Deliverable 6.4 Data for reaserch

Project Number:	690705
Classification	Confidential
Deliverable No.:	D6.4
Work Package(s):	WP 6
Milestone:	
Document Version:	Vs. 1
Issue Date:	2.10.2018
Document Timescale:	Project Start Date: September 1, 2016
Start of the Document:	Month 36
Final version due:	Month 36
Deliverable Overview:	D6.4. data for research
Compiled by:	Mohamed Cherif RAHAL, VED
Authors:	Fabio Tango, CRF Andrea Castellano, REL Jürgen Pichen, ULM Elsa Yousfi, VED Mohamed Cherif RAHAL, VED Maximilian Graf, ULM

Technical Approval:	Fabio Tango, CRF
Issue Authorisation:	Andreas Lüdtke, OFF

DISTRIBUTION LIST		
Copy type[1]	Company and Location	Recipient
T	AutoMate Consortium	all AutoMate Partners

[1] Copy types: E=Email, C=Controlled copy (paper), D=electronic copy on Disk or other medium, T=Team site (Sharepoint)

RECORD OF REVISION		
Date	Status Description	Author
1.10.2019	Structure of the document	MCR
4.10.2019	Inputs REL and CRF	FT AC
8.10.2019	Inputs VED	EY MCR
8.10.2019	Inputs ULM	MG
8.10.2019	Final version. Submission	MCR

Table of Contents

List of tables

Aucune entrée de table d'illustration n'a été trouvée.

Executive Summary

This documents describes for each scenario and each cycle the data generated and uploaded for research community.

1. Introduction

The Automate project has generated an interesting amount of data during the three cycles on both simulators and cars.

This data will be available, for research purposes, on the website of the project under request and explanation of the desired usage.

2. Peter Scenario

2.1 ULM Simulator

Several experiments have been conducted in simulator 1 throughout the project and in different work packages. The experiments have been conducted with different participants which were recruited through different channels inside and outside the university. Therefore, there was a mixed sample in each experiment, where all participants had a valid driver´s license. Some of the participants were familiar with the driving simulator, nevertheless each participant had to go through the simulator familiarization at the beginning of the experiments. The data reported in this chapter include both subjective (questionnaires) and objective (simulator's logs) feedbacks.

2.1.1 Cycle 1

WP4 – Input modality V&V

This was the first experiment to investigate the different input modalities to initiate the overtaking maneuver in the Peter scenario. Three different interaction modalities (Gesture, Touch, Steering Wheel) were tested against each other on different aspects. This dataset is the summary of the collected data of 36 participants.

Table 1: WP4 input modality validation

Answer/label	Description
vpNr	Participant number
susX_Y	X=number of the SUS question; Y=condition
intuitive	Which condition was the most intuitive one; 1 = Touch, 2 = Natural, 3 = Gesture
angenehm	Which condition was the most pleasant one; 1 = Touch, 2 = Natural, 3 = Gesture
futuristisch	Which condition was the most futuristic one; 1 = Touch, 2 = Natural, 3 = Gesture
ablenkend	Which condition was the most distracting one; 1 = Touch, 2 = Natural, 3 = Gesture
geschlecht	Gender; 1 = male, 2 = female
alter	Age; number = age in years
haendigkeit	Dominant hand; 1 = right, 2 = left
muttersprache	Mother tongue; 1 = German, 6 = other (German was fluent)

2.1.2 Cycle 2

WP6 - First evaluation cycle

This experiment has been conducted at the driving simulator to test the first enabler integrated version of the simulator 1 demonstrator. The data of 26 participants was collected where each participant drove through both, the baseline and the TeamMate condition in the Peter scenario. There was a special focus of the gaze behavior, therefore the included dataset involves the gaze behavior as well as the subjective rating.

The description of the experiment and the results can be found in the Deliverable D6.2 "Results of Evaluation in the 2nd cycle".

Table 2: WP6 first evaluation - Peter scenario (subjective data)

Item/label	Description
VPN Nummer	1=Male; 2=Female
ÜM[X]	Overtake number; X = number of overtake within the track
Color	Blue = baseline, Red = TeamMate
SystemVerhalten	To which degree was the system behavior acceptable; 0-10 Likert Scale; 0 = Not acceptable at all, 10 = Totally acceptable
Kritikalität	How critical was the situation; 0-10 Likert Scale; 0 = not critical at all, 10 = Extremely critical
Trust	How much trust they had in the System; 0-100%; 0 = no trust at all, 100 = complete trust in the system
Kommentar	Comments from the participant (optional)

2.1.3 Cycle 3

WP6 - Final evaluation

This experiment has been conducted at driving simulator 1 to test the final integrated version of the simulator demonstrator in the Peter scenario with all integrated and updated enablers in their final state. 18 users participated in the final experiment. The dataset consists of two files, one the zip file of the simulator logs (see Table 3) and the other file is the subjective rating of both systems.

