Positioning & Connectivity for Mobility

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STMicroelectronics

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9,800,000,000
Mobility is a major societal challenge

Fatalities and injuries, traffic congestion and rising emissions
Car connectivity is a key mobility enabler

Connectivity is revolutionizing vehicles

Cloud based services benefit occupants and manufacturers by enabling over-the-air software upgrades and predictive maintenance

In-car connectivity, Vehicle-to-Vehicle (V2V) and Vehicle-to-Everything (V2X) communications all need to be secured and linked with a telematics gateway
Positioning is a mobility enabler too!

Combining positioning and connectivity has advanced mobility

Applications enabled by Positioning & Connectivity

ST has constantly been at the forefront with GPS, Galileo, Glonass / multi-constellation receivers enabling
• Navigation
• Telematics and eCall solutions
• Eco-driving for Fuel Consumption reduction
• Tachographes, Tolling, Insurance boxes
Automotive sensors and data enabled services

New sensors, more advanced sensors, more cost effective sensors

Vehicle sensors for assisted driving
- High-definition cameras
- Long-range Radar
- Lidar
- Gyroscope & accelerometers

What latest semiconductor sensor technology nodes bring
- Higher accuracy in sensing
- New sensor type capability at acceptable cost
- Higher performance

ADAS Market Acceleration

<table>
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<th>Year</th>
<th>2018</th>
<th>2020</th>
<th>2022</th>
<th>2024</th>
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<td>37%</td>
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Diverse  Advanced  Pervasive

But today these only provide “relative” positioning

Absolute high-accuracy Timestamping and Geotagging

Source: Automotive news, McKinsey, Strategy Analytics, Hexagon AB, ST Internal
Why High-Accuracy is not enough

Higher integrity requirements across safety-critical applications

- Semi- and Autonomous driving safety-related applications requirements increase
  - Higher safety levels
  - Added redundancy
  - More Robustness and higher integrity
  - Security

- TeseoAPP (ASIL Precise Positioning) GNSS receiver as a new sensor based on ISO26262 safety concept with unique Absolute and Safe positioning information to address Integrity, Continuity, Robustness, Accuracy and Availability
V2X Connectivity for Safety

Vehicle-to-Everything (V2X) enables reliable sensing in all conditions

Certain conditions render certain sensors ineffective

V2X Key Benefits

- Significantly improves overall road safety
- Improves road mobility
- Effectively coordinates vehicles and self-driving cars

Source: Leaders Connected Noah 18, Tel Aviv
Precise Positioning and V2X Connectivity

V2X as safe communication channel to share Precise Positioning information

- GNSS Precise Positioning enables an additional **redundancy layer** that **complements** with other exteroceptive sensors, which might not be available due to environmental conditions.

- Absolute positioning with **higher integrity and protection levels** augments the reliability of the 3D environment model.

- Surrounding vehicles can deliver **dynamic and real-time high-accuracy PVT information** to enhance the prediction of their motion behavior.
Positioning and connectivity
past, present and future mobility enablers

Positioning

GPS

GNSS + Dead Reckoning

Safe, Precise Positioning & Timing

Safe, Secure Precise Positioning & Timing

Road navigation

Telematics services & Connected Nav

Advanced Drivers Assistance Systems

Semi- & Autonomous Driving

Connectivity

Cellular Connectivity

Connectivity & Correction Services

V2X Connectivity
STMicroelectronics in Automotive

At a Glance

- Over 30 years of Automotive Experience
- $2.22B Automotive Revenue in 2018
- Committed player in the automotive connectivity, positioning and ADAS sensor markets
- ST at the forefront of mobility evolution