CARRS-Q

ADS Driving Simulator

Simulator Video Control Software

Last Update: **16. September 2019**
optimised for Study: 1811

This Software is written at CARRS-Q to run
research studies for automated driving vehicles,
with focus on AES Level 3.
Questions regarding the research to:

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Publications using this Software:

2018:
https://dl.acm.org/citation.cfm?doid=3239092.3267418

2019:
https://doi.org/10.1145/3342197.3344533

Table of Content

Checklist

Non stationary devices (Pack list)

- ☐ Android Mobile with CARRS-Q ADS Simulator app installed
- ☐ iPhone with installed abc iview app
- ☐ HDMI to USB-3 Video Capturing Card
- ☐ Notebook with HDMI output
- ☐ Philips Night Vision Camera
- ☐ BioPac Licence USB-Key

Changes in Sim-Environment (need to be undone)

- ☐ Sound-card at Visual Centre
- ☐ Remove HDMI-USB-Device
- ☐ Sound Settings
- ☐ 2nd Display at Supervisor Computer
- ☐ Remove Camera and camera mounting extension
- ☐ Remove mobile phone in vehicle

Collections (Recheck for each collection trial)

Continuous (before closing the vehicle door until open it again)

- ☐ BioPac ECG, EMG and EDA
- ☐ Philips Night Vision Camera

Started / activated for each recording

- ☐ Seeing Machine Eye-tracker
- ☐ Sync Protocol (need to be activated in Software)

Questionnaire and Interview

- ☐ Demographic Questionnaire (beginning)
- ☐ Self-Assessment Manikin (SAM)(after each research drive)
- ☐ Semistructured Interview (At the complete End)

Checklist

Important Requirements (mandatory)

!

- ☐ Describe the ethics and let them sign
- ☐ Safety instruction (see checklist)
- ☐ Participant is belted
- ☐ Motion Sickness Tests (at least 2x, after fam. and after the last drive)
- ☐ Simulator Protocol for each Participant

Scenario Settings

☐ Late Hazard (Cut-in Vehicle)

Project: cutin
TOR: 00:12:50:833 (hh:mm:ss:ms)
Display pos: ARC Linkage
Volume Control: Master: Ambient: Warning:

☐ Early Hazard (Pedestrian with Bicycle)

Project: cyclist
TOR: 00:13:03:817 (hh:mm:ss:ms)
Display pos: ARC Linkage
Volume Control: Master: Ambient: Warning:

☐ Early and Late Hazard (Pedestrian + Reverse Car)

Project: pr
TOR: 00:13:37:067 (hh:mm:ss:ms)
Display pos: ARC Linkage
Volume Control: Master: Ambient: Warning:

Checklist

Preparation

- ☐ Start Simulator (see Simulator Guideline)
- ☐ Plug the Second display to Supervisor PC (Just Display Cable)
- ☐ Connect USB 3.0 HDMI Input Device to Visual Centre (bottom USB)
- ☐ Connect USB Audio to Visual Centre and plug car sound to it (top USB)
    - ☐ green to FL/FR
    - ☐ black to SL/SR
- ☐ Start Simulator CDN Server on Supervisor PC
- ☐ Start ADS Driving Simulator on Supervisor PC
    - ☐ check if projects available
    - ☐ select scenario
- ☐ Start Nodes / Slaves (Visuals)
- ☐ Install Philips Night-vision Camera in the Vehicle, turn on and power
    - ☐ Check if Date, Time and Settings are correctly set at Camera
- ☐ Install GPS Mobile Phone in Vehicle, start app and press connect
    - ☐ check Settings
        - ☐ brightness (on darkest state)
        - ☐ connected to Simulator Wifi
        - ☐ on complete loud (audio)
    - ☐ power phone
- ☐ Put Entertainment Mobile Phone in Vehicle (iPhone)
    - ☐ check Settings
        - ☐ brightness is on auto
        - ☐ connected to QUT Wifi
        - ☐ the sound is on full
    - ☐ power phone
- ☐ Start Notebook and test HDMI Image in simulator
- ☐ Remote to Seeing Machine Computer
- ☐ Place Windshield Display to position
- ☐ Fresh water and Mints in the Car

Participant User Story

Before

- [ ] Recruiting over QUT
- [ ] Send Ethic Information Sheet in advance
- [ ] Request to choose a video over 1.5 hours

On Study date

- [ ] Welcome
  - [ ] Collect signed! Ethics
  - [ ] Answer all Questions according to Ethics
- [ ] Introduction about Study (Script)
- [ ] Let Participant sit in Vehicle
  - [ ] Adjust Seat together (check with Seeing machine)
  - [ ] Safety Introduction
- [ ] Let Participant sit in Prep room
  - [ ] Demographic Questionnaire + let give RO Video Content
  - [ ] Attach BioPac and Test
- [ ] Back at Vehicle
  - [ ] Introduce Shadow drive and train
  - [ ] Familiarisation drive (including TOR and Shadow Drive)
  - [ ] 1. Motion Sickness Questionnaire
- [ ] Research Drive 1, 2, 3 (repeat all steps for each drive)
  - [ ] Research Drive
  - [ ] SAM
  - [ ] Ask if they like to have a 5 min break | good to continue
- [ ] 2. Motion Sickness Questionnaire
- [ ] Semistructered Interview (can be parallel with the next point)
- [ ] Clean Up BioPac
- [ ] Farewell (bring to door)

Research Officer User Story (study day)

Before Participant arrives

- [ ] Setup everything as described in Preparation Checklist
- [ ] Check / Test
  - [ ] IR-Sensors visible on camera (If not Debugging -> Sync Server)
  - [ ] Sound signal in BioPac
  - [ ] Moving Platform
  - [ ] Mobile Phone TOR
  - [ ] SeeingMachine SSD has enough storage left
  - [ ] Video Camera has enough storage left
  - [ ] Second Mobile phone connected to QUT Wifi
  - [ ] Participant-Code in Control Software and SeeingMachine

End of Day

- [ ] Collect data
- [ ] Make all changes reverse and shut down everything

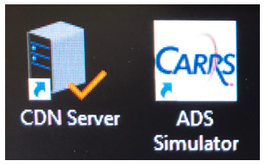
Main Simulator

CARRS-Q's ADS Driving Simulator is a Control-Software for managing the Video-playback in their Advanced Driving Simulator. This is extended with features, like displaying experimental interfaces, Sensor Synchronisation and mobile Simulator with Oculus Rift.

