



Next Generation Integrated Mobility:

Driving Smart Cities

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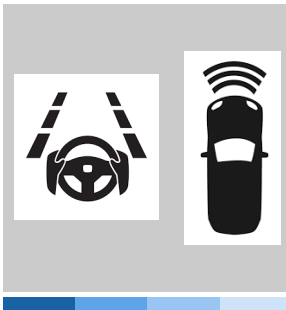
Oihana Otaegui

ootaegui@vicomtech.org
Vicomtech-IK4

**New ADAS Generation:
Connectivity and Data Privacy**

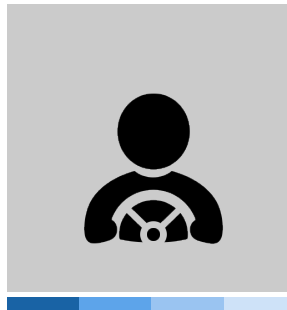
Importance of the Driver

Still many years ahead with manual or semi-manual vehicles on the road



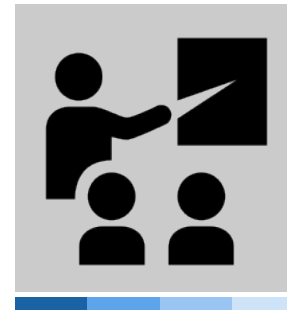
New ADAS Systems

Impact of the ADAS system on human driving behavior



Hand Over/Back

How to engage the driving to take decision in complex situations



Driver Training

Train the drivers individually based on the actions and reactions to maximize safety



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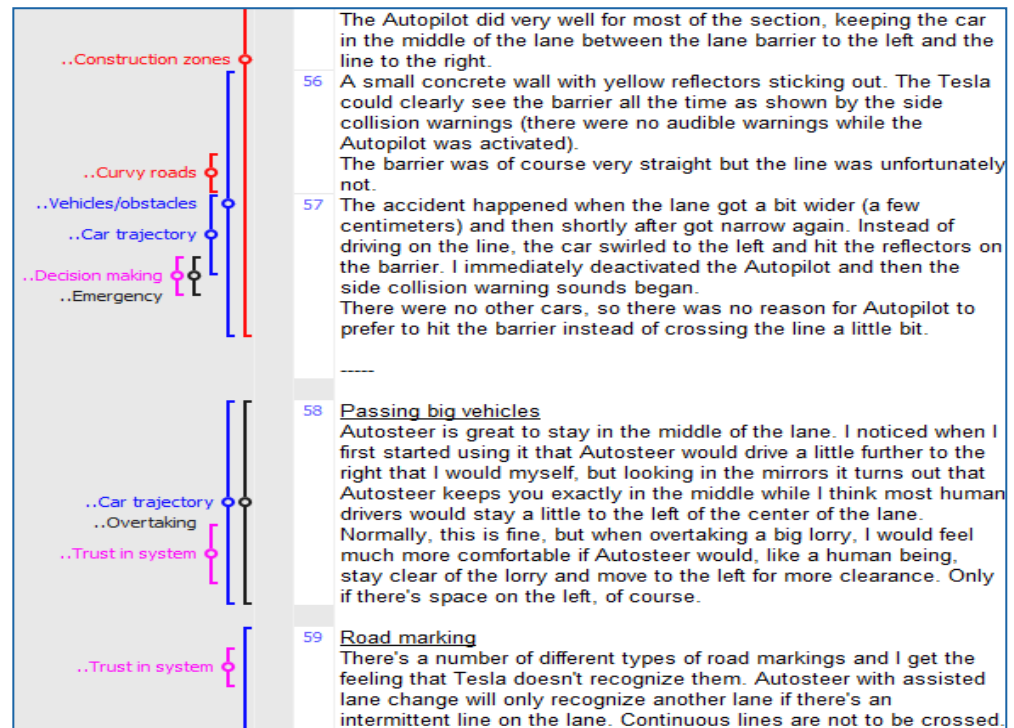
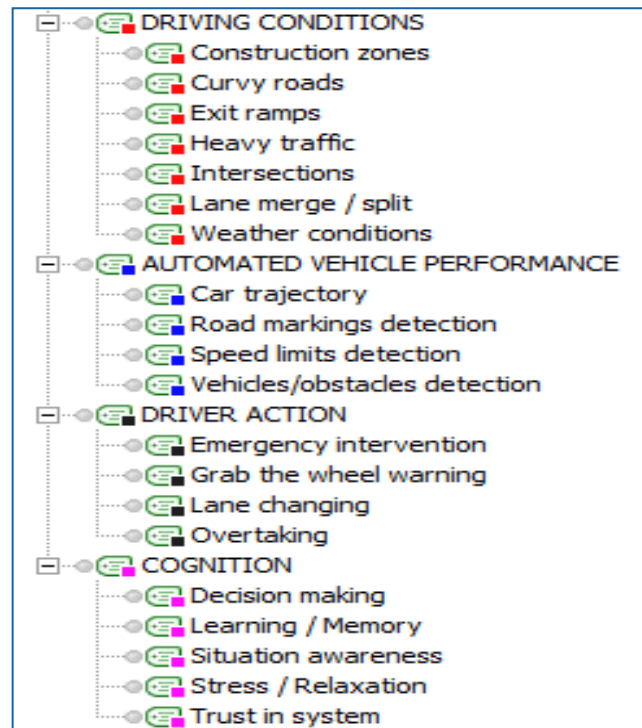
User/Driver Perception and Acceptance on ADAS and Automation Functionalities

- 2 studies
 - Internet Forums Analysis
 - Specific Questionnaire
- Categories
 - **Driving conditions:** elements that are independent from the car or the driver (e.g. type of roads, traffic conditions, etc.)
 - **Automated vehicle performance:** reliability of the driving assistance systems (e.g. trajectories, detection of road markings, etc.)
 - **Driver actions:** actions taken by the driver to handle situations or because he is prompted to do so (e.g. emergency interventions, grabbing the wheel, etc.)
 - **Cognition:** cognitive processes showing how the driver feels and reacts in different situations (e.g. situation awareness, decision-making, etc.)