The description of the experiment and the results can be found in the Deliverable D6.3 "Results of Comparative Evaluation after 3rd cycle".

Table 3: WP6 Final Evaluation - PETER scenario (simulator's logs)

Data	Unit	Description
Messzeitpunkt	ms	Timestamp of the recording
Messzeitpunktfehler	ms	Timestamp error
steering angle	degree	Steering wheel angle

brake pedal	0 - 1	How much is the brake pedal pressed right now; 0 = not pressed at all, 1 = pressed to the maximum
speed[m/s]	m/s	Current speed
Y_acceleration[m/s*s]	m/s²	Current acceleration
world object looked at	enum	AOI currently looked at
eyelid opening	m	Eyelid opening recorded by SmartEye eyetracker
pupil diameter	m	Pupil diameter opening recorded by SmartEye eyetracker
pupil diameter filtered	m	Filtered pupil diameter opening recorded by SmartEye eyetracker
Streckenmeter auf dem Modul[m]	m	Distance meter on the test-track
steering wheel angle	degree	Steering wheel angle
indicator left pressed	boolean	Is the indicator pressed at the moment; 0 = no, 1 = yes
Module ID	enum	ID of the test-track module
Instance ID	enum	Instance of the module
Wheelposition	enum	Steering wheel angle
Brake pedal postion	0 - 1	How much is the brake pedal pressed right now; 0 = not pressed at all, 1 = pressed to the maximum
Automation on	boolean	Is the automation currently on; 0 = no, 1 = yes

Table 2: WP6 Final evaluation - Peter scenario (subjective data)

Answer/label	Description
Age	(Participants write their ages with exact numbers)
Gender	(1=Female; 2=Male)
Years/driving license	(1=<5; 2=5-10; 3=10-20; 4=>20)
Kms/year	(1=<5.000; 2=5.001-10.000; 3=10.001-15.000; 4=15.001-20.000; 5=20.001-25.000;6=>25.001;7: I don't know)
Driving frequency	(1=<once a month; 2=monthly; 3=many times per month;4=weekly;5=many times per week; 6=every day)
Acceptance	Van der Laan questionnaire (1-5 Likert Scale)
Trust	Koerber questionnaire (1-5 Likert Scale)
Workload	NASA-TLX (1-20 Scale)

Usability	SUS (1-5 Likert Scale)
Willingness to buy	Willingness to buy (1-5 Likert Scale)
Willingness to pay	Willingness to pay (in €, 1=0;2=10000;3=30000;4=40000;5=50000)
Comment	Open comments from the participant (optional)

2.2 ULM car

The evaluation of the implemented team mate functions on the Ulm demonstrator vehicle was done in the frame of the Peter scenario. In the very beginning of this scenario a slower leading vehicle is driving in front of the team mate car. In order to minimize the travel time, the automation intends to overtake its leader. Due to the limits of sensor capabilities, the car cannot trigger the maneuver by its own, since it is not guaranteed, that the opposite lane is free. Subsequently, the driver should provide this information to the automation.

The evaluation results are filled questionnaires, wherein the test persons give feedback of how well the overall system performed. E.g. the intuitiveness, trust and driving performance are taken into account. To evaluate each aspect of the integrated enablers sufficiently detailed, six drives for each test person were performed. The description of what was focused within each drive can be found in D6.3 and is therefore not explained in this document. Below there are some representative charts from the evaluation studies. The first example shows the trust of the test persons into the team mate system compared to the base line.

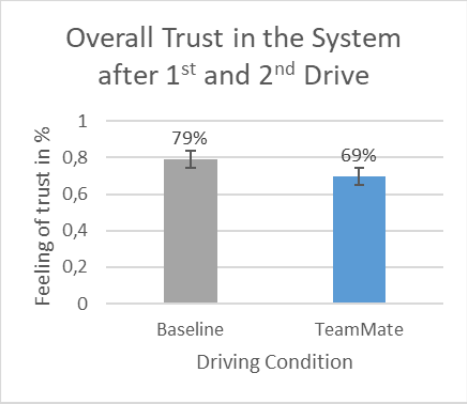

Chart 1

In the second chart the answers to several questions in concerns to system usability are listed.