Setup the Simulator (before Participant arrives)

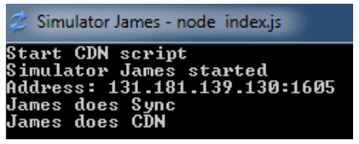
The Advanced Driving Simulator get started as normal. Setup-manual is provided in the control room.

Start Software Setup



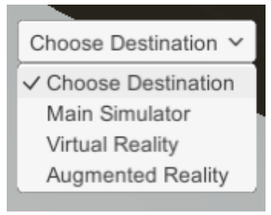
Before you start the simulator, ensure that all the computers are turned on as described in the Setup-Manual provided from for the Environment. We are starting at **Supervisor-Computer**.

After that, start at first „**CDN Server**", which opens a Terminal Window. Keep this window open all the time. You can minimize it, if it feels disturbing for you.



After that start „ADS Simulator".

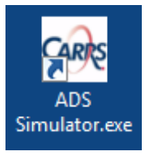
Start Master Server



The Software is written for more Environments. In this Case, we are using it in the **Main Simulator**, which need to be chosen at first.
The Log in the bottom should now display: „Destination Main Simulator".

After this, the Cluster-Nodes are able to reach the Control-Server, but not before.

Start Nodes



Now, you can start the Nodes. To reach all the nodes, press with „**strg**" + „**~**" at the KVM-Computer and use the **arrows** to switch through the computers. If you reached your destination, press „**ESC**" to exit the KVM-Switching mode and get full control of the Computer. Now you just need open „ADS Simulator".
In the console of the Control-Software, will bis displayed every connected node with a message.

Start-up ADS Driving Simulator Cluster Mobile

For running the GPS and TOR indicator in the vehicle, the Android-device should be started as well. This requires just open the App and attach the device in the mount in the vehicle and power it. After pressing connect, in the Control Software should appear the Message, new Mobile Device has been connected.

Consider:

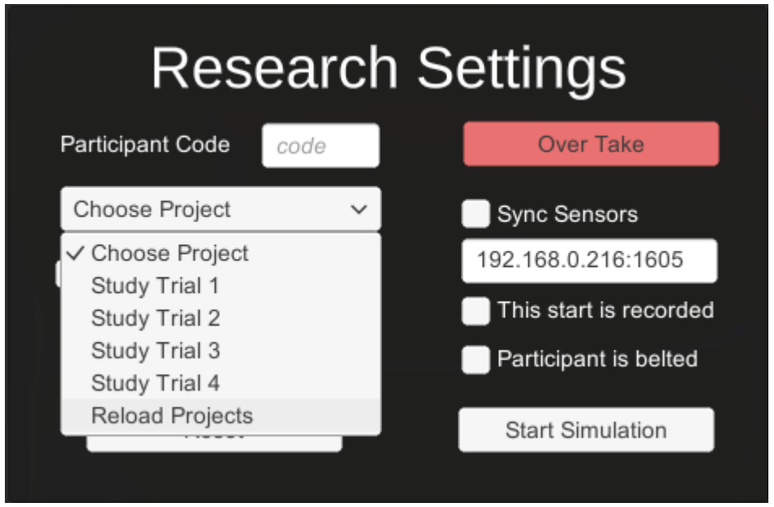
! Use most darken light settings and volume on high of device and mount it horizontally. It is recommended to power the phone

Research Settings

At first, choose the scenario. To change a predefined scenario, it is important that the CDN is active. If not, you need to start it now and choose „Reload Projects".

Now your Project should be displayed. A new scenario need to be downloaded by all nodes. Depending on the file-size and the count of nodes, this can take a couple of minutes. All nodes are ready, if the screens are changing to black or displaying the first image of the video.

Now you should write already the Participant-Code of your study in the Field in top, enter a TOR time (hh:mm:ss:msms, h=hours, m=minutes and so on).

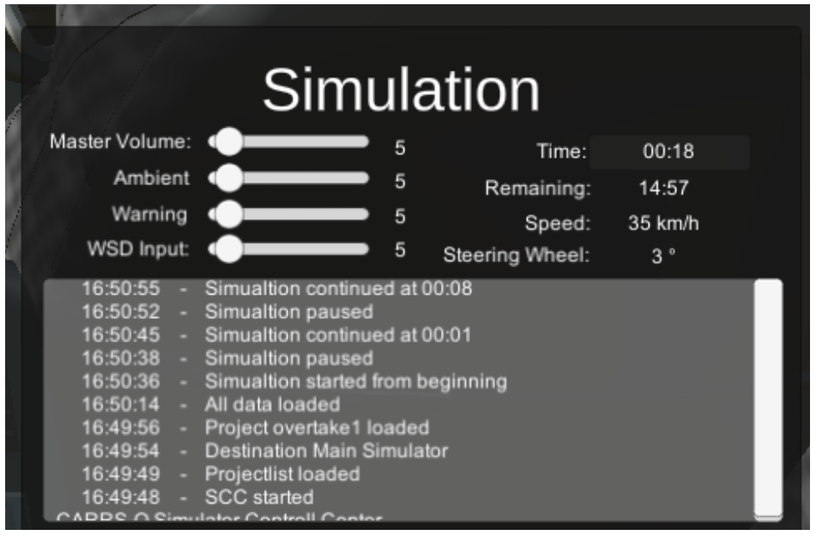


Important:

! Check before each drive, that the correct **TOR-time** is **set** and the „**this start is recorded**" is **checked**

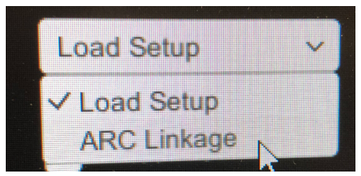
Simulation Settings

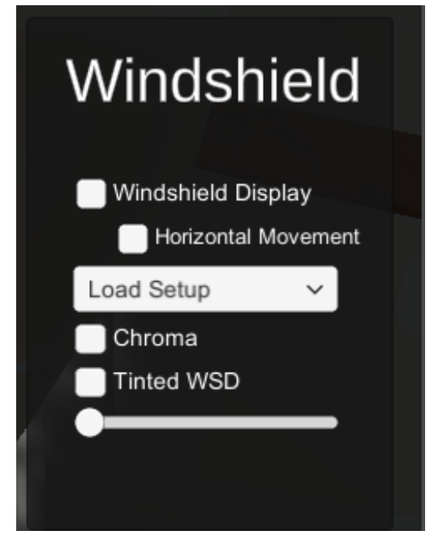
Simulation settings gives you audio-control over the scenario. Make sure, that every participant has the same Volume Settings.
If something doesn't work, check the Log.