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WEB ANALYSIS: Coding with MAXQDA



RESULTS

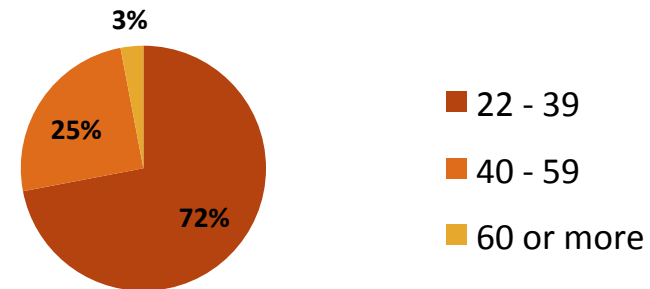
Main codes	Sub-codes	%
Driving conditions	Construction zones	2%
	Curvy roads	4%
	Exit ramps	3%
	Heavy traffic	4%
	Intersections	1%
	Lane merge / split	3%
	Weather conditions	2%
Automated vehicle performance	Car trajectory	11%
	Road markings detection	7%
	Speed limits detection	3%
	Vehicles/obstacles detection	6%
Driver action	Emergency intervention	6%
	Grab the wheel warning	4%
	Lane changing	4%
	Overtaking	1%
Cognition	Decision-making	6%
	Learning / memory	4%
	Situation awareness	9%
	Stress / relaxation	7%
	Trust	14%

		Driving conditions							Vehicle performance				Driver action				Cognition				
		Construction zones	Curvy roads	Exit ramps	Heavy traffic	Intersections	Lane merge / split	Weather conditions	Car trajectory	Road markings	Speed limits detection	Vehicles detection	Emergency intervention	Grab the wheel warning	Lane changing	Overtaking	Decision making	Learning / Memory	Situation awareness	Stress / Relaxation	Trust in system
Driving conditions	Construction zones																				
	Curvy roads	2																			
	Exit ramps	0	2																		
	Heavy traffic	0	6	2																	
	Intersections	0	2	0	2																
	Lane merge / split	0	2	4	2	0															
	Weather conditions	0	2	2	2	0	4														
Vehicle performance	Car trajectory	11	13	7	11	0	5	3													
	Road marks detection	2	6	2	6	2	2	2	12												
	Speed limits detection	0	0	2	0	0	2	0	3	2											
	Vehicles detection	2	8	2	2	0	2	0	16	6	2										
Driver action	Emergency intervention	4	7	4	2	0	0	0	12	2	0	10									
	Grab the wheel warning	2	0	0	0	0	2	2	4	2	0	0	2								
	Lane changing	2	0	6	0	0	4	2	5	4	2	2	4	2							
	Overtaking	0	0	0	0	0	0	0	2	0	0	2	0	0	0						
Cognition	Decision making	4	2	0	0	0	0	0	6	4	4	10	12	2	0	0					
	Learning / Memory	0	4	0	0	0	0	0	7	6	2	4	5	2	0	0	2				
	Situation awareness	2	3	2	2	0	0	0	16	9	5	11	2	4	4	0	4	9			
	Stress / Relaxation	0	4	0	6	0	2	2	8	4	0	2	2	2	2	0	2	10	11		
	Trust in system	2	8	6	6	2	2	2	11	6	4	5	5	8	2	2	4	12	21	9	

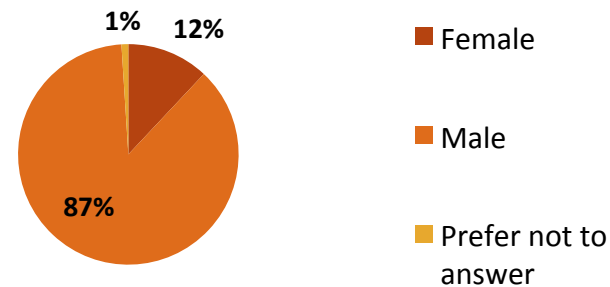
QUESTIONNAIRE: RESULTS

- 100 respondents
- Young drivers (75% of them younger than 40)
- Only 12% percent of the respondents are female

How old are you?

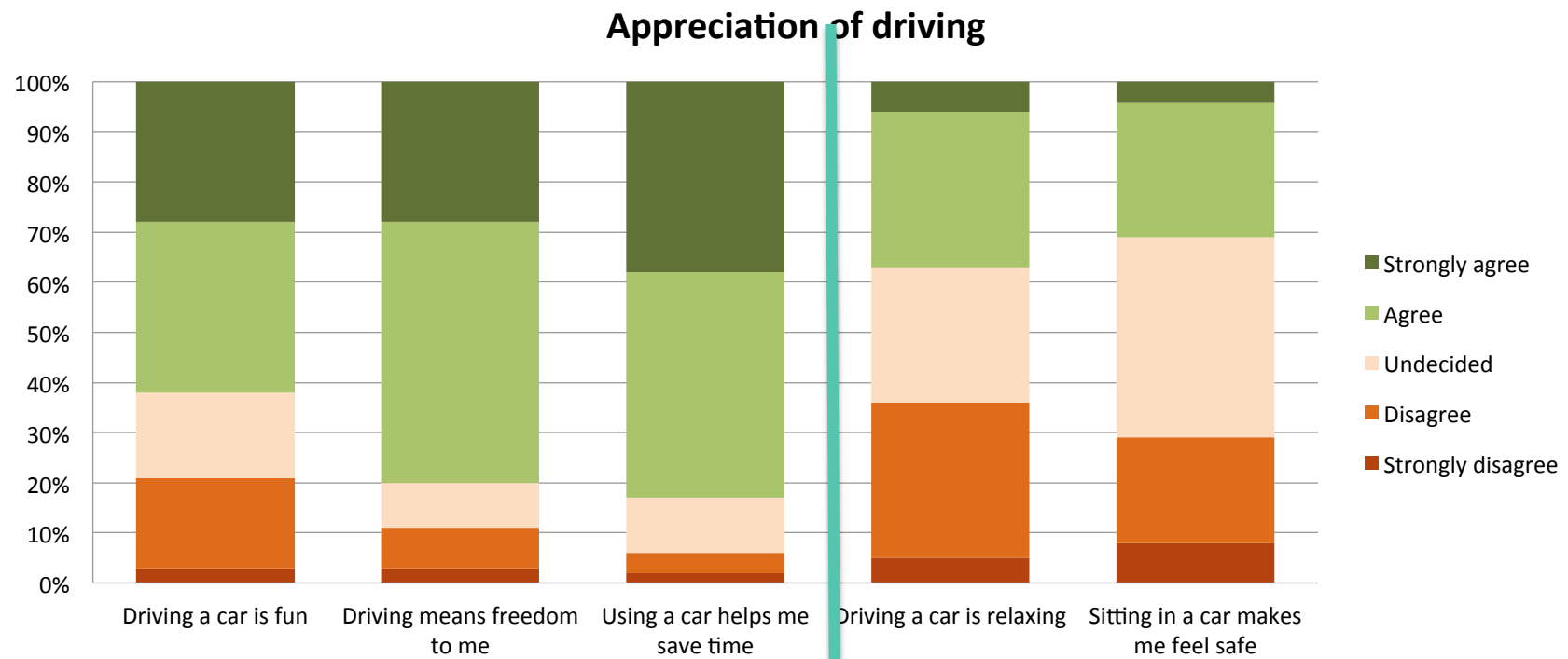


What is your gender?



