD map (Shape) → Service-ready HD map (NDS)
- Adding concepts of lanegroups
- Transforming (some) point objects to polygons
  NDS compiler
  (covers Open Lane Model only for 2019)
HD map service (3/3)

- HD Map Update
  - Freshness is the key issue for usefulness of HD map
  - Crowdsourcing road data collection and updating in server is essential

Data Flow

Road Observation Data Creation
- Perception & Localization
- 3D Environment Modeling

Update Map Contents
- Aggregation & Align
- Verify, Change detection, Update

Deliver & Publish
- Data layers & API
- Visualization
Development - Architecture
Development - Visualization

HD map DB

Mobile client (in dev)
Conclusion

○ Issues
  • Steep learning curve – large specification, many levels of referencing, high complexity of SDK libraries, etc
  • Not enough sample data, especially for Open Lane Model
  • Map viewer missing for Open Lane Model
  • Lack of API-level interface definition and example use cases
  • SQLite is inadequate for providing services to multiple users

○ Future work
  • The first trial with a few basic scenarios will be conducted at the end of 2019
  • Full HD map services, including update by crowdsourcing, will be demonstrated in 2020
  • In 2021, optimization and standardization will be done
Other HD map projects in Korea

- New committee for standardization of HD map
  - OEMs (including Hyundai) and service companies (including all three MNOs and major OTTs) have made an MOU in 2019 to make a new Korean HD map standards
  - Adopting (and extending) existing standard is an option, too

- Seoul C-ITS project
  - C-ITS infra for Seoul, the capital of Korea, is in development by the consortium led by SK Telecom
  - The scope includes HD map, Map update by crowdsourcing, Traffic control system, V2X on 5G/Wave, etc

- Incheon Free Economic Zone (IFEZ)
  - Incheon, where Seoul-Incheon International Airport is, and SK telecom made an MOU to build HD map for the whole area of IFEZ (132.9km²)
  - 5G N/W and Dynamic Data Platform will enable real-time change detection of road data and road conditions