

Peltihamsteri project

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Instruction manual Syncster 1.0.0 & Touchster 1.5

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1 What is Syncster?

Syncster is an application for the Windows 10 platform that collects data from multiple devices and temporally synchronizes data from those devices into one CSV file. An application called Touchster was developed for extracting touch data from Android devices. Syncster and Touchster were developed by a group of aspiring programmers as part of the course *TIES405 Sovellusprojekti* in the University of Jyväskylä during spring of 2019. The applications were developed for University of Jyväskylä's driving simulator laboratory for research purposes.

Syncster can gather and synchronize data from the following devices:

- 1) Eepsoft driving simulator (version 20150311d),
- 2) Wearable Sensing DSI-24 EEG device and DSI-Streamer (version 1.08.28),
- 3) Dikablis Professional eye tracking glasses and D-Lab (version 3.52),
- 4) Android mobile devices and Touchster.

Instructions for all devices and their Syncster modules can be found in chapter 2. A run through of Syncster and its features is covered in chapter 3.

2 Syncster's device modules

All Syncster devices work in a different way. In the chapter, specific information about each device is given.

To ensure Syncster's performance, **all devices must use different port numbers**. If devices and PCs are part of a network that restricts TCP/UDP traffic, user must first manually create firewall rules that allow ports to send or receive TCP/UDP traffic. It should be enough to create these rules on the PC running Syncster.

To make sure you get the best and most accurate recording results it is recommended to use a stable internet connection or local area network (LAN). Of all the devices, eye

tracker is the only one that can connect again if the connection disconnects, while other devices must be reconnected again from Syncster.

2.1 Driving simulator (Eepsoft)

Things to know before recording:

- 1) Use script *peltihamsteri_udp.lua* (name might be different if various versions of the script are used) when launching Eepsoft. Make sure it is in the same folder as *t.exe*.
- 2) Figure out the IP address of the PC running Syncster and replace script's IP address with it.
- 3) Make sure *Command extra* is selected in Simu starter. Add parameter *-dofile peltihamsteri_udp.lua* in it (change parameter according to script's name).
- 4) Choose port number (default is 5596) and replace script's port number with it.
- 5) On Syncster's *Devices* tab, input driving simulator's settings.
 - a. Select device to be used in study.
 - b. Make sure to use the same port number that was used in *peltihamsteri_udp.lua*.
 - c. Select the data you want to gather. To select all data, use the *Select all data* button. Figure 1 gives an example of module settings.