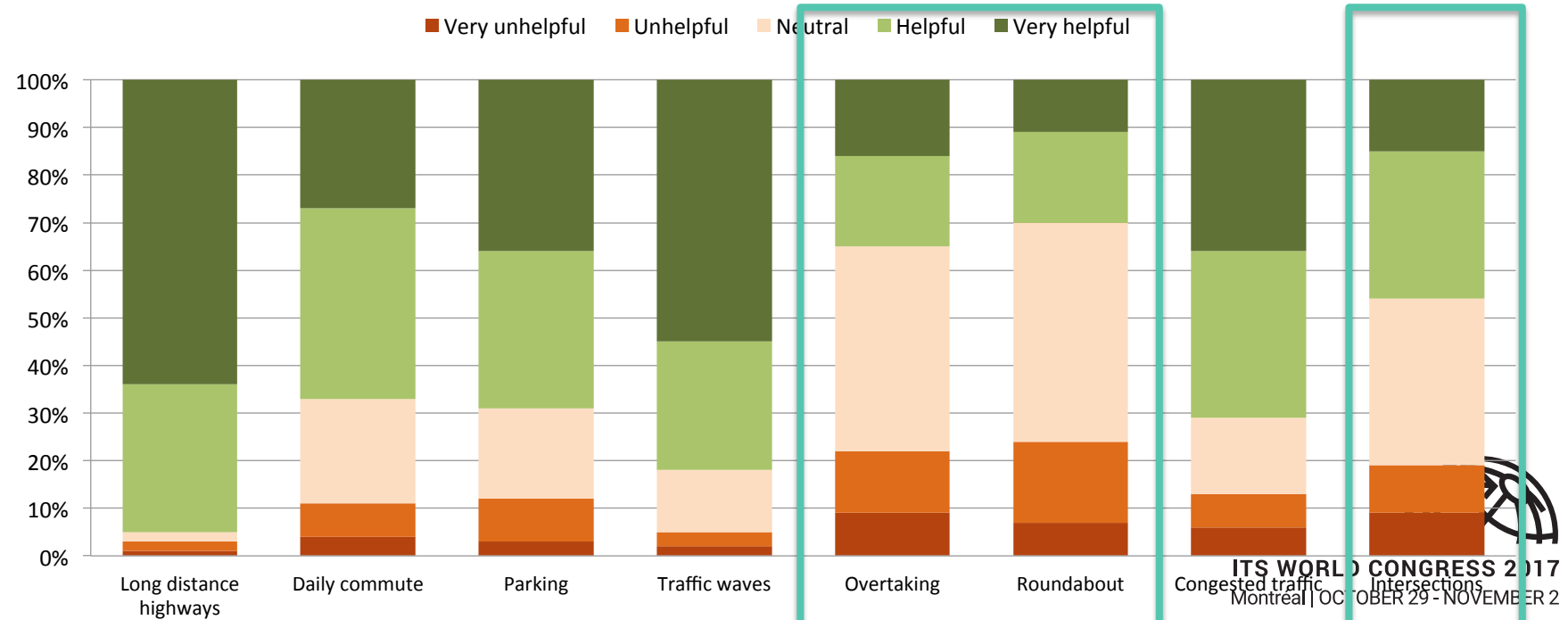
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RESULTS: DRIVING HABITS



RESULTS: SITUATIONS FOR AUTOMATED DRIVING / TRUST

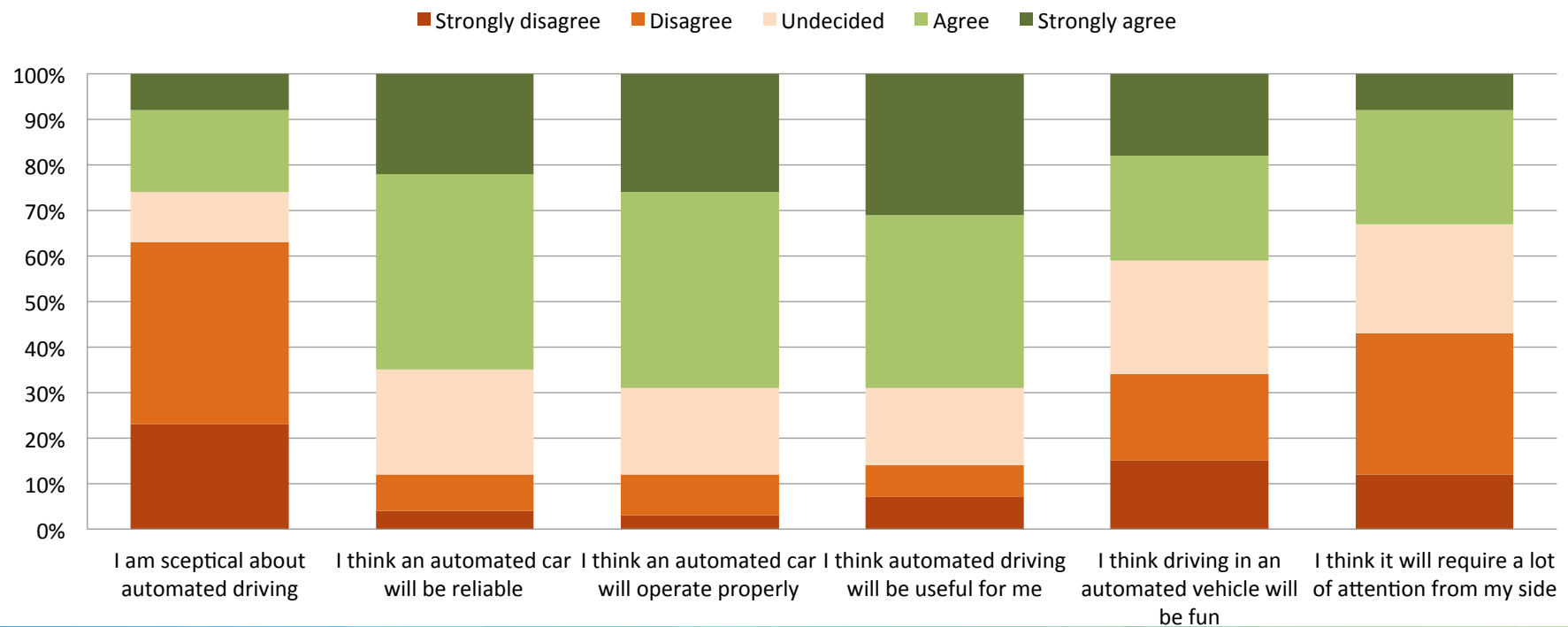
How helpful do you think a driving assistance feature could be?



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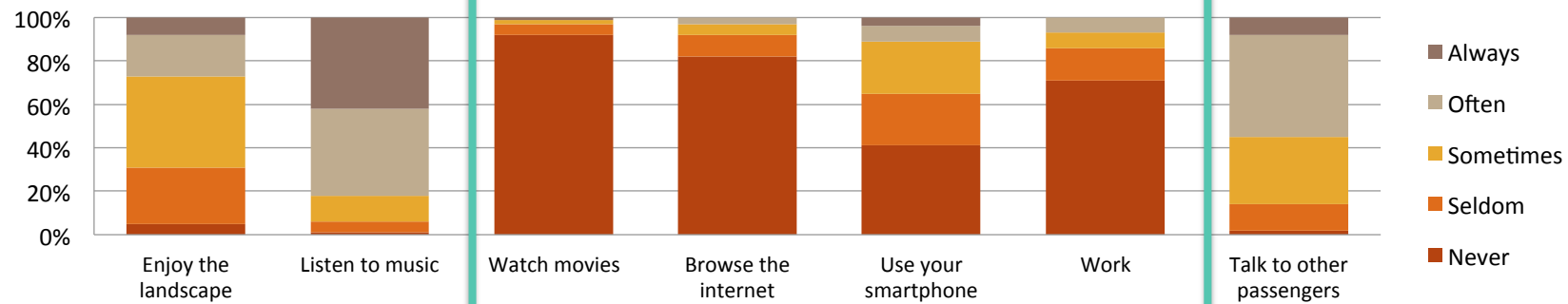
RESULTS: ACCEPTANCE OF AUTOMATED DRIVING

