Encontro com a Ciência e Tecnologia em Portugal 2016

Development & Innovation Roadmap for Automated Vehicles - GMV's vision

WHO WE ARE

A GLOBAL TECHNOLOGY GROUP

Multinational technology group

Headquarters in Spain (Madrid)

Over 1,200 employees

Aeronautics, Space, Defense, Security, Transportation, Healthcare, Banking & finances, and ICT industries.

Private capital

Subsidiaries in 10 countries

Founded in **1984**

Roots tied to the Space and Defence industry

Engineering, development and integration of systems, software, hardware, specialized products and services

WHAT WE DO

INDUSTRIES

- Aeronautics
- Space
- Defense & Security
- Cybersecurity
- Healthcare
- Transport
- Telecommunication
- Public Sector and Corporate ICT
- Banking & Finances

WHO WE ARE

INTERNATIONAL TECHNOLOGY LEADERSHIP

#1 Worldwide Satellite Control Center provider to commercial telecom operators (+300 Satellite missions worldwide)

First ever **worldwide** intraoperative radiotherapy planning system

Responsible of safety critical systems of European GNSS systems (EGNOS and Galileo)

Leader of Intelligent Transportation Systems for the **public transport sector** (+100 cities in Europe, Asia and America)

GMV's ***checker ATM security*** is the **worldwide leader** as multivendor cyber security protection for **ATMs**

GMV AS AN AUTOMOTIVE TIER-2 SUPPLIER

2007: Joint Venture with Tier-1 to develop Telematics Control Unit

2010: Service contract with Tier-1 – Engineering services for embedded SW and HW engineering support for final customer

GMV's software running in more than **1,5 Million TCU** units in the World for different customers

DAIMLER

RENAULT NISSAN


MEGANE

WHAT WE DO

GMV AS AN AUTOMOTIVE TIER-2 SUPPLIER

TELEMATICS SERVICES

Fleet management
Usage-Based Insurance
Car sharing
ECO coaching / scoring / ranking
Remote Diagnosis
Radio Network Quality
On-board messaging

SAFETY AND SECURITY

B-Call / Assistance call
E-Call (Manual and Automatic), EUR and Russia regulations
Stolen Vehicle Tracking
Vehicle Status report
Remote door operation
Burglar notifications
Speed limit notifications
Geo-fencing notifications
Towing notification

ELECTRIC VEHICLE

EV Battery charging status
EV Charging history
Battery charging notifications (start/
EV Charging remote activation/deactivation
EV Charging scheduler
EV Charging timer
EV Remote AC control
EV Plug-in missing notification

OTHERS

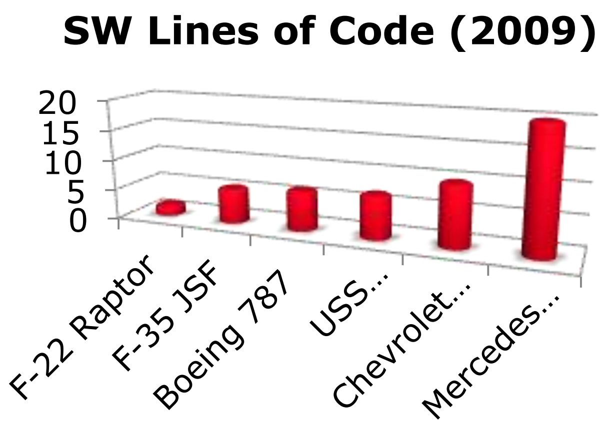
Maintenance reminder
Remote start
My car finder
Curfew Alert
Remote Horn & Light
MIL ON notification
Modem service

Innovation Roadmap

Automotive Industry

"Softwarization"

- The number of vehicles in operation in the world broke the **1 billion barrier in 2010** and by 2020 it is expected to be between 1,3 and 1,5 billion vehicles.
- Most vehicles today have **more than 100 million lines of software code** powering their navigation, infotainment and communications features, as well as their advanced fuel management, braking and drive train technologies. This is a much larger number of Lines of Codes (LOCs) than found in other transport industries: for example, a F-22 Raptor has around 1,7 million LOCs, and the new Boeing 787 has around 6,5 million LOCs.
- **35% to 40% of the cost of modern vehicles is caused by embedded electronics**.