Windshield Settings

To activate the Windshield, you just need to check the Box „Windshield Display". Make sure, before the participant arrives, you have checked, that the Windshield works and you have sound in the vehicle.
Load the Setup via the Dropdown „**ARC Linkage**" and check, that the position is changed.





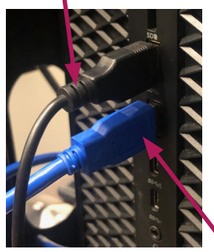
Sound in Vehicle

This Software-Setup has an other sound setup as the default configuration of the Simulator. You need to **plug** the external **USB-Soundcard** to „**Visual Centre**“.

At the back of „**Simulation**“ are plugged two audio-chinch-plugs, which need to be plugged into the USB-Card.

Green to **FL/FR** and black to **SL/SR**

Windshield-Display

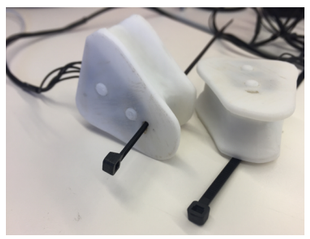


The content of the Windshield-Display is independent form the Simulation software. The input is controlled over an HDMI-to-USB device, which need to be plugged with **USB** to „**Visual Centre**“ too.

Connect the WSD-Content Computer to **HDMI**.

Consider:
The USB device need to be in **bottom as displayed** in the image (Workaround for a pending bug).

Bluetooth Vehicle Remote Controls

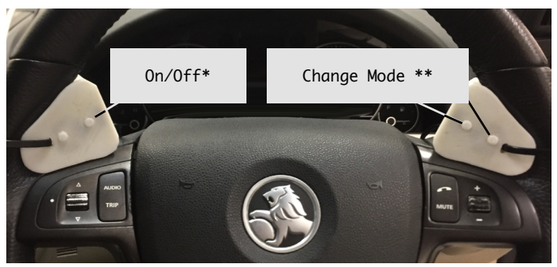


Not in use, in this study

At first, prepare the controllers housing cable ties and fix them to the steering wheel.

Insert batteries and fix the bluetooth transmitter at the bottom of the steering wheel, but be careful, that the cables **do not block the rotation of the steering wheel** and it is „invisible“ (at the back) for the participant.

After the Controller is connected, switch to GamePad Mode.



* long press until blue led at transmitter starts blinking fast
** Hold Mode (left) + C (right) to change in GamePad-Mode

Seeing Machine Eye-Tracker

Attach the Seeing-Machine device behind the Steering-Wheel (Behind the On/Off and Mode label). Ensure, that it has the calibrated angle (written at the Whiteboard). If not readjust it.
The plugs for the device are in the place to keep under the steering wheel.
Ensure, that the device is running and the Participant Camera in the control room (You see the IR-headlights flickering).

The device is fixed for this study.
Do not re adjust

After that open at Super-Visor Computer Remote Desktop-Connection and open Connection DMS and prepare the recording.

Note:

Now you should see the hidden IR-Sync-Lights attached to the sun visors. If you send now a test-signal from the Simulation-Software, you should see the LEDs flickering.

Important:

Seeing Machine is our business partner and the device is not published. Make sure, that the device has never been photographed.

Mobile Phone

Before you put the mobile phone in the vehicle ensure the settings:

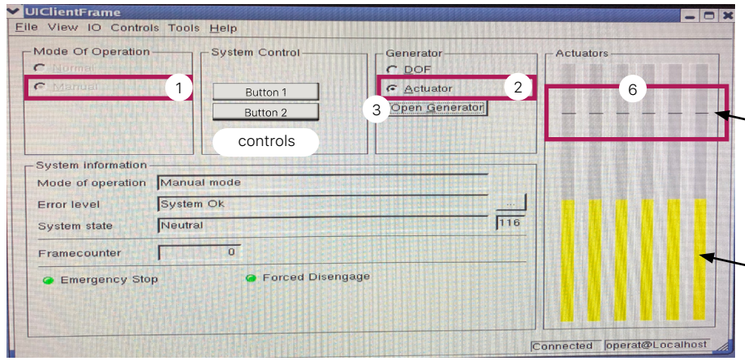
1. On Full Volume
2. Lowest Brightness
3. Connected with Simulator WiFi

After that, plug power and fix it in the mount.

In the last step, click connect and wait until the message confirms, that it is connected.

Moving Platform

To configure the following, you need to have the Simulator Operator Training!
The moving platform will be controlled manually. The motion-computer will be controlled remotely over the KVM. It is controlled with separate mouse (white).



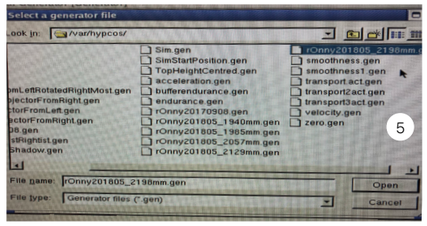
future state

current state

Important:

! While preparing the moving platform, the platform is in System Control in „**Settled**“, important **NOT** „**Engaged**“

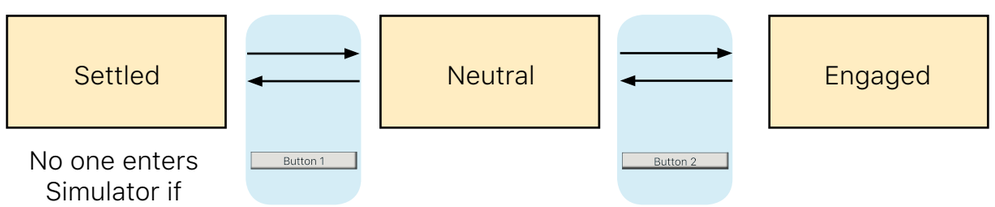
Preparing Moving Platform



1. Mode of Operation from Normal to **Manual**
2. Generator from DOF to **Actuator**
3. Open Generator
4. Load from File (no image of this window)
5. Select file „**rOnny201805_2198.gen**“ (**Do not load an other file!!!**)
6. Compare actuators with Image (black lines indicate future pos., yellow current)

