5G promotes the intelligence connected vehicles

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ICT enabled automated driving

• One of the important features of a smart car is automated driving. As far as the current industry status of vehicle research and application is concerned, there are several kinds of ways for ICT applied to the driving system.

• (1) “laser radar + sensors” mode. It is a kind of individual behavior, lacking overall coordination behavior of “automobile society”.

• (2) “Visual identification + sensors” mode. It’s easily affected by the environment, also the same as that of individual behavior.

• (3) Vehicle to Everything (V2X) communication mode. Vehicles can “talk” to every object all around, this way can easily let the motor vehicles follow the behavior criterion of “motor vehicle society”.

• (4) “High precision positioning + high precision map” mode. Also the same as that of individual behavior.

• (5) “Big Data + Edge cloud computing + AI” to remotely control.

• Broadly speaking, all of the above technology and technical means can be thought as some kind of Intelligence mode, so they can only achieve driving assistance / partial automation. Only integrating all these technologies can probably realize the full automated driving.
Evolving network technology promotes ITS upgrading

3G/4G
- Route planning
- Navigation, remote diagnosis
- Multimedia downloads
- 3G/4G Voice and data transmission
- 100ms delay
- 20-100Mbps transmission rate

4.5G
- V2I, V2V, V2P to assist in driving
- Traffic safety and traffic efficiency
- Customized communication technology for V2X requirements
  - DSRC/LTE-V2X Voice and data transmission
  - <20ms delay
  - >300Mbps transmission rate

5G
- Cooperation of vehicle, road and environment
- Safe intelligent traffic control
- Fully automated driving, e.g. Platoons
  - 5G V2X
  - <1ms delay
  - >10Gbps transmission rate
5G network provides guarantee for the realization of services and automated driving

**Low Delay**
- *1ms, Edge computing*
- Car-cloud interaction
- Emergency brake
- Safety response

**High Broadband**
- **Gbps level, 10x~100x**
- Real time downloading HD map
- Transmission HDV information
- HD video broadcast

**Massive Connection**
- **Nearly 100% reliability / availability**
- Seamless network coverage
- Network slicing
- Differentiated QoS

**High Reliability**
- **Multi-nodes and wide coverage, 10x~100x**
- Support multi-lane, congestion scenarios
- Support massive V2X connections,

**eMBB**: artificial intelligence + virtual reality + HD video

**eMTC**: V2X+ enhanced ITS

**uRLLC**: automated driving

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*ITU*
ICV Collaborative Innovation Labs

- 5G/V2X research and testing key technologies, standards development and validation
- Carry out ICV demonstration and test environment
- Research and development of innovative products for automated driving
- Provide best end to end solutions
- Establishing a win-win environment for development

China Unicom Group
CUSC
Smart Vehicle (Research institute)
ICV and ITS
ICV Security
Other labs
CU NTRI for network
CU SRI for Platform
CR RI for Device

@2017/10/19, Shanghai
Connected vehicles based on heterogeneous cooperative network
CU Cloud services to support more intelligent travel scenarios

- Emergency brake safety control
- Autonomous evading
- Collaborative path planning
- Intelligent Automatic Driving
- Data Sharing
- Parking Management
- Real-time speeding monitoring
- Collaborative Awareness
- Inter-car Network
- Wide Coverage High-speed hotspots
- Parking Management

Intelligent coordination travel cloud platform
Our practice - Key Technologies and Standard Research

- **C-V2X**
  - 5GAA Gold Member
  - LTE-V Frequency Test Project
  - Core member In China C-V2X work group
- **Pre-5G V2X**
  - Pr5 interface V2V/V2I - Direct connection scheme
  - eNode B Uu V2V/V2I - Cellular connection scheme
  - MEC and Multi network Cooperation
- **5G – V2X**
  - leading companies for the Phase2 eV2X WI in 3GPP
  - Scenarios: Platooning, Extended Sensors, Advanced Driving, Remote Driving
Practice 1 - Application Test of V2X Under Multi Protocol Condition

- **Vehicular multimode OBU**
- **Flexible network architecture**
- **LTE / LTE-V / DSRC Coordination**
- **Support Multi scene of V2V / V2P / V2I / V2N**

The national ICV demonstration area @2017.6
Practice 2 - Collaborative Test of V2X and Autonomous Driving

- Automatic start shift
- Automatic straight line travel
- Automatic perception of traffic lights
- Automatic curve driving
- Automatic following / emergency braking
- Automatic construction section warning

V2X provides more effective information to the vehicle intelligent brain.
Practice 3 - More V2X Landing Scenes And Products

- Based on V2V
  - Forward collision warning
- Based on V2V
  - Lane change collision warning
- Based on V2P
  - Emergency brake warning
- Based on V2V
  - Emergency vehicle priority
- Based on V2I
  - Traffic state display
- Based on V2I
  - Road information tips

The 4th China International Forum on intelligent vehicles in Chengdu V2X Open experience day @2017.9
Full service supplier

Provide the best Network service

FORTUNE 500  Forbes 185

Focus on Industry innovation

4,000 million terminal users

China United Network Communications Group Co., Ltd.
A wholly-owned subsidiary of China Unicom Group, innovation pilot enterprise; Founded in August 2015, 6 regional branches, 2 research and development centers, more than 200 employees.

- Service for autonomous driving and intelligent transportation
- Integration of communication and application scenarios
- Achieve continuous and efficient safe operation
- Provide customers and users with quality service
Rich Operation Experiences of Professional Services

- 10 Years
- 63 OEMs

- 3 million TSP customers
- 10 million Communication customers

Integrated communication services

Call center services

Platform integration & operation services

Business operation services

Online store services

Service revenue

Communication revenue

28%

72%

• 10 Yrs
• 63 OEMs

• 3 million TSP customers
• 10 million Communication customers

Integrated communication services

Call center services

Platform integration & operation services

Business operation services

Online store services

Service revenue

Communication revenue

28%

72%
China Unicom Mixed Ownership Reform

The only pilot State-owned enterprise to adopt entire-group based mixed-ownership reform.

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<th>Large Internet Corporation</th>
<th>Tencent</th>
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<th>百度</th>
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All the business from strategic investors is highly related to the main business of China Unicom, China Unicom will cooperate in the fields of cloud computing, IoT, big data and industrial Internet, to promote the innovation of resources and service advantages.
To be the Enabler of Wonderful Carlife

Thank you for your attention.

China Unicom Smart Connection Technology Co., Ltd.