Human Factors in AD: Can IoT enhance Safety & User Acceptance?

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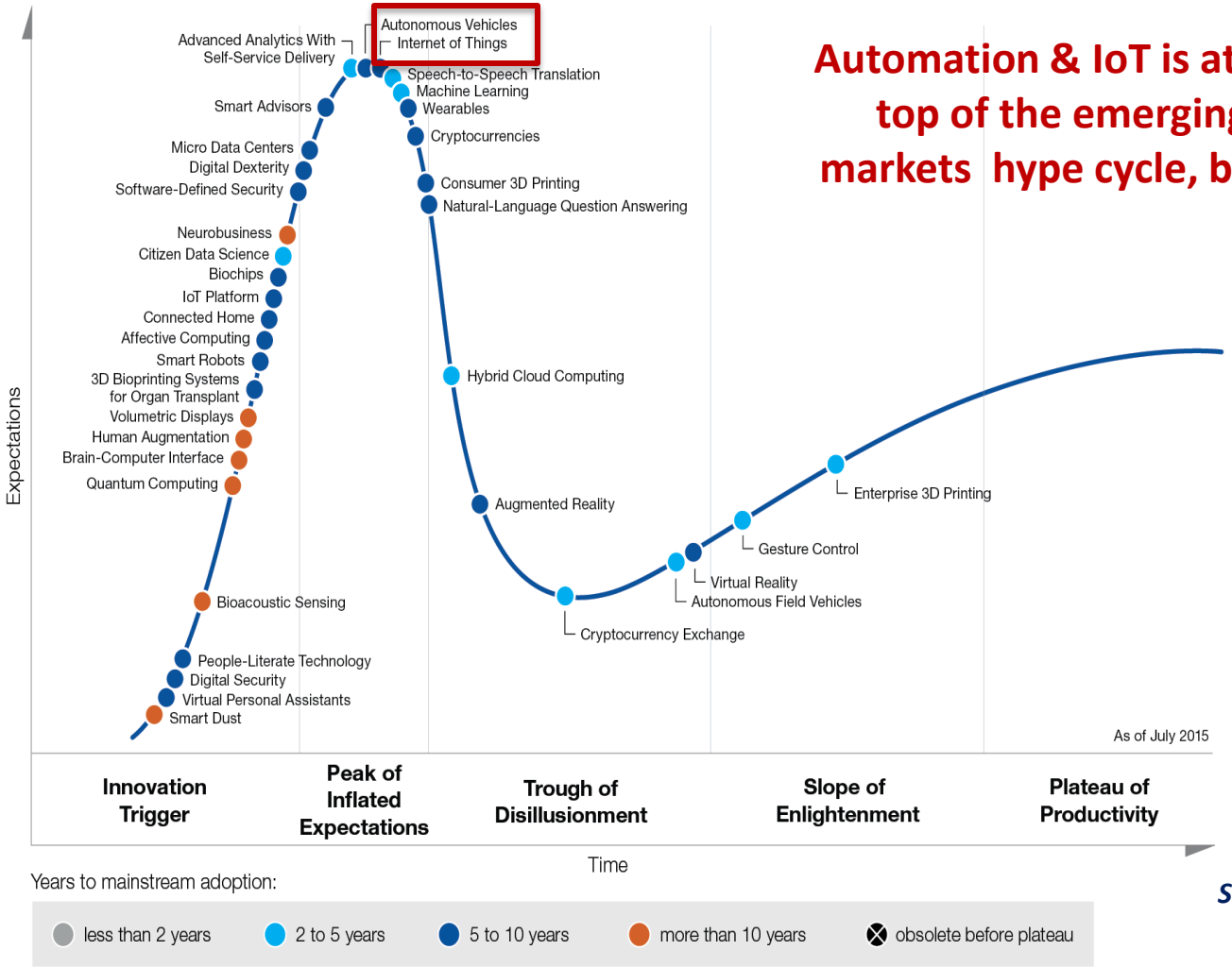
Automation & Safety: Roadmap

- If maximum safety is indeed the goal…
  - **Add** the system's vigilance to the driver's vigilance instead of bypassing the driver's vigilance
  - Comprehensive hazard warnings plus some control assistance
- If the driver is out of the control loop (texting, sleeping, or not present), the system has to handle **everything**…
  - Unpredictable scenarios
  - Ethically untenable scenarios

Automation: Market perspective



Automation & IoT is at the top of the emerging markets hype cycle, but…

Source: Gartner Hype Cycle for Emerging Technologies, 2015

Automation: User Acceptance

Users' feedback related to the usage of automated vehicles:

End-user expectations		
safety (33%)	more free time (20%)	fuel economy (18%)
lower insurance costs (11%)	less traffic congestions (7%)	lower CO2 emissions (5%)
End-user concerns		
equipment failure (32%)	price of equipment (18%)	liability (12%)
learning to operate (8%)	data privacy (7%)	losing driving skills (6%)

…safety is the highest priority for user acceptance and therefore deployment

Source: Goldman-Sachs (2015)

Automated Driving: Safety impact

The safety impact of automated driving follows two patterns:

1. estimates based on consideration of how automation will resolve current factors in crashes
2. es vehicles

- Automated vehicles will be 50% safer than non-automated ones, even with a market penetration as

However, the first fatal crash with a Tesla automated vehicle took place in January, 2016 (China) and the second one May, 2016, (US) suggesting that automated driving does not necessarily result in a significant traffic accident reduction if it is not properly designed and implemented.

Human Factors challenges 1/2

The continuous evolution of software integration into systems magnifies the gap between humans and machines, whereas the nature of the human machine interaction is changing rapidly as well.

- Main issue: to provide the ***right integration*** capability at the ***right time*** and in the ***right way***.
- Target: ***Perception*** of situation, its ***comprehension*** and the necessary means of projection in order ***to act*** safely, efficiently and comfortable.

Source: Guy Boy (2013), Orchestrating Human-Centered Design, Springer

Human Factors challenges 2/2

How to understand the interaction between humans and automated vehicles (in-vehicle and outside vehicle) at different levels of automation?

How to design the safe, intuitive interaction of automated vehicles with other road users?

How to derive interaction design concepts for the automated vehicles so that both the human driver and other humans in the surrounding traffic sufficiently understand the capabilities and limitations of the vehicle?

Source: ERTRAC Automated Driving Roadmap, 2017

Automation and VRU Safety

- Vulnerable Road Users are more likely to get involved in fatal accidents or accidents with serious injuries due to the lack of added protection.
- While current vehicle autonomous systems have a considerable potential to save lives such as Autonomous Emergency Braking (AEB), the effectiveness is sensitive to restrictions on functionality as in darkness and high speeds.
- Mass and fast communication between ITS can drastically improve safety for all road users.

Source: Rosén, Erik. Autonomous Emergency Braking for Vulnerable Road Users. 2013

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Cloud-based applications for detecting VRU-related critical situations

- Using a smartphone or similar device as a mobile sensor for active safety systems has shown that while the lateral deviations are too high to allow for lane-level localization, the longitudinal accuracy is good enough for many active safety applications already.
- All such applications can be easily embedded by an IoT Platform, combining vehicles' OBU and infrastructure's RSU to get the best possible outcomes.

Source: Active safety for vulnerable road users based on smartphone position data. Martin Liebner, Felix Klanner and Christoph Stiller. Gold Coast, Australia : Intelligent Vehicles Symposium (IV), 2013 IEEE, 2013