Lift Moving Platform

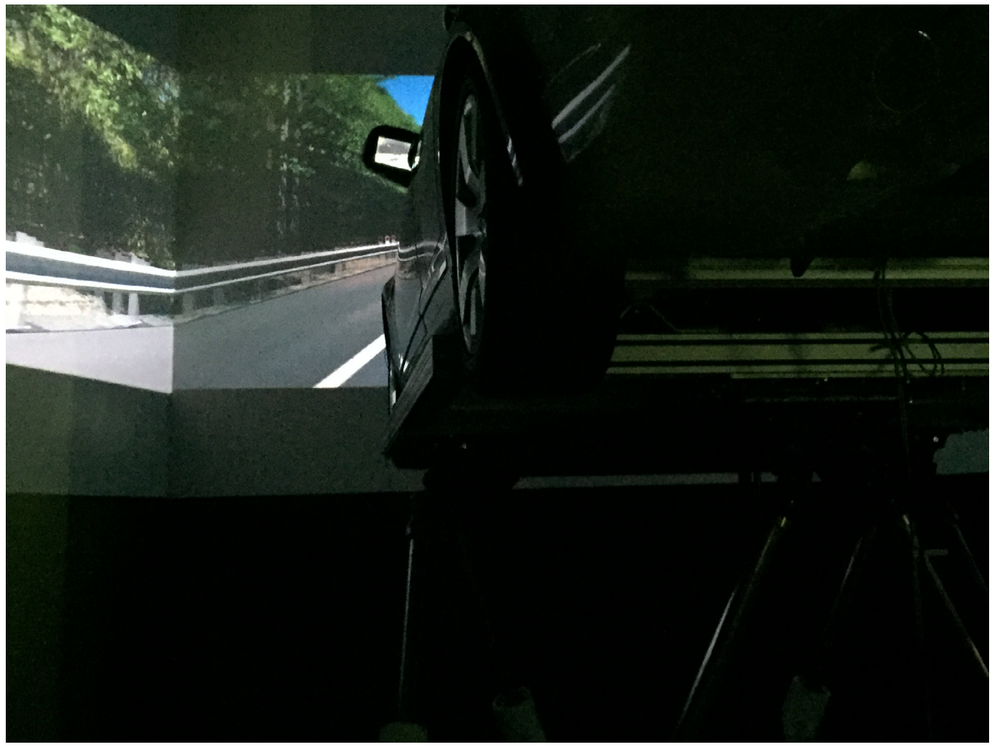
Lifting up and down will **exclusively** controlled over the „System Control“ area. Before you can bring the platform in the selected position, you need to bring them at first in the neutral position. Follow these steps:



! No one enters Simulator if not Settled

Important:

! If the moving platform is not moving, check at first all the security precautions. Read the messages in the acknowledge window.
If the participant is not belted, the platform will not move as well.



Main Simulator

Video recording (Philips VTR 8200)

Mount and Unmount in Vehicle

The camera is fixed at the passengers door (Image 1). Between camera and mount is an additional shoe (See Image). This shoe stays in the car if you remove the camera temporary for data collection. Just remove it the end of the day.

- Do not readjust the screw
- Be careful if you need to remove the shoe
    - you need to lift at first the rubber as displayed (Image 2)
    - after that you are able to press the two bottom parts together (Image 3)
    - now you can lift it vertically
- If you need to remove the camera temporary, just lift it up, as it is displayed in Image 4.

Setup Camera for Study

1. Before mounting the camera in the vehicle, check if the Settings are correct, especially Date and Time. (Date and Time gets lost, if battery is Empty)
2. Check if Card is empty (16GB ~ 22h)
3. Power camera
4. Turn on
5. Test if remote works

Consider:

! If you remove the camera temporary, just **lift the camera vertically**, as described in Image 4.

Consider:

! If the remote does not response, it may need to pared new. For this turn the camera on and off. After that hold the menue-button until a white light blinks in top of the camera. Then press power at the remote.

Consider:

! The recording Button on the remote is at the bottom. You can't control the camera from the simulator room!

Video recording Settings

That we can easily compare later the videos, we need to have them in the same settings. The Settings are for this study are.

First Tab (Audio)
Record Type: HQ
Mic sensitivity: Medium

Second Tab (Video)
Resolution: 2304x1296 30P
Video quality: S.Fine
Pre_record: Off
Delay record: Off

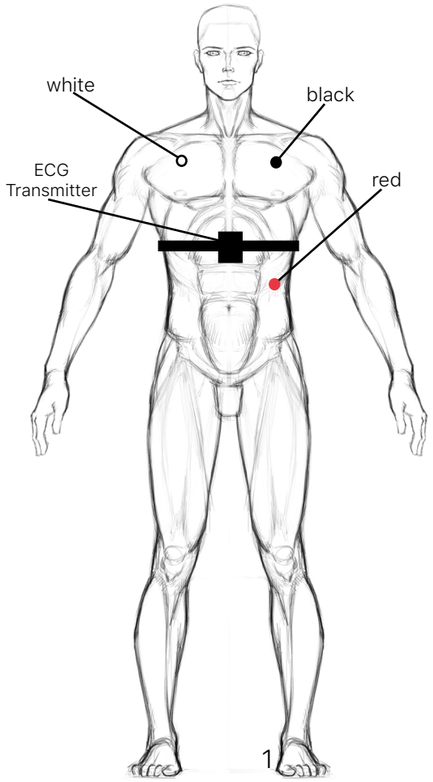
Fourth Tab (Global Settings)
Language: English
TV-Mode: NTSC
System time: **Need to be correct**
Auto off: Off
LCD auto off: 30 sec
Volume: 0
In-car mode: off
Duration: 30 min
Key tone: Off
Indicator light: On
Infrared switch: Auto
Motion detect: Off
EV: 0.0,
GPS: OFF
ID Number: V7 CARRS_Q 00000

Night Vision Camera in Vehicle

Main Simulator

Setup Bio Sensors

BioPac - ECG (Heart rate)



Check List (Preparation):

- ☐ Disposable gloves
- ☐ Cotton swab
- ☐ Alcohol swab
- ☐ Preparation gel
- ☐ ECG electrode
- ☐ ECG transmitter
  - ☐ check if enough charged?
    (green light = fine, yellow = need to be charged)
- ☐ Mulit-lead cable

How to Setup:

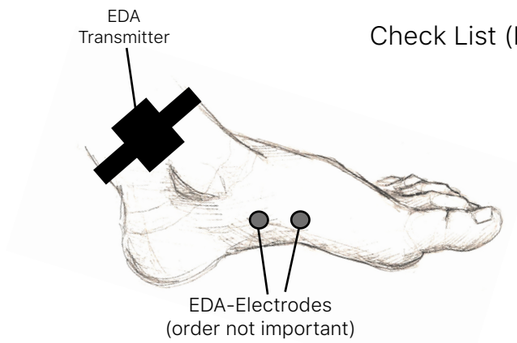
1. Mark position on skin with eyebrow pencil (see sketch)
   a) two fingers (about 3 cm) below left clavicle
   b) two fingers (about 3 cm) below right clavicle
   c) below the last rib of left chest, near the lower edge of the elbow