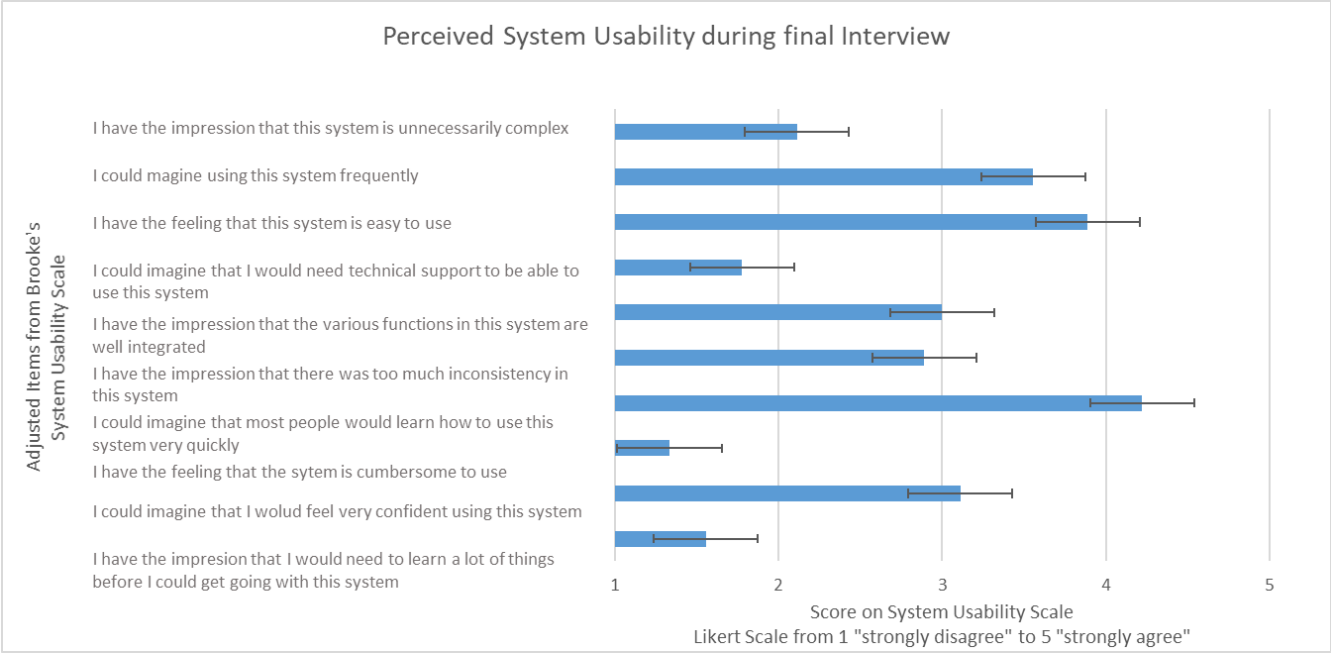

Chart 2

To also get information in concerns to potential market impact, the test persons were asked whether they are willing to pay for the system. The answers can be seen on the chart below.

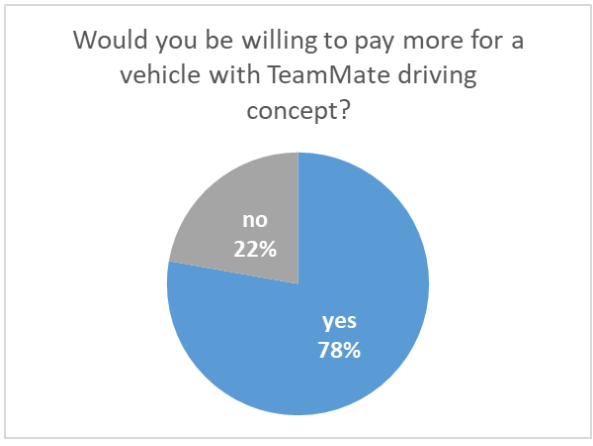

Chart 3

The shown examples are only a small part of the whole evaluation results. More data can be found within the official provided set of data.