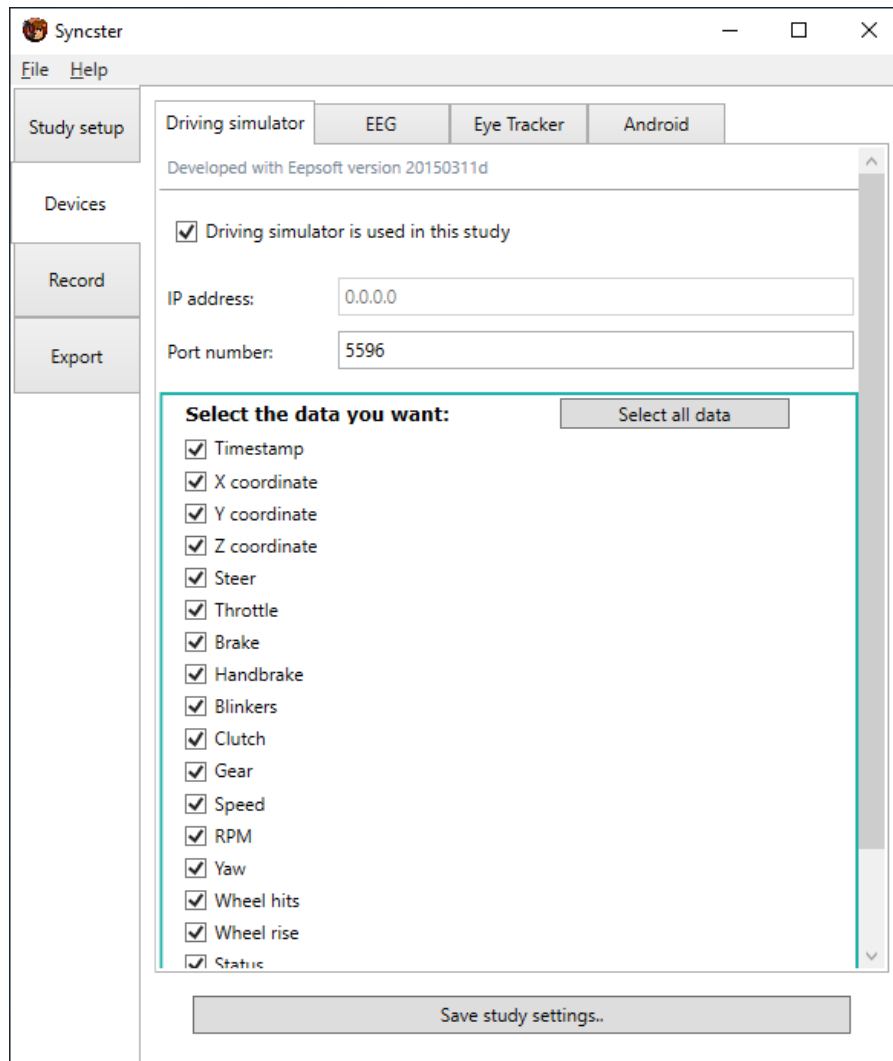


Figure 1. Driving simulator module settings example

Recommended procedure when using this device:

- 1) Launch driving simulator's software (Eepsoft) with *peltihamsteri_udp.lua*.
- 2) Connect devices from Syncster.
- 3) Start recording from Syncster.
- 4) Start driving.

Recording process...

- 5) Stop recording from Syncster.
- 6) Disconnect devices from Syncster.
- 7) Close Eepsoft.

NB: Driving simulator sends data with UDP, so this procedure doesn't need to be followed to the letter, if you know what you are doing. Just make sure to start the recording before you start driving, so that your data will all be gathered.

2.2 Dikablis Professional eye tracking glasses

Things to know before recording:

- 1) Eye tracking glasses should be in use and streaming data to D-Lab.
- 2) D-Lab has a *Relay* function (under screen layout) which can send data in real-time via TCP/IP. Drag the data you would like to send from the *Recording Devices* window and drop on to the *Relay* window.
- 3) Configure the settings in D-Lab's *Relay* window in order to send from a specified IP address and port number. Check boxes *Send Column Headers* and *Send Timestamps*.
- 4) On Syncster's *Devices* tab, input Eye Tracker's settings.
 - a. Select device to be used in study.
 - b. Make sure to use the same values in Syncster's Eye Tracker module's *IP address* and *Port number* text fields that are used in D-Lab.
- 5) You can open multiple relays from D-Lab. Different relays need different port numbers to work. Syncster supports two D-Lab relays. To activate the second port check *Eye tracker port 2 is used in this study* checkbox and fill *Port number 2* text field with the same port number that is used in D-Lab's second relay. Figure 2 gives an example of module settings.
- 6) For more information check *D-Lab Manual version 3.0*.