2. Clean skin at target position and place ECG electrode (repeat for each electrode)
   a) apply cleaning-gel (has sand-particles in it) on skin for one position
   b) scratch carefully the marking with the tissue of the skin (no leftovers)
   c) use alcohol swab to clean the spot let it dry (~ 10 secs)
   d) place electrode

3. Connect multi-lead cable to electrode
   a) White cable to left shoulder
   b) Black cable to left shoulder
   c) Red cable to lowest lib electrode

4. Check signal
   a) Connect cables to testing device, press & hold the power to test
   b) All three (Vin+/GND, Vin-/GND, Vin+/Vin-) need to be green
      (yellow and green together is accepted, but only yellow or worse need to be redone)
   c) Place transmitter in the middle of chest and connect the cables (keep the device off)

BioPac - EDA (Skin Connectivity)



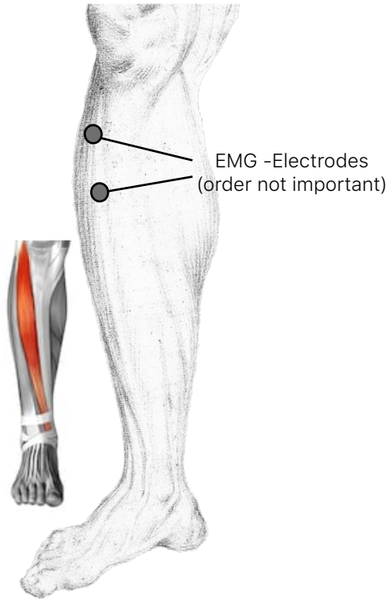
Check List (Preparation):

- ☐ Disposable gloves
- ☐ EDA Electrode
- ☐ EDA Transmitter
- ☐ Multi-lead cable
- ☐ Disposable sock
- ☐ Flip Flop

How to Setup: (**left foot**)

1. Wash spot with water where the leads will be attached and dry them with paper towels
2. Place EEG electrodes (self-adhesive)
3. Connect multi-lead cable to electrode use red and black cable and don't need check signals
4. Let the Participant put the disposable sock on (Be careful that the leads not been moved)
5. Connect cable to EDA Transmitter (keep it off)

BioPac - EMG (Muscle stimulation)



How to Setup: (**right leg**)

1. Target two spots, and clean them with the prep-gel (See ECG)
2. Attach nodes to Tibilis Anterior muscle (see sketch)
3. Tie the cables somewhere at the participant (with a bandage)
4. Test Signal
5. Plug are in the vehicle

Sensors and Data Recording

BioPac

Prepare / Setup

1

The Raspberry Pi has an Audio-cable, which need to be plugged to the receiver-station of BioPac. This sends a morse-audio-signal to it, to mark different positions.

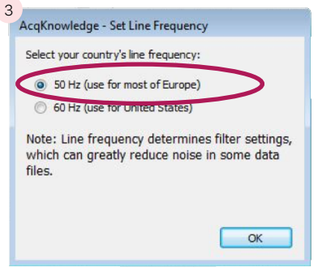
BioPac has for the recordings an own Computer. To start the software a Licence Key USB-stick is required.
Plug it in, before you start the Software „**AcqKnowledge**“ and start then.

2

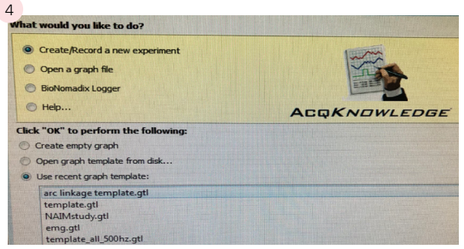
In the next step, choose **50Hz line frequency**.

Then you will be asked, to create or open an existing template. Select at first
„**use recent graph template**“ and choose then
„**arc linkage template.gtl**“.

3



4



Record

BioPac recording starts **before the door of the simulator will be closed**, because you need to turn on the transmitters.
After loading the template you can press **„Start“**. Follow the instructions in the small pop-ups, to sync the sensors.

Export

After the study, stop recording and go over „**File**“ and then „**Export Graph as**“ change the Path to „**Biopac Data/ARC Linkage/Participants**“ and change the export type to „**Graph (*.acq)**“. Export it additionally as „**MATLAB Mat-file (*.mat)**“.

Seeing Machines

Prepare / Setup

Seeingmachines Computer is running all the time. To connect to it, open at **Supervisor** Computer, „**Microsoft Remote Desktop**“ and connect to **DMS**.

The **software is running**, when you see the DMS **flickering** at the participant camera screen.

If it is not flickering, open the Software „**DMS**“, the Icon is on Desktop. After that the DMS should start flickering.

Create a folder on the hard drive with the **participant code** and **in it for each drive**.
After that change the participant code in the recording settings and choose the folder.