3. EVA Scenario

3.1 REL Simulator

Several experiments have been conducted in simulator 2, both in V&V process (for WP4) and in evaluation cycles. The tests have been conducted with real users; depending on the aim of the experiment, a different sample and different type of users have been used (e.g. for validation tests a smaller user sample have been considered, for SDK validation only professional users – i.e. software developers – have been considered). Data reported in this chapter include both subjective (questionnaires) and objective (simulator's logs) feedbacks.

3.1.1 Cycle 1

WP4 - HMI V&V

This experiment related to this data, conducted with 10 users, has been conducted at driving simulator. The test has been used to validate the requirements from "REQ1.43" to "REQ1.57". 10 users have been involved in the validation. The test consisted in using the HMI in a generic driving scenario. Different HMI states (in different configurations, i.e. with and without ambient lights) were forced to simulate the conditions able to measure (with objective and subjective measures) the requirements previously defined.

The results are reported in the document "AutoMate_WP4 HMI Validation".

Table 1: WP4 HMI validation

Answer/label	Description
1	Correct or positive answer
0	Wrong or negative answer
With	With ambient lights
Without	Without ambient lights

3.1.2 Cycle 2

WP6 - First evaluation cycle

This experiment has been conducted at driving simulator to test the first integrated version of the simulator 2 demonstrator. 20 users have been involved in the experiment; each user repeated the test twice, in Baseline and in TeamMate Mode. The experiment, performed using EVA scenario, was focused on roundabouts, and in particular on distraction. The users encountered three roundabouts: at

roundabout 1 and 2, the car hesitated and, when the user was attentive, the "H2A support in perception" was activated to request a trigger to enter roundabout; at roundabout 3, the (simulated) car performed a request of take-over (in TeamMate mode, when the driver was distracted, the TOR was reinforced by haptic feedback on the seat).

In this test, both objective and subjective data has been collected.

The results are reported in the document "AutoMate_WP6 Evaluation_2nd cycle" and in the folder "AutoMate_WP6 Evaluation_2nd cycle_records".

Table 3: WP6 first evaluation - EVA scenario (subjective data)

Item/label	Description
Gender	1=Male; 2=Female
Qualification	0=primary school; 1=high school; 2=bachelor's degree; 3=master's degree; 4=Ph.D. or equivalent
Km/year	1=<5.000; 2=5.001/10.000; 3=10.001/20.000; 4=>20.000
Do you have ADAS?	1=false; 2=true
Frequency of use	1-7 Likert Scale
Acceptance	Van der Laan questionnaire (1-7 Likert Scale)
Trust	Koerber questionnaire (1-7 Likert Scale)
Workload	NASA-TLX (1-20 Scale)
WTB	Willingness to buy (1-7 Likert Scale)
WTP	Willingness to pay (in €)

Table 2: WP6 first evaluation - EVA scenario (simulator's logs)

Data	Unit	Description
Time	s	Timestamp of the recording
Speed/X	km/h	Speed on X axis
Speed/Y	km/h	Speed on Y axis
Actual Gear Ratio	enum	Current gear (in manual or automated)
Auto Mode	enum	Mode of automation
Brake Pedal force	daN	
CoG position/X	m	X position of the (simulated) vehicles' Center of Gravity
CoG position/Y	m	Y position of the (simulated) vehicles' Center of Gravity
CoG position/Z	mm	Z position of the (simulated) vehicles' Center of Gravity

CoG position/Roll	°	Roll of the (simulated) vehicles' Center of Gravity
CoG position/Pitch	°	Pitch of the (simulated) vehicles' Center of Gravity
CoG position/Yaw	°	Yaw of the (simulated) vehicles' Center of Gravity
Tangential speed	km/h	Linear velocity at any instant
Yaw speed	°/s	Yaw speed
Intersection ID	enum	ID of the intersection in the scenario
Lane ID	enum	ID of the lane in the scenario
Road ID	enum	ID of the road in the scenario
Steering wheel Angle	°	Angle of steering in real-time

3.1.3 Cycle 3

WP5 - SDK validation

This experiment has been conducted in a desktop experimental setup, to test the usability and the added value of the third-party SDK developed in the project.

As stated before, 5 professional users, i.e. software (in particular mobile app) developers have been involved in the test; they were company employees not involved in the project. The test consistent in performing a small exercise of development and read the documentation of the SDK.