Acceptance of automated driving

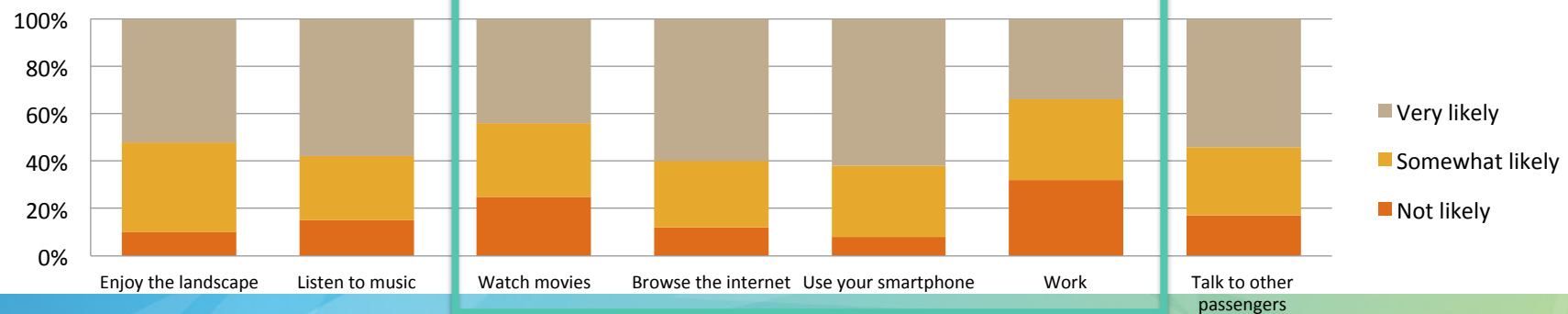


RESULTS: ACTIVITES

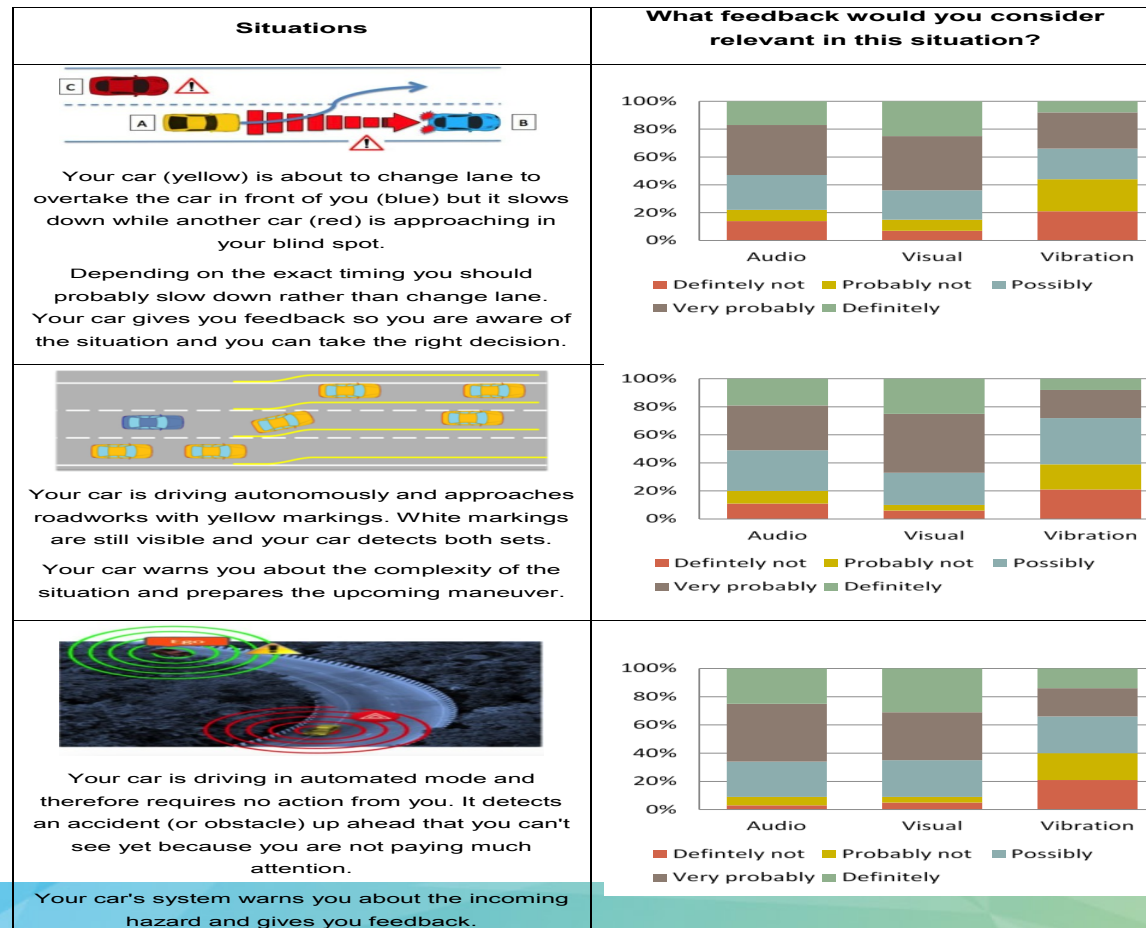
What do you usually do while driving?



In an automated car, how much more likely would you be to do the following?