Fly-by-wire

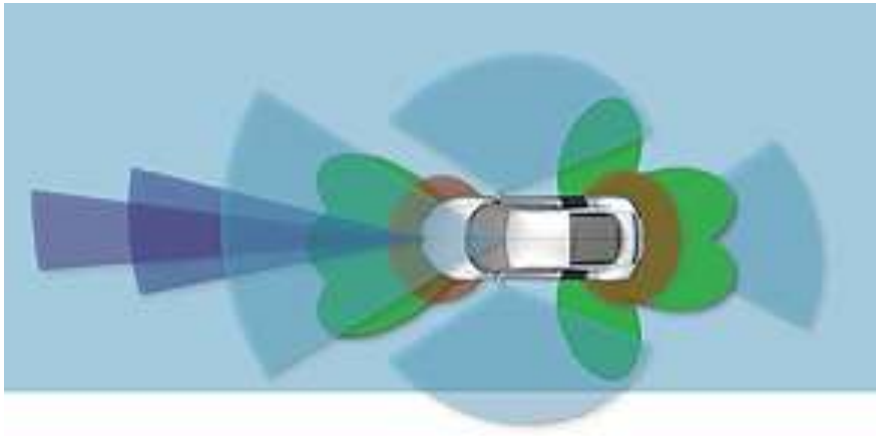
- Today **most automotive systems still operates autonomously** with services provided through **multiple ECUs connected with in-vehicle networks**. However **mechanical backup systems still exist**, thus the basic functions of a car are preserved even if an electronic system fails.

- However, mechanical systems will be replaced by electronic systems, thus **implementing true automotive by-wire systems**.

Advanced Driver Assistance Systems (ADAS)

- There are several systems on the market today that **intervene when it is beyond the human capability to act**, like ABS (Anti-Lock System) and ESC (Electronic Stability Control).

- New **ADAS** systems already in the market or to be introduced **in the near future have a significant impact on driving efficiency and safety**: Lane Change Assist, Lane Departure Warning, Front Collision Warning, Adaptive Cruise Control, Lane Keeping Assist, Traffic Jam Assist, Traffic Jam Chauffeur, Highway Chauffeur, Highway Pilot, …



Autonomous vehicles

- The development of **autonomous vehicles** has progressed significantly to the point of **real world testing** (e.g. Google Driverless Car).

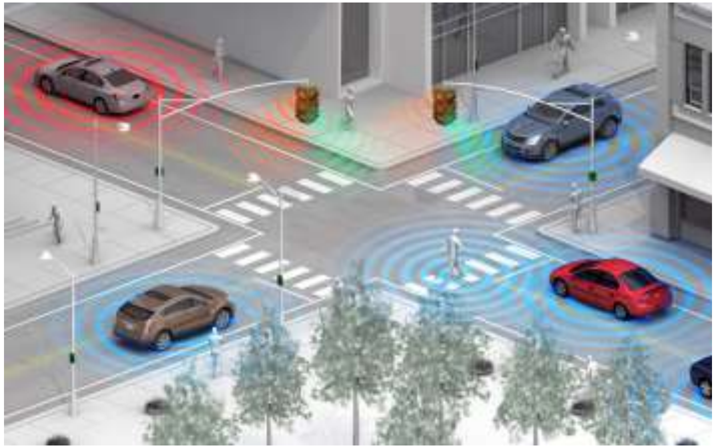
- The use of **autonomous vehicles** will also foster the appearance of **new Advanced Driver Assistance Systems** (ADAS) that in turn can bring relevant social effects at road safety and fuel economy levels. The same systems are also suited to advanced applications in the field of cooperative driving; thus, the beneficial impact is further increased.

- Autonomous vehicles are approaching **commercial maturity in the next 5 to 10 years**. Sensors, positioning, imaging, guidance, control systems, mapping and V2x communications technologies are sources of data and technologies at the core of autonomous vehicles.

V2x

- **Communication between vehicles** (V2V, Vehicle-to-Vehicle) and between vehicles and infrastructure (V2I, Vehicle-to-Infrastructure) adds new capabilities to transport systems, as it **allow users to share information** (about road hazards, accidents and incidents, for instance) and reach a common goal (like **vehicle platooning**). In all these applications, **input to vehicle control** may originate or be heavily influenced by **an outside source**.

- In October 2015, the 16 OEMs organised in the CAR 2 CAR Communication Consortium reiterated their intention to jointly bring cooperative ITS and services to the European market based on the European and US market standards: ETSI ITS-G5 and IEEE 802.11p (WLANp), respectively.



Transport Systems of the Future

- Driver free
- Cooperative
- Connected
- Green
- Modular

Innovation Roadmap

Issues

Issues

- Today's **ECUs have different software architectures**. Virtually every ECU supplier has its own approach regarding the software architecture which may also be changed in every ECU project.

- One important **difference between automotive-application security and "traditional computer security"**, is that not only data and functionality of the systems that are at risk but also **human life**. In this sense, security and safety can't be seen no more as running in parallel, but rather as "two sides of the same coin". This relationship brings the need to redesign the system so that it's not only safe and secure, but also ***safe with respect to security***.

- The deployment of ADAS, V2x systems and autonomous vehicles can be **hindered** by concerns related with **security** and especially **safety** issues:
  - V2x protocols were not designed with safety (of life) in mind, hence its use in cooperative autonomous vehicles requires additional mechanisms that need to be cost effective to be applied by automotive suppliers in their ECU design and development.
  - Current safety standards (ISO 26262) does not cover automated or cooperative vehicles.
  - How to achieve high Reliability, Security and Safety with acceptable costs?