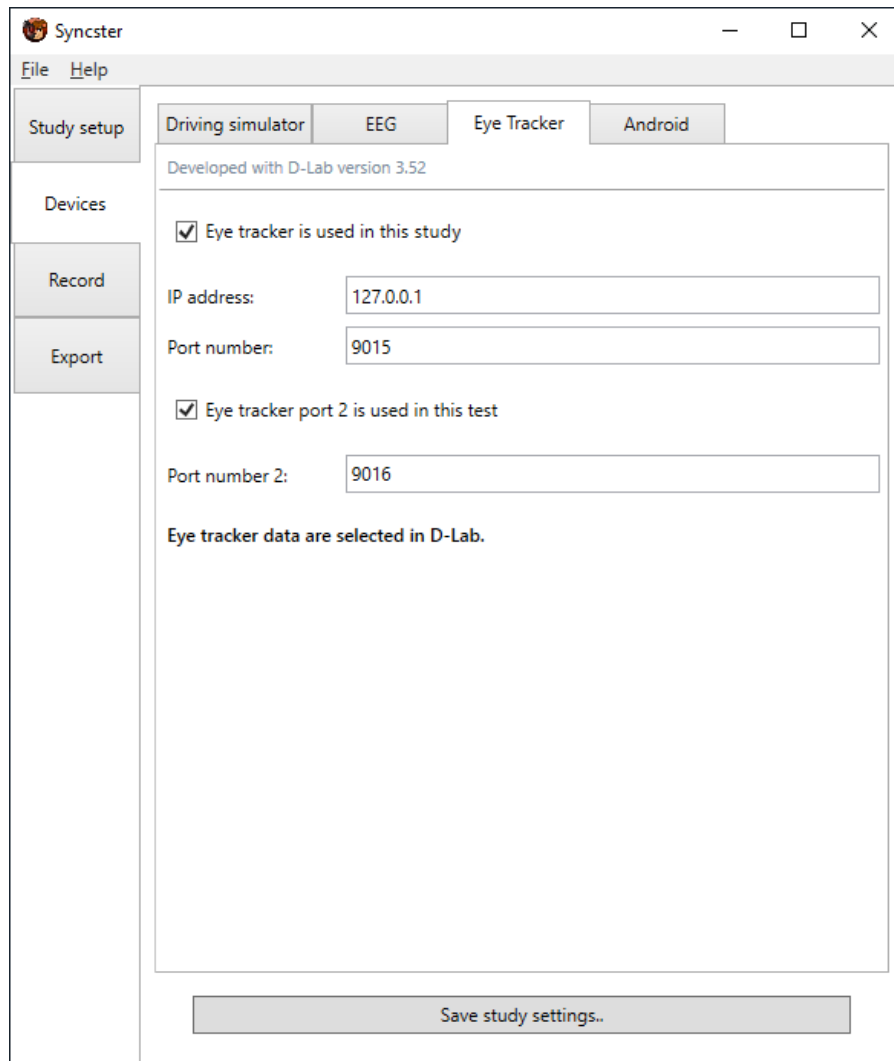


Figure 2. Eye tracker module settings example

Recommended procedure when using this device:

- 1) Launch D-Lab and make it stream data.
- 2) Connect devices from Syncster.
- 3) Start recording from D-Lab.
- 4) Start recording from Syncster.

Recording process...

- 5) Stop recording from Syncster.
- 6) Stop recording from D-Lab.

2.3 DSI-24 EEG headset

Things to know before recording:

- 1) Syncster and DSI-Streamer must be running on the same PC.
- 2) EEG should be in use and streaming data to DSI-Streamer. For more information, check *Wearing Sensible DSI-24 EEG Headset User Manual version 0.8*.
- 3) To stream EEG data to Syncster, you must select *Activate TCP/IP Socket* in DSI-Streamer's *TCP IP* tab.
- 4) On Syncster's *Devices* tab, input EEG's settings.
 - a. Select device to be used in study.
 - b. Make sure to use the same port number that was used in DSI-Streamer's *Client Inport* field.
 - c. Select the data you want to gather. To select all data, use *Select all data* button. Figure 3 gives an example of module settings.

Recommended procedure when using this device:

- 1) Launch DSI-Streamer and make it stream data.
- 2) Connect devices from Syncster.
- 3) Start recording from Syncster.

Recording process...
- 4) Stop recording from Syncster.
- 5) Close DSI-Streamer.