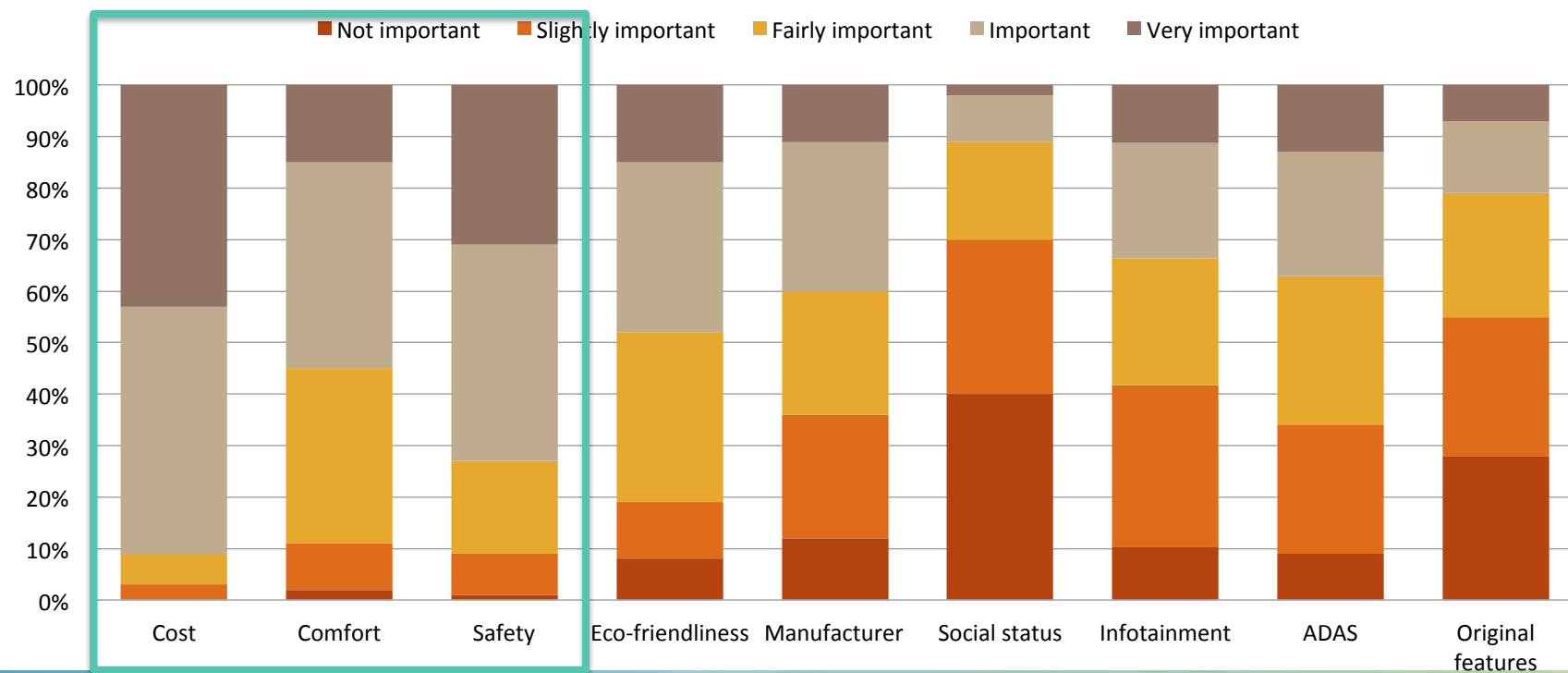


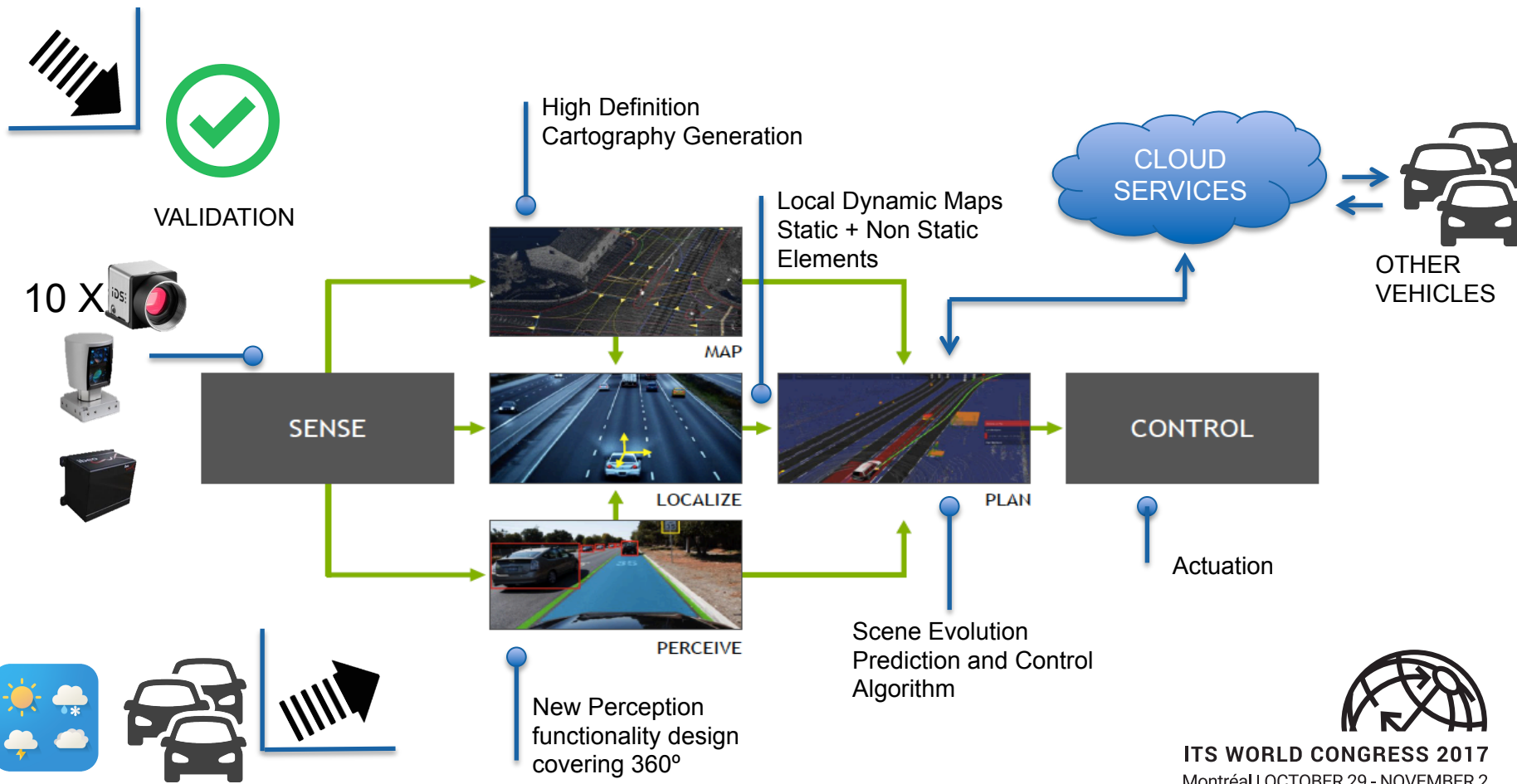
RESULTS: USE CASES & TYPE OF FEEDBACK



RESULTS: CRITERIA WHEN BUYING A CAR

What criteria do you consider important when buying a new car?

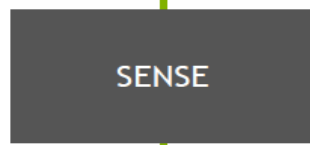
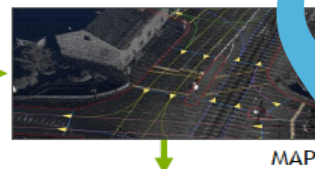