The results are reported in the document "AutoMate_WP5 SDK". In the sheet, a detailed description of the

Table 4: WP5 SDK validation

Answer/label	Description
TAM	Technology Acceptance Model (1-7 Likert Scale)
SUS	System Usability Scale

WP6 - Final evaluation

This experiment has been conducted at driving simulator 2 to test the final integrated version of the simulator demonstrator in EVA scenario, including the enablers integrated in the last cycle (e.g. the Driver Intention Recognition). 20 users have been involved in the experiment; each user repeated the test twice, in Baseline and in TeamMate Mode. The main issue in this evaluation scenario were the roundabouts, with a special focus on the take-over request, on state-adaptive distributed HMI and on

human-like behavior in entering the roundabout. The users encountered three roundabouts per each scenario: at roundabout 1 and 2, in TeamMate Mode, the Driver Intention Recognition triggered the entering in the roundabout when detected the intention to enter; in the 3rd roundabout, while the users were distracted a take-over request appeared (in TeamMate mode, the TOR appeared also on the mobile app).

The detailed description of the use case and the test setup is reported in deliverable D6.3.

In this test, both objective and subjective data has been collected. The results are reported in the document "AutoMate_WP6 Evaluation_3rd cycle" and in the folder "AutoMate_WP6 Evaluation_3rd cycle_records".

Table 5: WP6 Final Evaluation - EVA scenario (simulator's logs)

Data	Unit	Description
Time	s	Timestamp of the recording
Speed/X	km/h	Speed on X axis
Speed/Y	km/h	Speed on Y axis
Actual Gear Ratio	enum	Current gear (in manual or automated)
Auto Mode	enum	Mode of automation
Brake Pedal force	daN	
CoG position/X	m	X position of the (simulated) vehicles' Center of Gravity
CoG position/Y	m	Y position of the (simulated) vehicles' Center of Gravity
CoG position/Z	mm	Z position of the (simulated) vehicles' Center of Gravity
CoG position/Roll	°	Roll of the (simulated) vehicles' Center of Gravity
CoG position/Pitch	°	Pitch of the (simulated) vehicles' Center of Gravity
CoG position/Yaw	°	Yaw of the (simulated) vehicles' Center of Gravity
Tangential speed	km/h	Linear velocity at any instant
Yaw speed	°/s	Yaw speed
Intersection ID	enum	ID of the intersection in the scenario
Lane ID	enum	ID of the lane in the scenario
Road ID	enum	ID of the road in the scenario
Steering wheel Angle	°	Angle of steering in real-time

Table 6: WP6 Final Evaluation - EVA scenario (subjective data)

Answer/label	Description

Age	(1=18-26; 2=27-35; 3=36-44; 4=>45)
Gender	(1=Male; 2=Female)
Years/d. license	(1=<5; 2=5-10; 3=10-20; 4=>20)
Kms/year	(1=<5.000; 2=5.001-15.000; 3=15.001-25.000; 4=>25.001)
Driving frequency	(1=one a month; 2=once a week; 3=3-4 times per week; 4=every day)
Acceptance	Van der Laan questionnaire (1-5 Likert Scale)
Trust	Koerber questionnaire (1-5 Likert Scale)
Workload	NASA-TLX (1-20 Scale)
WTB	Willingness to buy (1-5 Likert Scale)
WTP	Willingness to pay (in €)

3.2 CRF Car

3.2.1 Cycle 3

The TeamMate (TM) car 3 has addressed the Eva scenario, which is described as follows: “A TeamMate Car is driving through a complex roundabout with different traffic and driving status conditions”. In particular, we have considered the type of support “Human To Automation” (H2A), with two different modes: cooperation in perception and in action. On CRF demonstrator, we took into account these two kinds of support: H2A support in perception and H2A support in action. For more details, the interested reader can see D1.3, D1.5 and D6.3.

In particular, the experiment with demonstrator 3 aimed at testing the final integrated version of all enablers developed in WPs2-4 and necessary for the implementation of EVA scenario (e.g. the Driver Monitoring System, Multi-modal HMI, etc.). Twenty (20) users have been involved in the experiment; each user repeated the test twice, in Baseline and in TeamMate Mode. The main issue to be investigate in this evaluation scenario was the behaviour at roundabouts, with a special focus on the sharing control, on state-adaptive distributed HMI and on safe behavior in entering the roundabout. The users encountered twenty-three (23) roundabouts per each scenario; in particular, in two of these the subject is asked to perform a secondary task to trigger the driver distraction classification and thus activate different HMI channels and modalities (in TeamMate mode, the request for take lateral control in the shared control appeared also on the mobile app).

The detailed description of the use case and the test setup, as well as of main subjective and objective results, is reported in deliverable D6.3.