Issues

- “***A product, system, or service is considered to be secure to the extent that its users can rely that it functions (or will function) in the intended way***” (ISO/IEC WD 15443-1).

- Autonomous vehicles and secure automotive V2x applications require:
  - **Entity identification**: Each entity should have a different and unique identifier;
  - **Entity authentication**: Each entity proves that it is its actual identity
  - **Privacy preservation** through untraceability and unlinkability:
    - Untraceability establishes that vehicle´s actions should not be traced (i.e. different actions of the same vehicle should not be related);
    - Unlinkability establishes that it should be impossible for an unauthorized entity to link a vehicle´s identity with that of its driver/owner.
  - **Non-repudiation** guarantees that it will be impossible for an entity to deny having sent or received some message.
  - **Confidentiality** assures that messages will only be read by authorized parties.
  - **Availability** establishes that every participating entity should be capable of sending any information at any time.
  - **Data trust** through data integrity and data accuracy: data should not be altered and, more importantly, it should be truthful.

Issues

- Other Key Challenges (*ERTRAC's Automated Driving Roadmap, July 2015*):
  - *What are the requirements for the physical infrastructure to enable/support higher levels of automated driving?*
  - *What level of connectivity (communication) and what databases (enhanced map databases, digital infrastructure) are required for what level of automated driving?*
  - *How to prepare a harmonised European approach for adapting nation road codes/laws to allow and avoid fragmented solutions for automated driving in general?*
  - *How to deal with liability issues and how to involve insurance companies to adapt their models on these new requirements?*
  - *How to ensure trust between automated vehicles, drivers and other road users?*
  - *How to ensure safe vehicle handling with reduced driver attention to the driving task?*
  - *What "other" tasks can a driver safely carry out while in automated driving?*
  - *What are proper validation procedures and tests for automated driving functions?*
  - *How to enable cost effective testing?*

Innovation Roadmap

Ethical Dillemas

THE WALL STREET JOURNAL.

BUSINESS

With Driverless Cars, a Safety Dilemma Arises

Survey respondents say cars should try to protect as many pedestrians as possible in an accident scenario

Pennsylvania Department of Transportation Secretary Leslie Richards and other officials talk about the state's steps to lead on autonomous-vehicle development in Pittsburgh on June 1. PHOTO: ASSOCIATED PRESS

By AMY DOCKSER MARCUS

Updated June 23, 2016 6:43 p.m. ET

29 COMMENTS

In one, participants were asked to imagine that they are in a self-driving vehicle traveling at the speed limit. Out of nowhere, 10 pedestrians appear in the direct path of the car. Should engineers program the car to swerve off the road in such instances, killing the passenger but leaving the 10 pedestrians unharmed, or keep going, killing the 10 people?

RELATED

- How New Technology is Illuminating a Classic Ethical Dilemma (June 8)

In that scenario, 76% of the 182 participants said the moral thing for the car to do was sacrifice the passenger rather than kill the 10.

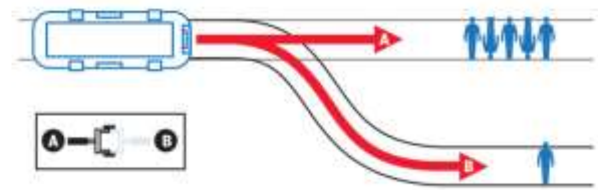
Most people, researchers say, intuitively understand that, when viewed through the lens of the greatest good, sacrificing one to save 10 makes sense. But as researchers in the study continued with their surveys, eventually involving over 1,900 people in total, they identified what they call a "social dilemma."

Researchers asked participants which car they would prefer to actually purchase, one programmed to put a heavier premium on saving more lives, or one that might sacrifice them or family members in the name of the greater good.

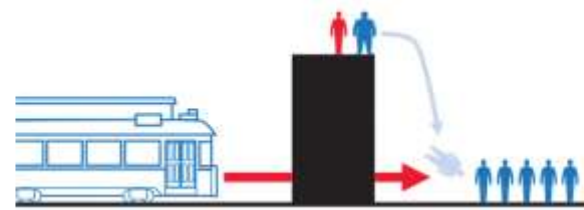
In that case, participants "preferred the self-protective model for themselves," the researchers wrote.

THE TROLLEY PROBLEM

A trolley is running out of control down a track. In its path are five people who have been tied to the track by a mad philosopher. Fortunately, you could flip a switch, which will lead the trolley down a different track to safety. Unfortunately, there is a single person tied to that track. Should you flip the switch or do nothing?



THE FAT MAN VARIATION
Another trolley is running out of control down another track. In its path are five people who have been tied to the track by a different mad philosopher. You are on a bridge under which the trolley will pass; you can stop it by dropping a heavy weight in front of it. As it happens, there is a very fat man next to you— your only way to stop the trolley is to push him over the bridge and onto the track, killing him to save five. Should you proceed?



ANDREW BARR / NATIONAL POST

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