inLane
Lane Navigation Technology

CogNet



Actuation

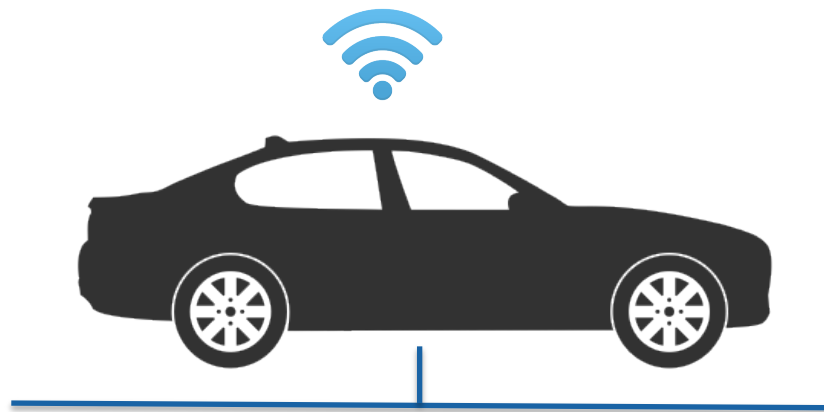


PERCEIVE



New ADAS Functionalities

Data Generation **Outside Sensing**



Lane Keeping



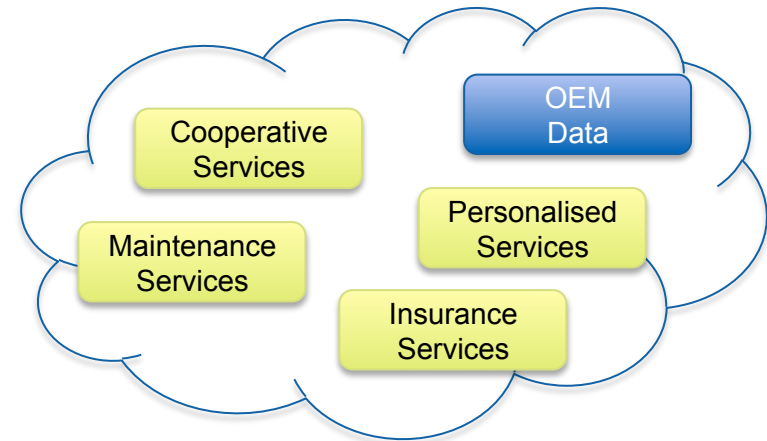
Vehicle Position & Velocity



Distance Keeping



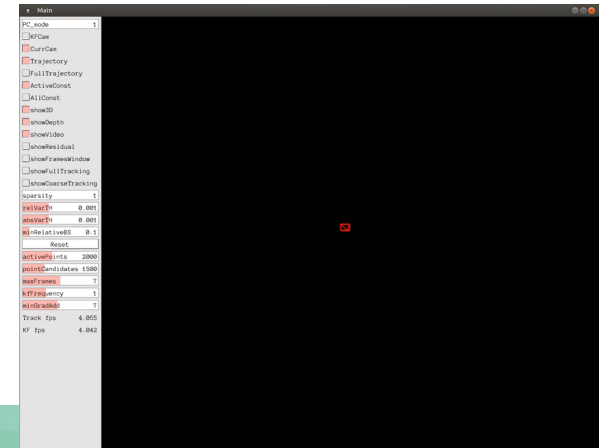
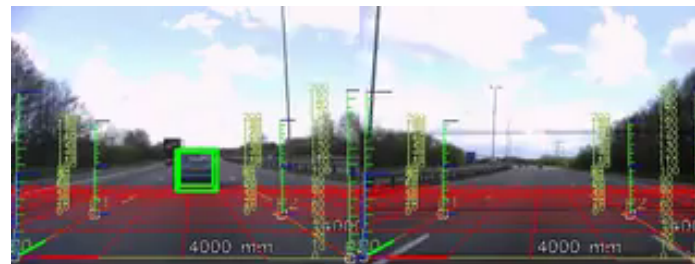
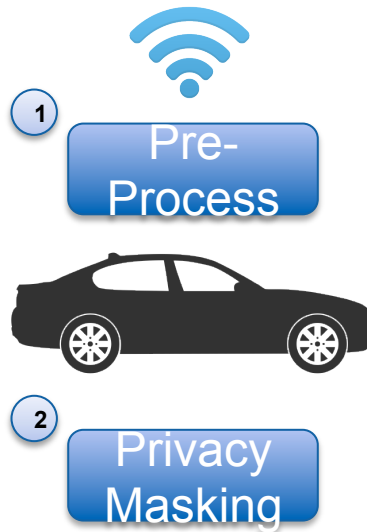
Blind Spot



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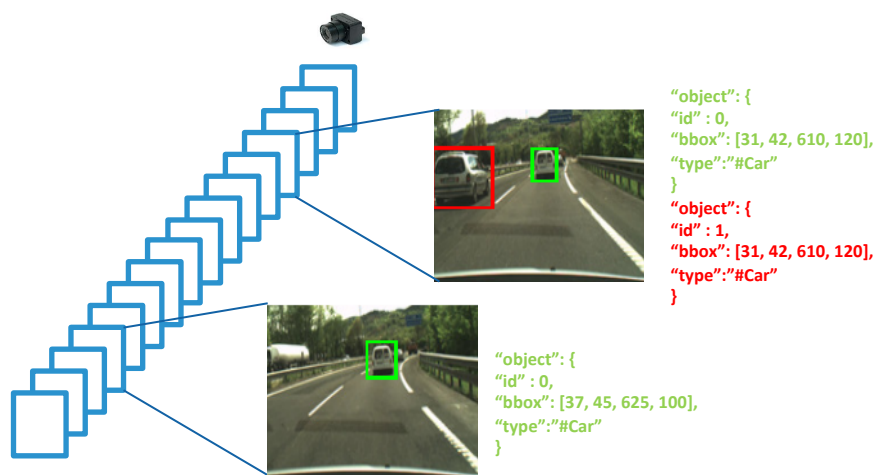
New ADAS Functionalities

Data Generation **Outside Sensing**



Data Pre-Processing: Video Content Description

Data Generation **Outside Sensing**



A **VCD** is a **detailed description** of the Objects, Actions, Contexts and Relations of a recording
VCD entries can be stored in **document-oriented databases**

Video Content Description (VCD)

VCD ID	
VideoMetaData	
SCD ID	Recording name
Resolution	Start timestamp
Annotator	
Frame i-th annotations	
Frame n-th annotations	



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Privacy Masking

Data Generation **Outside Sensing**

Person detection and tracking

Detect persons in videos and identify their position, size and trajectory

The identity of the persons is not determined

License Plate detection and tracking

Detect License plate in video and identify their position, size and trajectory

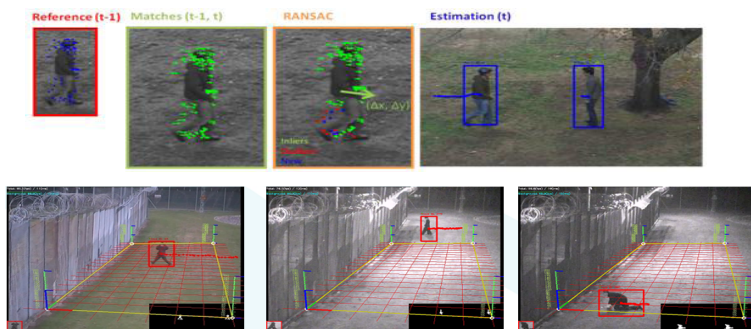
The identity of the vehicle is not determined

Implementation

Perspective calibration to determine the identify as persons moving elements in the scene