In this test, both objective and subjective data has been collected. The results are reported in the document “AutoMate_WP6 Evaluation_3rd cycle” and in the folder “AutoMate_WP6 Evaluation_3rd cycle_records”.

In the following tables, the data collected by the vehicle tests and by the user’s questionnaires are reported.

Table 6: WP6 Final Evaluation - EVA scenario (vehicle logs)

Signal Name	Unit	Description	Meaning

Vehicle Data			
BrakeInterventionSts_t65	#[2]	Status of brake actuator.	[0,1], where 0 = not pressed; 1=pressed
VehicleSpeedVSOSig_t67	km/h	Vehicle speed.	Longitudinal direction
LatAcceleration_BSM_t69	m/s^2	Lateral acceleration.	From CAN C2 vehicle
LongAcceleration_BSM_t71	m/s^2	Longitudinal acceleration.	From CAN C2 vehicle
LwsAngle_t77	Deg	Steering angle.	---
LwsSpeed_t78	Deg/s	Speed of steering angle.	Variation in time
YawRate_BSM_t74	Deg/s	Yaw rate.	
Lane_Model_C0_t33	m	Left Line distance.	Negative value
Lane_Model_C0_t42	m	Right Line distance.	Positive value
Lane_Type_t36	#	Type of left line.	[1 2 3 4 5 15=Invalid], where: 1=Solid; 2=Road Edge; 3=Dashed; 4=Double Line; 5=Dot; 15=Invalid]
Lane_Type_t45	#	Type of right line.	Idem
time[3]	s	Time of signals.	See the footnote
Obstacle Data			
ObstaclePosX_t22	m	Position along Ox for closest obstacle (ACC obstacle).	Longitudinal distance (computed from front bumper middle point)
ObstaclePosY_t23	m	Position along Oy for closest obstacle (ACC obstacle).	Lateral distance (computed from front bumper middle point)
ObstacleRelVelX	m/s	Leader's relative speed.	
ObstacleVelX_t17	m/s	Obstacle absolute X velocity.	
ObstacleVelY_t18	m/s	Obstacle absolute Y velocity.	
ObstacleType_t25	#	Type of obstacle.	[0 1], where 0=Vehicle; 1=Truck
HMI Data			
StatusFSM_Automate_t15	#	Output of AutoMate Finite State Machine/Diagram.	[0 1 2 3], where: 0=Manual Mode (MM); 1=Automatic Mode (AM); 2=Control Sharing (CS); 3=Minimum Risk Maneuver (MRM)[4]
RoundBoundApproachingSt_t12	#	Closer Round Bound approaching warning detected.	[0 1], where: 0=Not present; 1=Roundabout approaching
RoundBoundCrossingSt	#	Round Bound in crossing status.	[0 1], where: 0=Not present; 1=Round Bound crossing

[2] The symbol "#" means *enum*.

[3] The last part of each signal name indicates the time corresponding to that specific variable. So, for example, let's consider the signal "`VehicleSpeedVSOSig_t67`": the last part indicates that the time for the variable *vehicle speed* has the name "`t67`". This is applied to all signals of the table.

[4] In case of demonstrator vehicle 3, the MRM is a *Safety Stop*.

RoundBoundWarningSignReachedSt	#	Round Bound warning signal reached by the car.	[0 1], where: 0=Not present; 1=Roundabout reached
AttentionState	#	Driver Attention level.	[0 1 2 3 4], where: 0=Unavailable; 1=Attentive; 2=Mid attention; 3=Low attention; 4=Distracted
DrowsinessState	#	Drowsiness State.	[0 1 2 3 4], where: 0=Unavailable; 1=Alert; 2=Slightly Drowsy, 3=Drowsy, 4=Sleepy

Table 7: WP6 Final Evaluation - EVA scenario (subjective data from vehicle)

Answer/label	Description
Age	(1=18-26; 2=27-35; 3=36-44; 4=>45)
Gender	(1=Male; 2=Female)
Years/d. license	(1=<5; 2=5-10; 3=10-20; 4=>20)
Kms/year	(1=<5.000; 2=5.001-15.000; 3=15.001-25.000; 4=>25.001)
Driving frequency	(1=one a month; 2=once a week; 3=3-4 times per week; 4=every day)
Acceptance	Van der Laan questionnaire (1-5 Likert Scale)
Trust	Koerber questionnaire (1-5 Likert Scale)
Workload	NASA-TLX (1-20 Scale)
WTB	Willingness to buy (1-5 Likert Scale)
WTP	Willingness to pay (in €)

4. MARTHA Scenario

MARTHA scenario was tested in VED demonstrators. During cycle 2, two experiments were conducted in the driving simulator. During cycle 3, one experiment was conducted in the driving simulator and one experiment was conducted in the vehicle platform. An aditionnal evaluation of the enablers develloped in the AutoMate project was conducted in the vehicle platform during the demo of the final event.