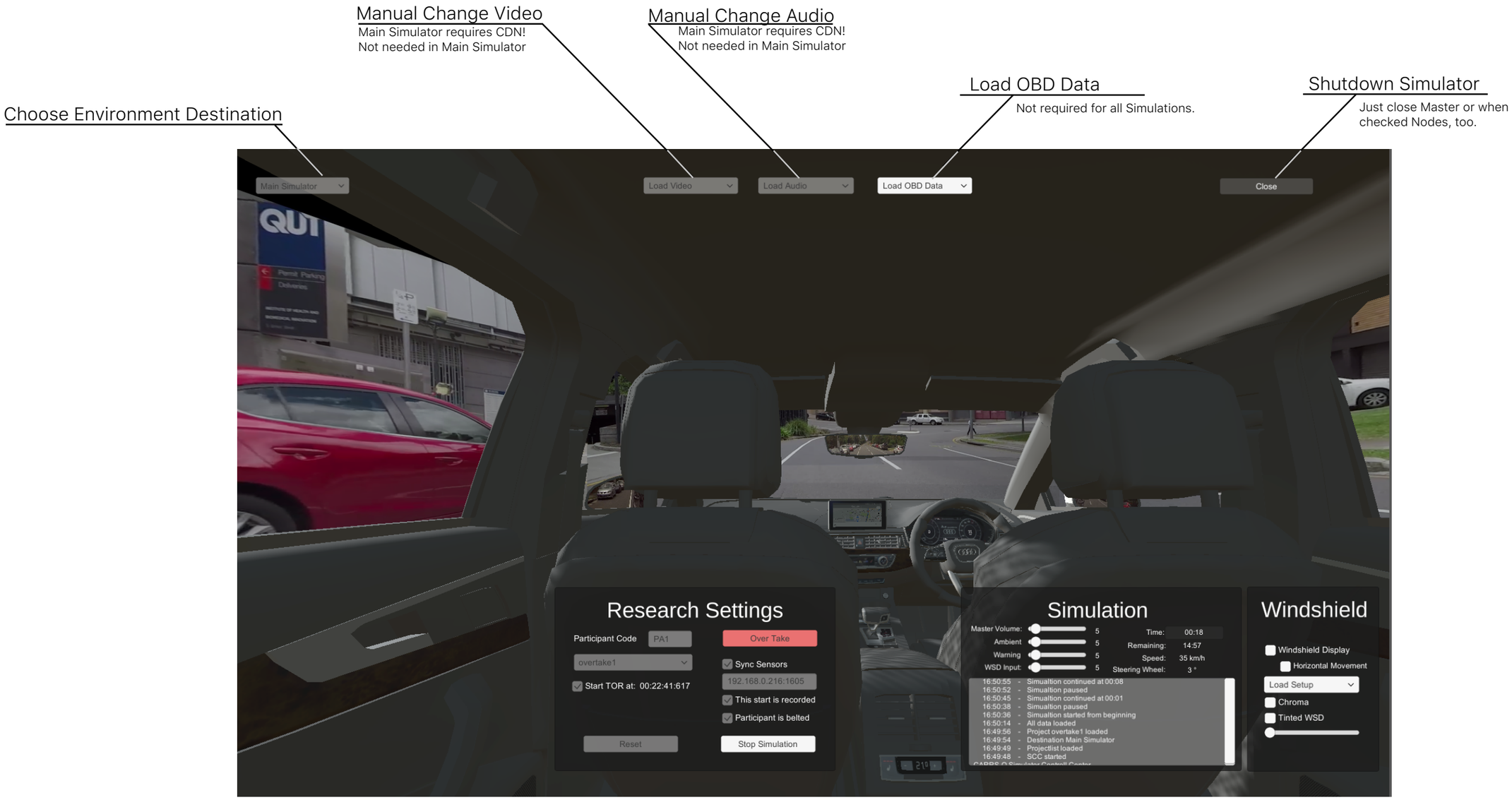
! Consider:
Be careful not to change values in the software setup. If values has been changed, load the configuration file new.

Record

1. Check, that the participant sits high enough, that the complete face is visible in the camera and not hidden from the steering wheel (If not ask them, to adjust the seat)
2. Start recording (Circle right bottom) before you press start the simulation
3. Stop recording after stopping simulation

! Consider:
Make sure before you start recording, you have enough stage on the hard drive. If not change it before!

Control ADS Simulator



Main Simulator

Windshield Display

Setup

The Windshield Display is the Input from an external Computer, to make the simulation environment independent from the Content. The **USB 3.0** Device should plugged to the **Visual Centre**. The other side (**HDMI**) is connected to the **Display-Computer**, which will be provided from the researcher.

Consider:

! To not disturb the User Experience from Participant, let it seem invisible. **No Menu-Bars, no mouse**. Use Hot-keys on a wireless connected keyboard for the researcher. Steering-Wheel Buttons are provided in the Simulator (Game-Pad Engine).

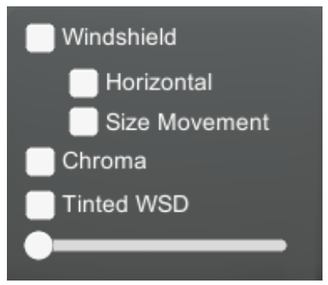
Chroma Key

The Software is able to render Chroma-Keys for transparencies. The researcher can use the colour as Background or for making something invisible/transparent.

```
#FF00FF //RGB Color Code
```

Activate and configure WSD

Overall to activate the Windshield, set the Windshield Check-box. Some configurations are able to Setup the WSD, these controls are changing during the Software evolution and testing different Setup. An important Check-box is Chroma, which activates the Chroma Shader to the Virtual Display.



Manual Display Sizement and Placement

The Windshield Display is able to get placed everywhere in the Windshield. The depth-limit area is between the camera and front wall. To move the Display, you can use the Num-Pad from the Supervisor-Keyboard.

Before you start the study, select Tetris and lock it with Num-Lock, that the Display is always at the same position.

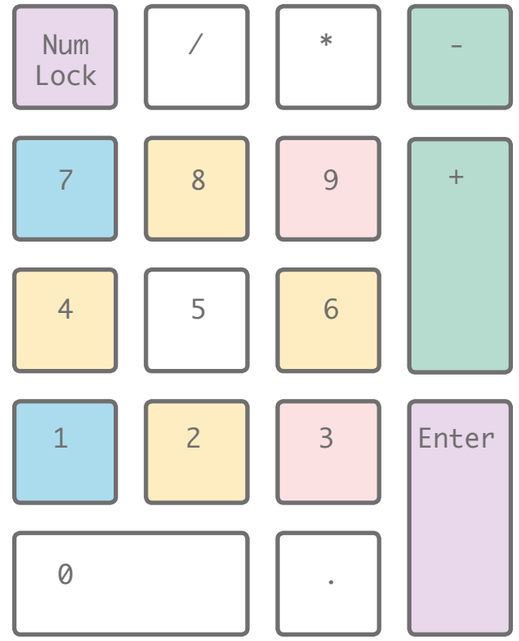
Position
- 8 -> Up
- 6 -> Right
- 2 -> Down
- 4 -> Left

- 7 -> Further away
- 1 -> Closer

Size
- \- -> Smaller
- \+ -> Bigger

Rotation
- 9 -> Anti-Clockwise
- 3 -> Clockwise

Help
- Num -> Lock Keypad
- Enter -> Reset Position



Consider:

! Recommended is to prepare the position before the Participant arrives. If the Display is deactivated, the values doesn't change

Consider:

! Lock the display after loading a setup, that every participant has the same WSD position.

Debugging

Config File

The Software is always the same and will be configured with a config file for Start-up. This can be found in the directory:

```
/Documents/VideoWall/VideoWall_Data/StreamingAssets/node-config.xml
```

The content should like this:

```
<?xml version="1.0" encoding="UTF-8"?>
<node type="master" screen="0" debug="0">
    <server ip="192.168.0.5" port="25000"/>
    <cdn address="http://192.168.0.5:1605"/>
    <hdmi video="USB3.0 Capture Video" audio="Digital Audio Interface
(USB3.0 Capture Audio)"/>
</node>
```

Consider:

! Red marked are all variables, you can change. There is no input-value check. Wrong inputs may cause unwanted behaviour or errors.