Motion and appearance (faces, upper-body and/or full-body), time consistency

Motion-based detection
Background subtraction
Optical flow-based tracking



Appearance-based detection
Face, upper-body and full-body

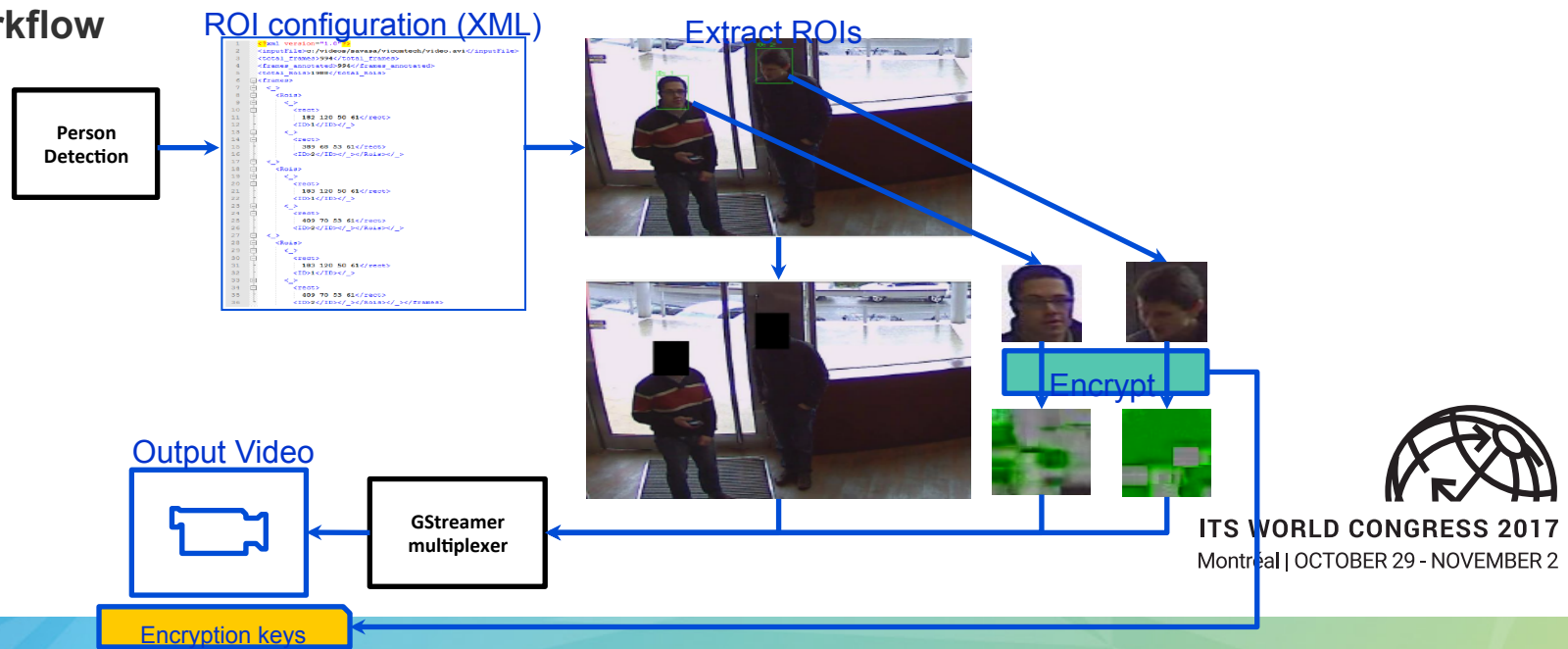


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Privacy Masking Implementation

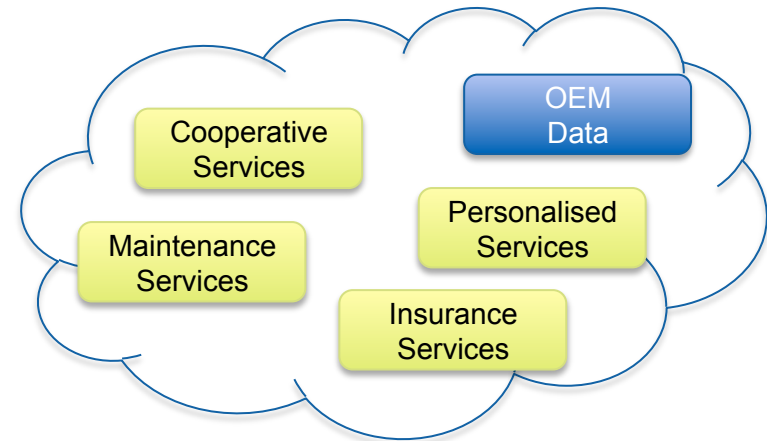
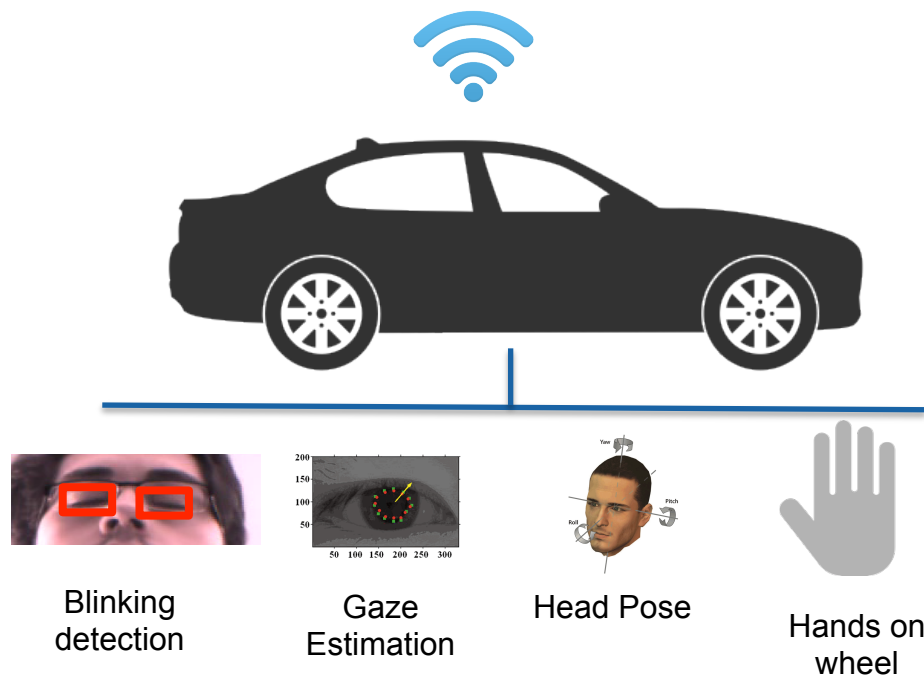
Data Generation **Outside Sensing**

- **Privacy masking videos**
 - Occlude / obfuscate regions holding privacy information (people, faces)
 - Allow for original video reconstruction upon valid authentication
- **Workflow** [ROI configuration \(XML\)](#) [Extract ROIs](#)