4.1 VED Simulator

4.1.1 Cycle 2

During cycle 2, two experiment were conducted in VED driving simulator. Each experiment focused on a different use case called “roadworks zone” and “distracted-driver”.

The first study encompasses two experimental conditions (BaseLine and TeamMate) associated with two driving scenarios described in detail in deliverable 6.2. A brief description of those scenarios is proposed below:

BaseLine: The driver is in manual mode. The automated mode activation is proposed. After activation of the automated mode, the driver is free to engage in non-driving-related tasks. When the distance to a roadworks zone located on the road is below 200 meters, the system issues a takeover request.

TeamMate: The driver is in manual mode. The automated mode activation is proposed. After activation of the automated mode, the driver is free to engage in non-driving-related tasks When the distance to a roadworks zone located on the road is below 1 kilometer, the system issues a takeover request.

The Table 1 describes the data of this experiment presented in the file « DataRoadwork2018 ».

Table 1: WP 6 - Cycle 2 evaluation - MARTHA scenario - Roadworks zone use-case.

Variable	**Description**
Participant	Participant identification number
Condition	Experimental condition: BaseLine or TeamMate
Age	Age of the participant (year)
Sexe	Sexe of the participant (H = male : F = female)
DrivingExperience	Driving experience of the participant (year)
KmDrivenPerYear	Kilometers driven per year for each participant (Km)
DistanceDrivenLAstWeek	Distance driven by the participant the week before the experiment (Km)
DrivePerWeek	Frequency of driving activity in a regular week
BaseLineConditionOrder	Order of completiono f the driving scenario during the experiment (A = BaseLine first ; B = TeamMAte first)
MinTTC	Minimum time to collision with the roadwork zone (seconds). MEasured from the manual takeover to the lane change to avoid the roadworkzone
Usefullness	Results from the acceptance questionnaire (from -2 to 2)
Satisfaction	

MentalDemand	Results from the workload questionnaire (from 0 to 100)
PhysicalDemand	
TemporalDemand	
Performance	
Effort	
Frustration	
Reliability	Results from the trust questionnaire (from 1 to 5)
Predictability	
Familiarity	
IntentionOfDevelopers	
PropensityToTrust	
TrustInAutomation	
Trust	
WillingnessToBuy	Results from the willingness to buy questionnaire (from 1 to 5)
WillingnessToPay	Results from the willingness to pay questionnaire (from 1 to 5)
Usability	Results from the usability questionnaire (from 0 to 100)

The second study encompasses three experimental conditions associated with three driving scenarios described in details in deliverable 6.2. A brief description of those scenarios is proposed below:

BaseLine: the participant is driving in manual mode and receives an eMail and starts to read it. The vehicle followed brakes and decreases suddenly the time to collision between the two vehicles.

Propose: the participant is driving in manual mode and receives an eMail and starts to read it. The driver monitoring system (DMS) detects that the driver is distracted and suggests him to activate automated mode. The vehicle followed brakes and decreases suddenly the time to collision between the two vehicles.

Force: the participant is driving in manual mode and receives an eMail and starts to read it. The driver monitoring system (DMS) detects that the driver is distracted and automatically activates automated mode. The vehicle followed brakes and decreases suddenly the time to collision between the two vehicles.

The Table 2 describes the data of this experiment presented in the file « DataDistractedDriver2018 ».

Table 2:WP 6 - Cycle 2 evaluation - MARTHA scenario – Distracted driver use-case.