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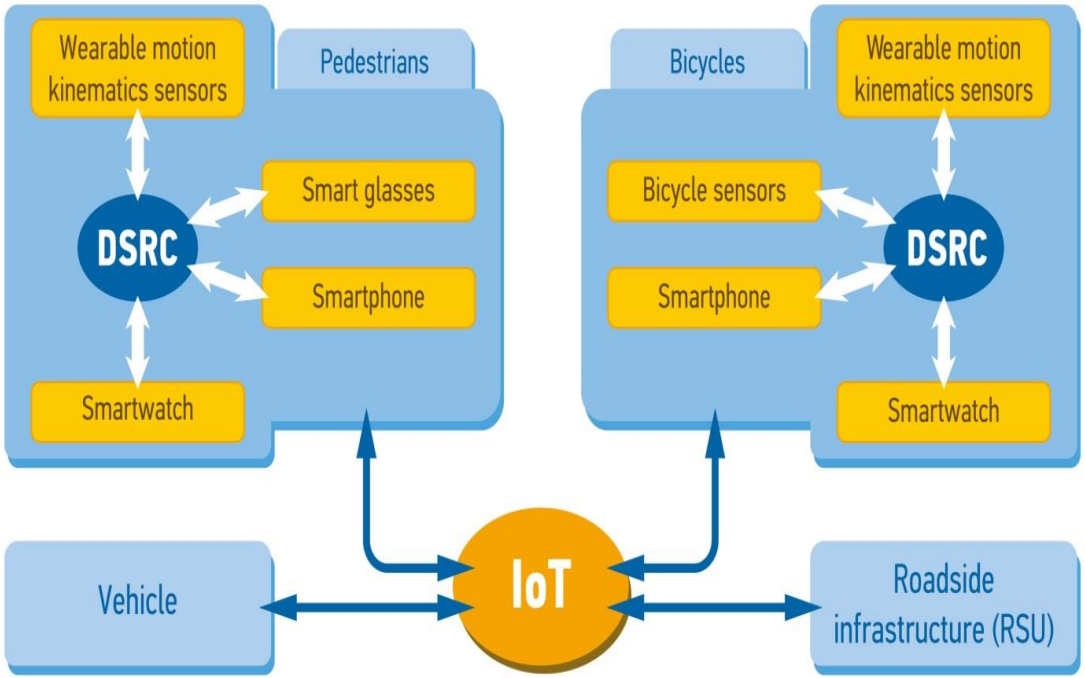
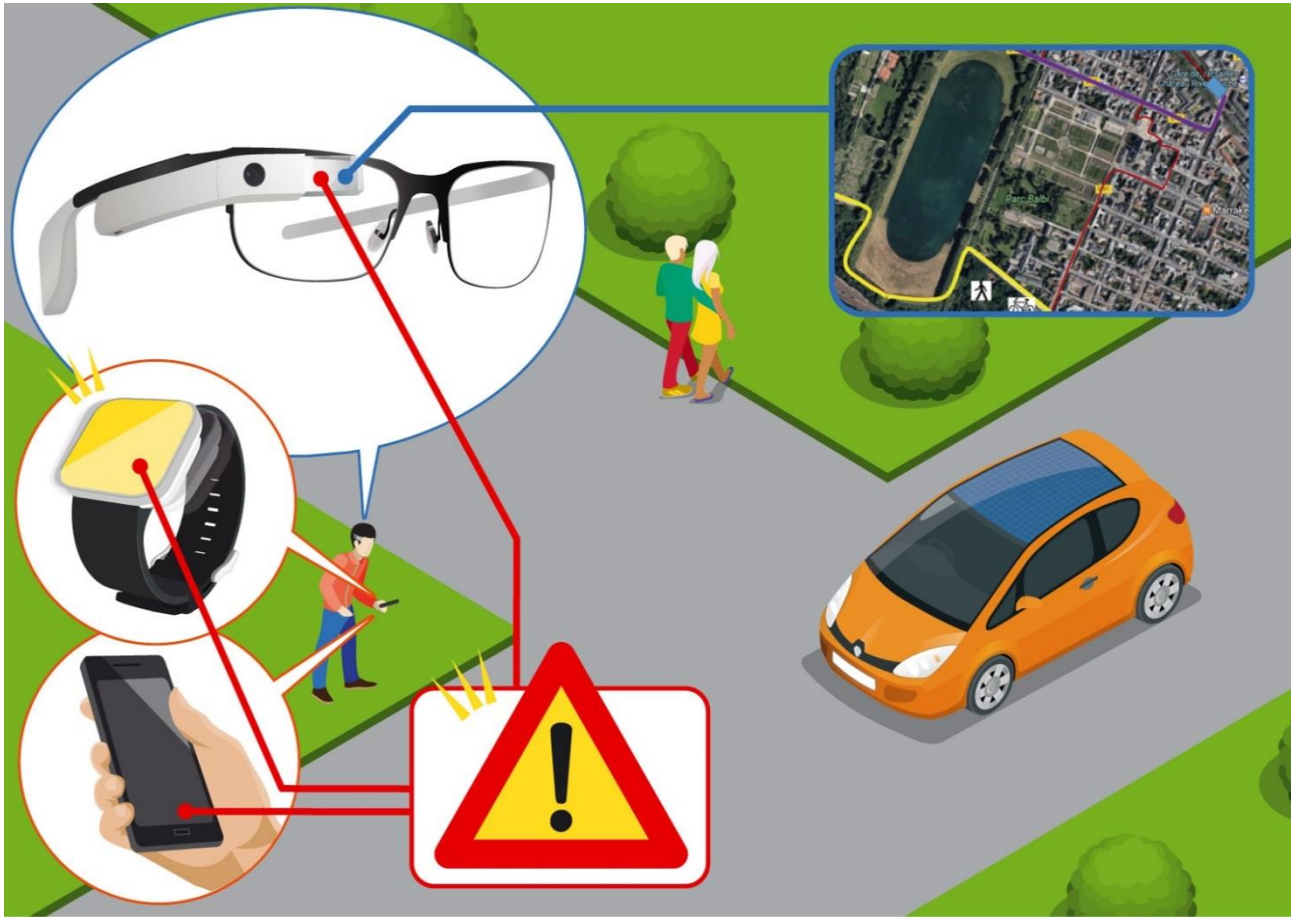
Collaborative perception in AUTOPILOT

Pedestrian's and bicycle's detection and communication via smart devices using an IoT-based platform

- Use of a combination of wearable, on board and roadside sensors , with short range and direct WiFi communication.
- Absolute position and intention detection estimated by a fusion of GPS, kinematics sensors and RSSI measurements, through an IoT cloud-based service.
- Open communication with automated vehicles and roadside infrastructure (access to vehicles CAN-bus, infrastructure input, etc.) and VRUs path and intentions.