New ADAS Functionalities

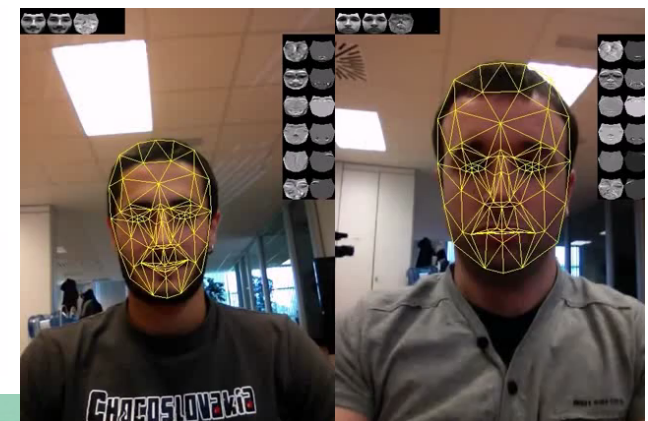
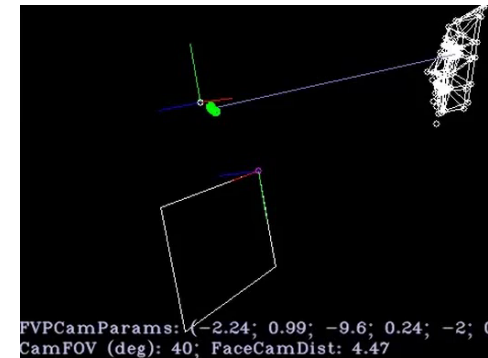
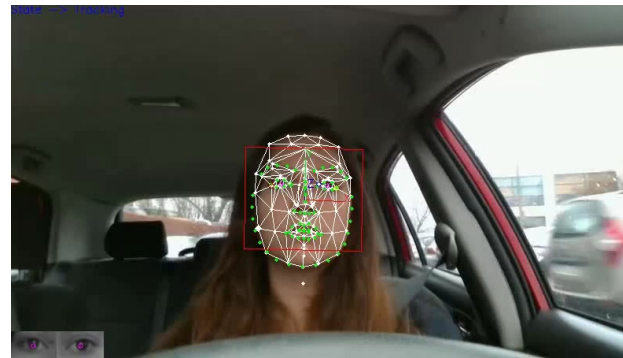
Data Generation **Inside Sensing**



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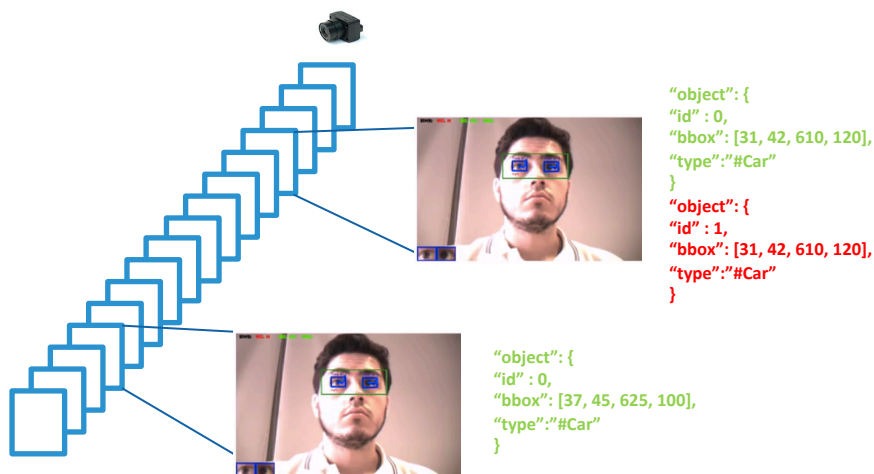
New ADAS Functionalities

Data Generation **Inside Sensing**

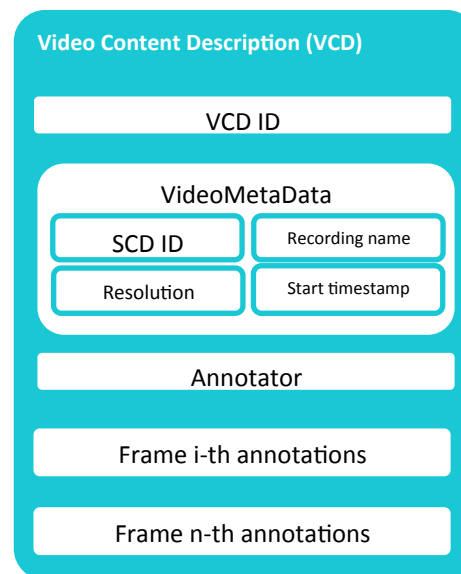


Data Pre-Processing: Video Content Description

Data Generation **Outside Sensing**



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Cloud Connection – Data Services



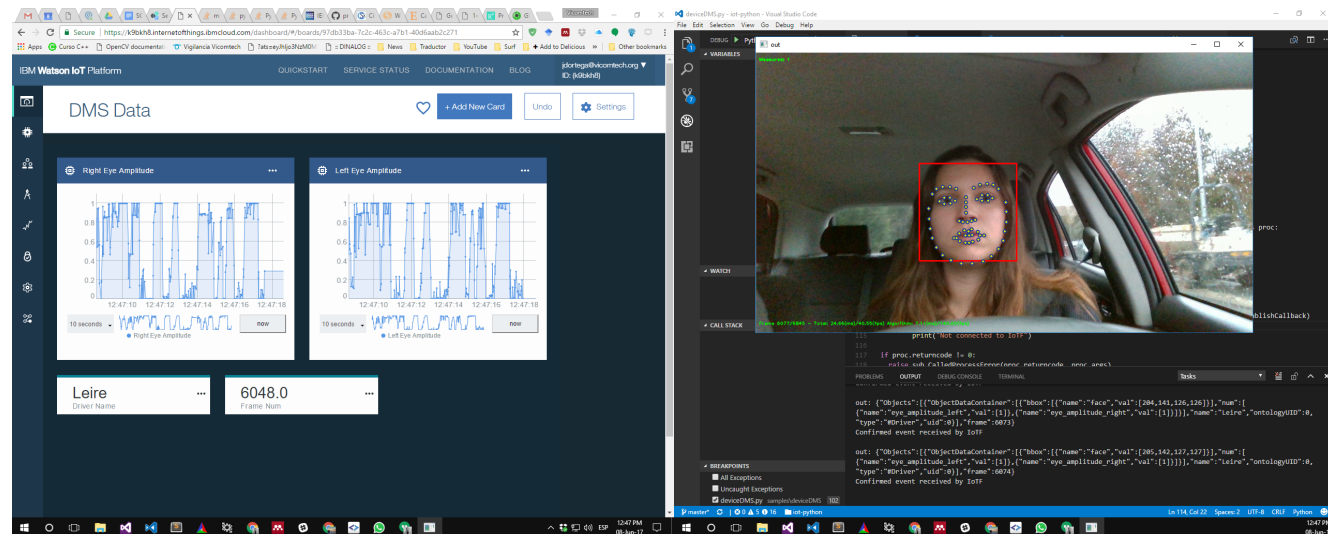
- Extract parameters and record driver status & maneuvers
- Analyse the driver behaviour
- Offer individual services
 - Training
 - Driver mode monitoring
 - Etc.



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Cloud Connection

- Data Storage
- Big Data Analysis
- ADAS Services





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THANK YOU!

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