Introduction of SMART Highway Test Bed and Test Results

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Contents

- Overview of SMART Highway Project
- Best Practices of Developed Technologies
- Smart Highway Test Bed
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- Future Plan & Conclusion
OVERVIEW OF SMART HIGHWAY PROJECT
Background

2006.10. 29-vehicle crash at Seo-hae Grand Bridge - victims : 60 persons (Killed : 12 persons)

2011.12. 90-vehicle crash at Cheonan-Nonsan Expressway - victims : 30 persons

2010. 7. Bus fall-off accident at Incheon Grand Bridge - victims : 24 persons (Killed : 12 persons)
✓ One of VC-10, national R&D project by MOLIT
✓ SMART Highway project to realize “Intelligent Highway”
Organization

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BEST PRACTICES OF DEVELOPED TECHNOLOGIES
SMART IDS (Automatic Detecting System)

- Radar H/W: frequency (34.5GHz)
  - detect range: max. 1km, 5 lane road
- Data analysis S/W:
  - real-time data analysis
  - decision of incident situation

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Operation SW (Traffic center)

Field test & verification

In Vehicle

Camera View

Smart Device (WAVE)

Traffic Info

Radar View

Seohae Grand Bridge
SMART-I (Automatic Detecting System)
- Array camera
- Tracking CCTV
- Radar

Array camera  Road radar

ARRAY CAMERA
Incident Detection

AUTO TRACKING CCTV

ARRAY CAMERA

AUTO TRACKING CCTV
INCIDENT

RA RADAR DETECTOR
Keeping Performance (Night and Bad Weather)

Radar detector

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Trial Product

Array Camera
※ 7 cameras inside
- detect unexpected event
  - fallen object
  - car driving wrong way
  - car in sudden stop
- coverage: 1km

Auto-tracking CCTV

Field test & verification
SMART Tolling (Non-stop, multi-lane tolling system)

- Wireless communication (DSRC, WAVE)
  - DSRC (Dedicated Short Range Communication)
  - WAVE (Wireless Access in Vehicular Environment)
- Any media (smart phone, wave terminal)

Test & Verification on highway

- WAVE Tolling terminal
- Smart phone tolling App.
Seamless communication through the V2V & V2I
Providing vehicle safety services

WAVE Communication (V2I, V2V)
Various wireless communication
WAVE, DSRC, Wi-Fi

**WAVE** (Wireless Access in Vehicular Environment)
Wireless communication technology designed to be suitable for vehicular environments

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SMART HIGHWAY TEST BED
Test Bed

Description

- Verification of SMART Highway development technologies on the actual road
- Collection and provision of traffic information in real driving environment

Construction background

- Gyeongbu Expressway
  - Seoul TG-Suwon IC (length: 11km)

Construction Section

- Chronically congested sections
- Easy to promote in Korea and abroad
  (Technical demonstration site for World Road Congress SEOUL 2015)

Selection background

- Construction: 2013. 12 ~ 2014. 6
- Operation: 2014. 7 ~

Realizing early commercialization through real road verification of SMART Highway development technologies
Map of SMART Highway Test Bed
Demonstration course and scenario

- Briefing of SMART Highway
- SMART-Tolling
- SMART-I, Radar
- WAVE Communication Explanation
Safety Services

**Work Zone Warning**
After seeing the warning, the driver drives slowly until he or she passed the road work vehicle.

**Obstacle Warning**
This is how V2I vehicle-to-communication technology prevent accidents.

**Emergency Vehicle Warning**
When the driver receives this notification he or she can slow down and change lanes to avoid the emergency vehicle.

**SOS Service**
**In Vehicle Signage**
Seoul TG-Shingal JC normal traffic 4 min
This allows the driver to drive smarter on the highway.

**Chain Accident Prevention**
Center Operation

Manage & Monitor System
Collect & Analyze data
Provide traffic safety
Information to vehicles through smart terminals

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TEST RESULTS
Test Results

- **WAVE Communication Range**
  - Range : V2I : Max. 1.4km, I2V : Max. 1.4Km
  - Avg. Latency (Goal : within 100ms)

<table>
<thead>
<tr>
<th>Service</th>
<th>Avg. Latency</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSM(Basic Safety Message)</td>
<td>1.65ms</td>
</tr>
<tr>
<td>Chain-Collision Prevention</td>
<td>1.50ms</td>
</tr>
<tr>
<td>Emergency Situation Notification</td>
<td>2.06ms</td>
</tr>
</tbody>
</table>

- **PER(Packet Error Rate) : 7.33% (Goal : within 10%)**

- **SMART-IDS(Road Radar) : accuracy 96.6%, detecting range 1km**

- **WAVE Tolling : accuracy 99.05%**
Test Results

- Communication Performance Degradation between RSE4 & RSE5
- Speculating Geological Factor & Antenna Beam Pattern

Modification Plan
- Modification of Antenna Beam Pattern
- Adjusting antenna angle, after modifying antenna beam pattern
FUTURE PLAN AND CONCLUSION
Future Plan & Conclusion

- Advancement of V2X(V2I, V2V) Communication Technologies
- Extension of SMART Highway Test Bed
  - Youngdong Expressway Singal JC ~ Hobup JC : 35km
    - Tunnel(2EA), IC(4EA), JCT(2EA)
- Application of SMART Highway technologies on the entire expressway throughout the verification on the test bed
25th World Road Congress (SEOUL)

- Date/venue: 2-6 November 2015/COEX in SEOUL
- Theme: Roads and Mobility – Creating New Value from Transport
- Expected Number of Participants
  - About 3,500 experts from over 120 countries
  - Over 1,200 government officials
  - Ministers/Vice-ministers from over 50 countries