Variable	Description
P	Participant identification number
Condition	Experimental condition: manual or force or propose
NombreSortieVoie	Number (count) of lane exceendance during the non-driving-related task (eMail reading)
TimeOxposedtoTTC4	Time (seconds) exposed to a time to collision inferior to 4 seconds (with the followed vehicle)
WillingnessToBuy	Willingness to buy the DMS and the automated driving system (from 1 to 5)
WillingnessToPay	Willingness to pay for the DMS and the automated driving system (from 0 to 50000)
Usefulness	Results of acceptance questionnaire (from -2 to 2)
Satisfaction	

4.1.2 Cycle 3

The study carried-out during cycle 3 in the driving simulator encompasses two experimental conditions associated to two driving scenarios described in details in deliverable 6.3. A brief description of those scenarios is proposed below:

BaseLine : The driver is in manual mode. The automated mode activation is proposed. After activation of the automated mode, the driver is free to engage in non-driving-related tasks. When the distance to a roadworks zone located on the road is below 40 meters, the system issues a takeover request.

TeamMate : The driver is in manual mode. The automated mode activation s proposed. After activation of the automated mode, the driver is free to engage in non-driving-related task. When the distance to a roadworks zone located on the road is below 500 meters, the system notifies the driver with a vocal and a visual message to get ready to takeover manual driving bcause of a roadwork zone. When the distance to the roadwork is below 120 meters, the system issues a takeover request.

The Table 3 describes the data from this experiment presented in the file « DataRoadwork2019 ».

Table 3: WP 6 - Cycle 3 evaluation - MARTHA scenario - Roadworks zone use-case.

Variable	Description
Participant	Participant identification number
Condition	Experimental condition: BaseLine or TeamMAte

Usefulness	Rasults from the acceptance questionnaire
Satisfaction	
Acceptance	
Reliability	Result from the trust questionnaire (from 0 to 5)
Understanding	
Familiarity	
Intention of developers	
Propensity to trust	
Trust in automation	
OverallTrust	
Usability	Result from the usability questionnaire (from 0 to 100)
MentalDemand	Result from the workload questionnaire (from 0 to 100)
PhysicalDemand	
TemporalDemand	
Performance	
Effort	
Frustration	
WillingnessToBuy	Results from the willingness to buy questionnaire rated from 0 to 5
WillingnessToPay	Results from the willingness to pay questionnaire rated from 0 to 5
MinimumTTC	Minimum time to collision with the roadwork zone in seconds. Measured from the takeover request to the lane change to avoid the roadwork zone.

4.2 VED Car

4.2.1 Cycle 3

As described in detail in D6.3, the experiment conducted in the driving simulator for the 3rd cycle of evaluation was replicated in the vehicle platform on a test-track. The Table 3 describes the data in the file “DataRoadWork2019VehiclePlatform”.

4.2.2 Final demo evaluation

This evaluation was carried-out during the demo of the project final event. The evaluation of the TeamMate system and of each enabler was done with questionnaires filled by the passive passenger

who attended the demo. In this demo, the driver of the TeamMate car is in manual mode when encountering a slower vehicle. The intention recognition function learnt that the driver is willing to overtake. The online risk assessment evaluates the maneuver and communicates through the Augmented Reality HMI and informs when it is safe to overtake. Afterwards, the driver looks for information on his/her iPad, therefore the DMS detects that the distracted, and the automated mode activation is suggested. The drievr activates the automated mode and can engage in non-driving related tasks. Thanks to V2I communication, TeamMate detects in advance an upcoming roadwork zone and asks the driver to overtake manually. The early takeover request allows a comfortable manual takeover and a safe avoidance of the roadwork zone.

The Table 4 describes the data of this experiment presented in the file “DataEvaluationFinalEvent”.

Table 4: Final event evaluation - MARTHA scenario.

Variable	**Description**
Participant	Participant identification number
Age	Particpant’s age
Gender	Participant’s gender : M = male : F = female
Profession	Participant’s occupation
Country	Participant’s country
Driving Experience	Participant’s driving experience in year
AV Knowledge	Knowlegde of automated driving from 1 (low) to 5 (high)
DMS	Driver monitoring system satisfaction (Likert scale from 1 to 5)
Visual HMI	Visual HMI satisfaction (Likert scale from 1 to 5)
Audio HMI	Audio HMI satisfaction (Likert scale from 1 to 5)
DIT	Driver intention detection satisfaction (Likert scale from 1 to 5)
V2I	Vehicle to infrastructure communication system satisfaction (Likert scale from 1 to 5)
ARG	Augmented reality glasses (Likert scale from 1 to 5)
Usefulness	Results from the acceptance questionnaire (from -2 to 2)
Satisfaction	
Acceptance	
Usability	Results from the trust questionnaire (from 0 to 5)
Reliability	
Understanding	
Familiarity	

Intention of developers	
Propensity to trust	
Trust in automation	
Overall Trust	