Define Software-type: If it is the Supervisor Computer, define master, if it is a Visual Computer choose slave.

```
type="master" or type="slave"
```

Screen defines, which Screen it will display. Choose just one number between 0 and 6

```
screen="0 - 6"
```

0	=	Control Screen
1	=	Front Wall
2	=	Left Wall
3	=	Right Wall
4	=	Navigation (used from mobile)
5	=	Mirrors
6	=	Speedometer (not activated at the moment)

Debug displays informations in top of the walls. Should be deactivated for studies.

```
debug="0" (deactivated) or debug="1" (activated)
```

Server IP is the address of the choosen `type="master"` port is default from Unity.

```
server ip="192.168.0.5" port="25000"
```

The CDN is able to run on other Computers in the Network, for this reason, you need to write the CDN address in the config file, which is displayed during the start.

```
cdn address="http://192.168.0.5:1605"
```

The Windshield Display uses a device, which detect a HDMI signal as Video Input. This need to be configured for each type of device. In our case its (no need to change):

```
<hdmi video="USB3.0 Capture Video" audio="Digital Audio Interface (USB3.0
Capture Audio)"/>
```

Starting CDN without Batch-file

CDN is the acronym for Content Delivery Network. This type of Software shares the all files with all computers. The CDN is a NodeJS written Software and should be started before the Control-Software get started (no need, but recommended).

Starting CDN

On the Desktop is an Short-cut to the Terminal Window with NodeJs support. It starts on Users-Directory. To change the directory use this commands:

```
dir                          // list currentdirectories items
cd Documents                 // change directory
cd „CARRSQ Video Simulator“
cd „CDN Server“
```

Consider, that is the directory from CARRS-Q Supervisor Computer.
C:\Users\Carrs-Q\Documents\CarrsQ Video Simulator\CDN Server

To start the Server, just type:

```
node index.js
Simulator CDN is running on: 192.168.0.5:1605
```

If everything went well, the dark grey messages should appear. If not, check that there is no other CND instance running. It blocks the port 1605 for itself and doesn‘t start twice.

Adding new Scenarios to CDN

It is easy to add new scenarios to the environment, if you know how. At first you go in the directory of the CDN.
At the Supervisor Computer it is:

```
C:\Users\Carrs-Q\Documents\CarrsQ Video Simulator\CDN Server
```

In this directory, there is a folder called „**cdn**“. By creating a folder, you will create a new scenario. If you create or delete folders in this directory and reload the Projects as described in „Change Driving Scenario“, you will find the change already the list in the Control Centre.

That the software is able to find the files, you need to name them in a special style and file-format (all files need to be synchronised before):

wf.mp4	Video file for front wall
wl.mp4	Video file for left wall
wr.mp4	Video file for right wall
nav.mp4	Video file for high mounted display
ma.mp4	Video file for mirror all
mb.mp4	Video file for mirror back
ml.mp4	Video file for mirror left
mr.mp4	Video file for mirror right
soundL.ogg	Audio file left
soundR.ogg	Audio file right

Consider:

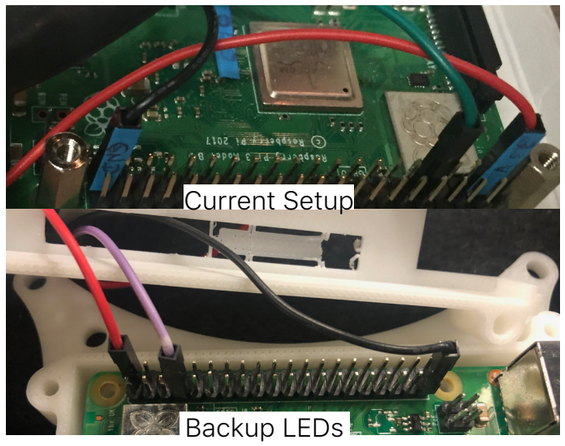
- All other file-names and types get ignored!
- The first run requires the Download to the Nodes, which takes a time.
- To update files, just overwrite the files at CDN

Clean up Files from Master and Nodes

When your study is finished remove the files from the nodes and master, to keep our environment clean. The Path is:

```
C:\Users\USER\AppData\LocalLow\CarrsQ\Simulator Video Controll Center\PROJECT
```

Sync Server



IR Plugs

Normally it shouldn't happen, but if someone unplugs the IR-Sensors for Sync. The red need to be Plugged in (1), Green in (4) and Black in the last (See Image, Top).
The Backup system has other colours. (See Image, Bottom).
The Backup System is already installed in the simulator, but hidden (LEDs need to be replaced with the current setup). Blue labels on the right back door showing the LEDs, and the connectors are attached with blue stripes as well in top of the Raspberry Pi in the trunk.

Sync-Audio signal to BioPac and GoPro

From the SyncServer to BioPac and GoPro will be used a Audio-Cable to send a Sound-Signal. Therefore will be used a Audio-Splitter (Y-Plug), which is Plugged at the Raspberry Pi.

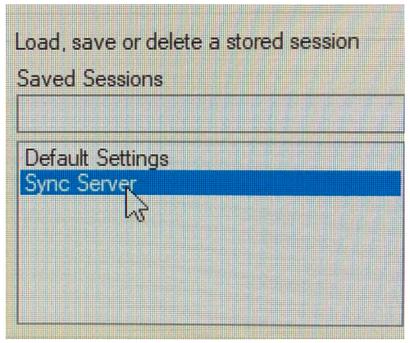
Raspberry Pi -> Y-Audio-Adapter -> GoPro Audio Adapter -> USB-C->GoPro
-> BioPac to Port 1

Device Configuration and Status LEDS

The Device is always powered, but It can happen that the car was turned off. Check all connections (1 Ethernet, 1 Audio, 1 Power and the IR-Pluggs from above). When the devices is powered some LEDs should indicate the power state (you will see them flashing in the security camera or Eye-tracker when you start or stop the simulation in the control software).

When Sync Server is not reachable

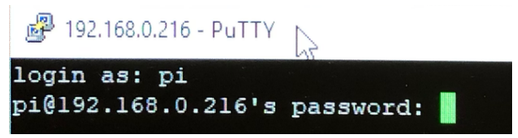
The Sync-Server (is in the car) should be started after attaching the Sensors (see Sensors, GoPro). To start it, use ssh to access the server. For this open the software **Putty** and select **Sync Server** and press open.



After pressing open, a window opens and will ask you for a password.

It is „**sync2018**" and confirm it by pressing enter.