AUTOPILOT: Enabling VRU communication through IoT – Pedestrian Example



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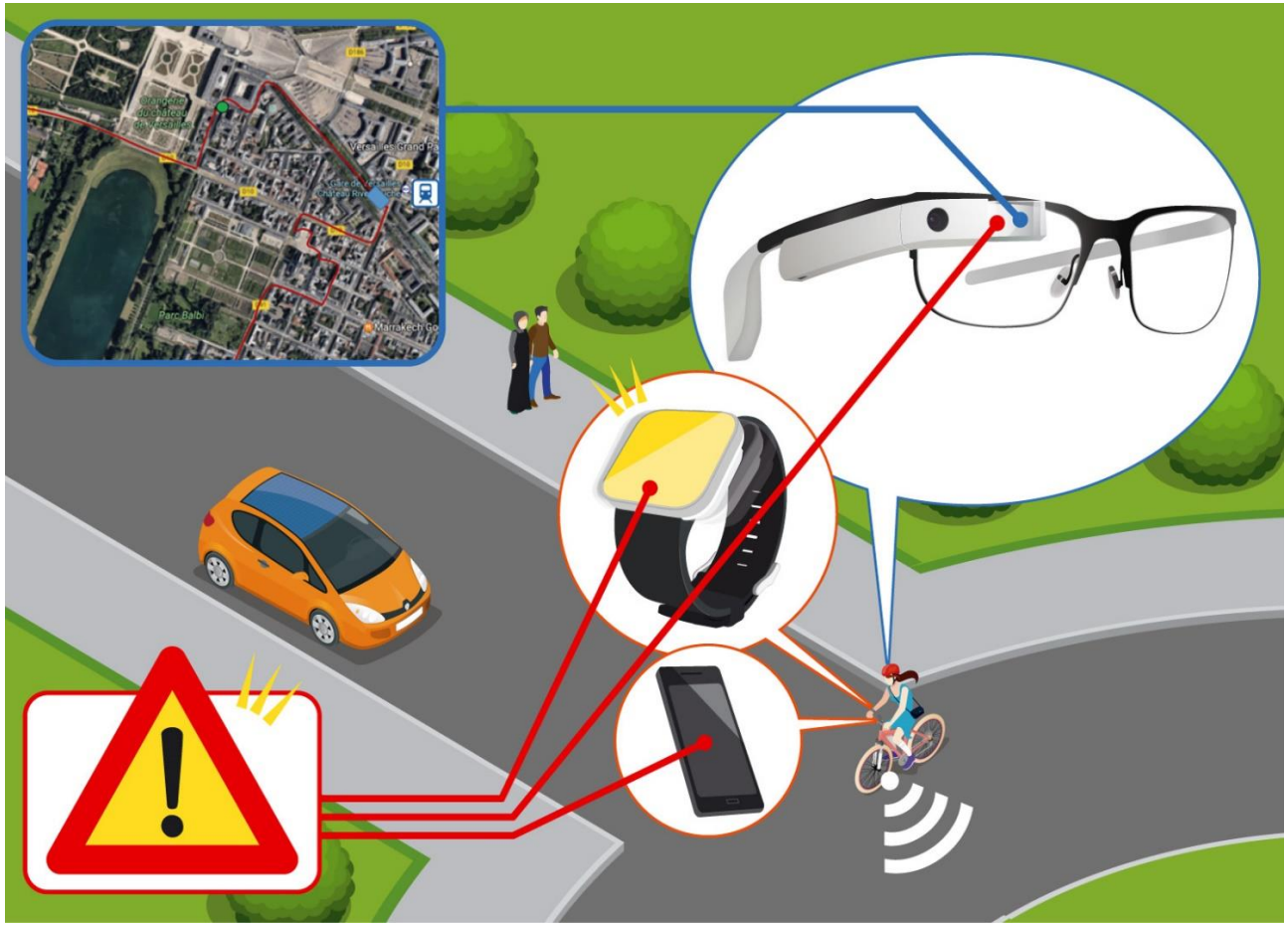
AUTOPILOT: Enabling VRU communication through IoT – Cyclist Example



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Thank you for your attention

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