After that following the following procedure in the terminal window. After each command press Enter.




```
sync2018                        <- Password not visible in Terminal
cd James                        //change in dir with Sync Server
node index.js &                 //start Sync Server in Background (1)
[1] XXX
ps ax | grep node                   //check if process is still running
XXX pts/1    Sl     0:01 node index.js
```

If a number appears (Process Number) everything worked fine. You can verify the process by using `ps ax` with the search string node. It should display you the same number.
(1) Change PAR with Participant Code, that a new file is generated.

Explanation:
1. **node index.js** -> starts the server
2. **>> PAR.txt** -> stores the console output in a file
3. **&** -> run's this commands as demon, if you close the ssh-connection, it does not shutdown the server (important!)

After that, you can checkmark „**Sync Sensors**" in Research Settings.

Check all Sonsors:

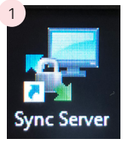
! In addition, make a test recording, by starting the Simulation. You will see at the Front Display the recording process.
Tip: For testing this, **do not check** „This start is recorded"

How to Collect data

To collect the data, you will have an USB-Drive. If possible don't delete files anywhere (except it is written), keep them at the original source. After having all the data on the USB-Drive you upload them to the research drive

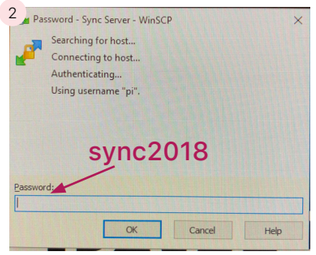
1. Sync Files

1



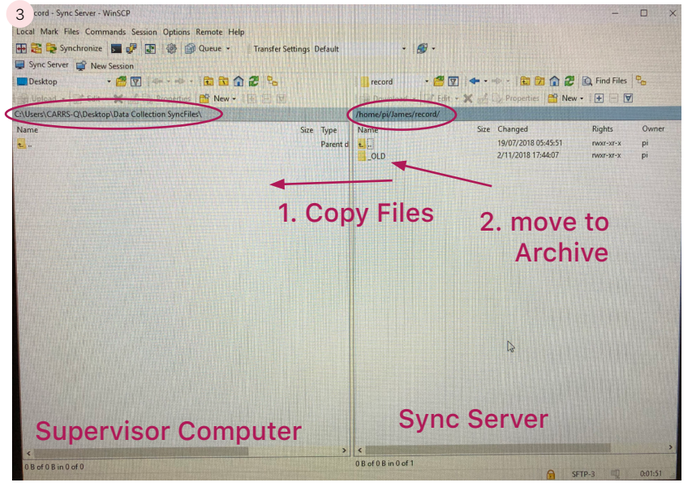
The Sync Files are stored at a small server in the car. To remote connect to it, double click at the **Supervisor Computer** at „**Sync Server**" (1). It will ask you for a password which is „**sync2018**" (2). An interfaces opens, on the right side you see the remote computer on the left the Supervisor computer (3).

2



The filepath on the sync server are:
/home/pi/James/records
copy the files at first to the Supervisor Computer to
C:\Users\CARRS-Q\Desktop\Data Collection Sync Files

3



Never delete files, we keep the files on the Sync Server as Backup. Move them into the Archive „_OLD" after downloading them.

After downloading them, you can copy them to the USB-Drive you collect all the data.

Video Files

To collect the video-files, you unplug and take the camera from the car with you. The easiest way is to connect the camera to a computer and copy the video-files to the USB-Drive (on the same port you plug the power).
The video files need to removed from the video-storage, but **after** successful upload to the research network drive.

Important:

! The video-files are splitted every 20 minutes. That means for each participant are existing more files.
Sort them directly in the folder for the participant.

Bio Pac

As described at the BioPac settings, export the files as *.acq and *.mat.

Go over „**File**" and then „**Export Graph as**" change the Path to „**Biopac Data/ARC Linkage/Participants**" and change the export type to „**Graph (*.acq)**". Export it additionally as „**MATLAB Mat-file (*.mat)**".

Put the files in the folder for the participant and into the scenario folder. Make sure all files are copied correctly.

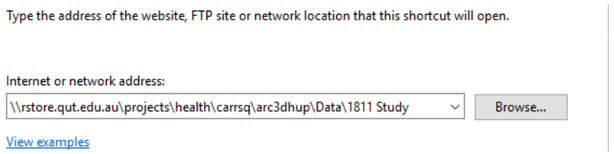
Seeing Machine Eye-tracker

Check, if the hard drive has enough space for an other recording. If not change the hard drive. Plug the new hard drive to the computer and copy the files into each scenario in the participant folder. Keep the files untouched on the hard drive and pass them after that to Dr. Ronald Schroeter for sending them to SeeingMachines for the analysis. (The files are big, the upload will take a while. To speed up the process, make sure you are uploading from a computer which is **wire** connected **(not wifi)** to the QUT network).

Upload to Research Drive

Connect

Log into a QUT-Asset computer and connect with the research drive:
To connect this go to „**This PC**“, right-click, „**Add a network location**“, 2x Next, enter this address:
\\rstore.qut.edu.au\projects\health\carrsq\arc3dhup\Data\1811 Study and insert your credentials (with name@qut.edu.au and password), press next and Finish.



If it does not accept your credentials

If it asks you for your credentials and they will not be accepted, you need to type them with the domain: @qut.edu.au.
To change the name, click in the password pop-up, „More choices“ and then „Use different account“ and write your then your credentials with the domain.

Data Structure of Research Drive

Put all the data in the folder „**Data Collection**“.
Follow exactly the following folder structure:

- 1811 Study
  - Data Collection
    - Participant Code **(for each participant)**
      - Scenario Name **(for each scenario)**
        - **Sync Protocol**
        - **SAM results**
        - **Eye Tracker**
          - **SeeingMachine Files**
      - **Originals**
        - **Video Recording**
          - **Video Files**
        - **BioPac**
          - **BioPacs *.acq**
          - **BioPacs *.mat**
        - **Interview**
          - **Audio File**
          - **Notes**
        - **Forms**
          - **Demographic Questionnaire pdf**
  - Forms
    - Participant Surname_Name
      - **Signed Ethics**
      - **Signed Image consent form**
      - **Signed Research consent form**

Important:
! Before you digitalise this documents, check that there is **NO** participant code on it, that the real name is not possible to match with the collected data. Pass the paper forms to Ronny. He will forward them to the archive.

This Software is written at CARRS-Q to run
research studies for autonomous driving vehicles,
with focus on AES Level 3.
Questions regarding the research to:

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Technical questions:

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Check the latest versions at:
https://github.com/carrs-q/IVAD-Simulator