NB: If DSI-Streamer happens to crash or Syncster's EEG module loses connection when you are recording, you have two options: you can either continue recording without further EEG data, or stop the recording and start a new one. The EEG module does not know how to reconnect, and in case of DSI-Streamer's crashing and resetting its relative timestamp, the module would not be able to reliably calculate timestamps.

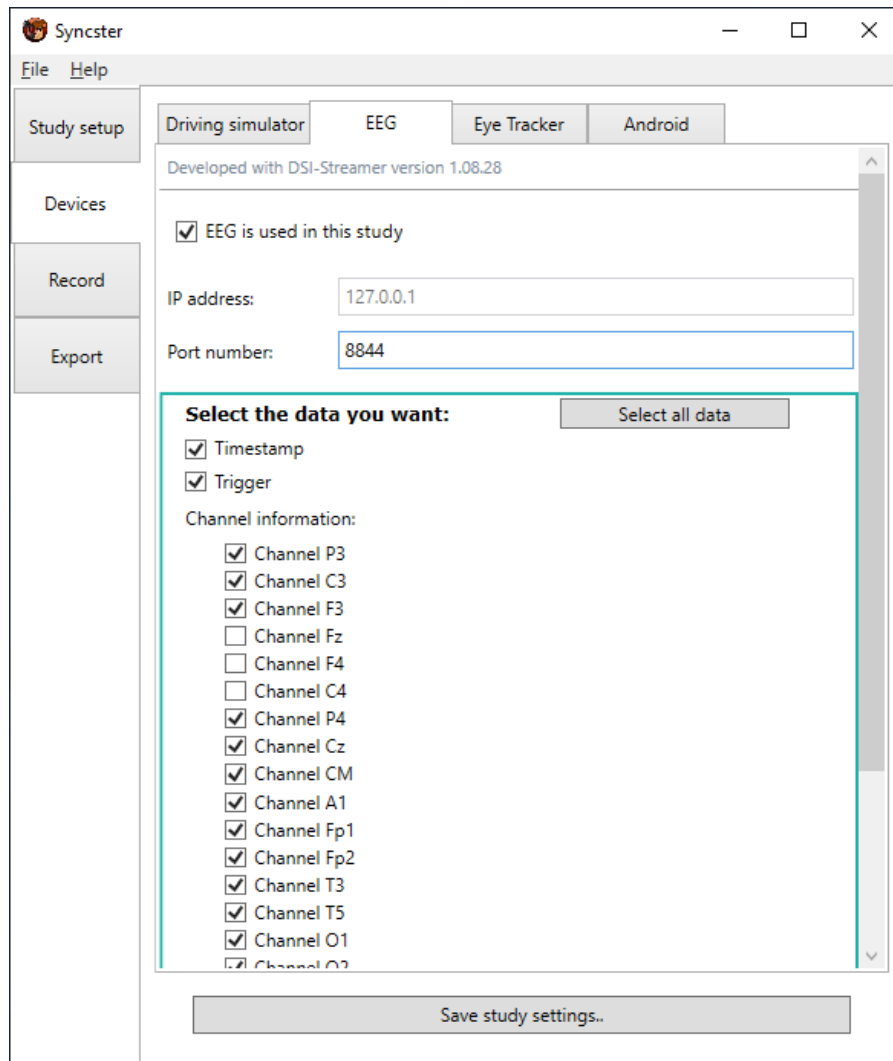


Figure 3. EEG module settings example

2.4 Touchster (Android device)

Things to know before recording:

- 1) If your PC running Syncster is connected to university's internet, your Android device running Touchster must also be connected to university's internet. Otherwise the university's firewall will block the connection.
- 2) On Syncster's *Devices* tab, input Android's settings.
 - a. Select device to be used in study.
 - b. Choose port number.

- 3) When launching Touchster the first time, it will look like the left picture in figure 5. Touchster will save values that are in the IP address and port number text fields when you close the app. Saved values are placed back to text fields in your subsequent launches of Touchster.

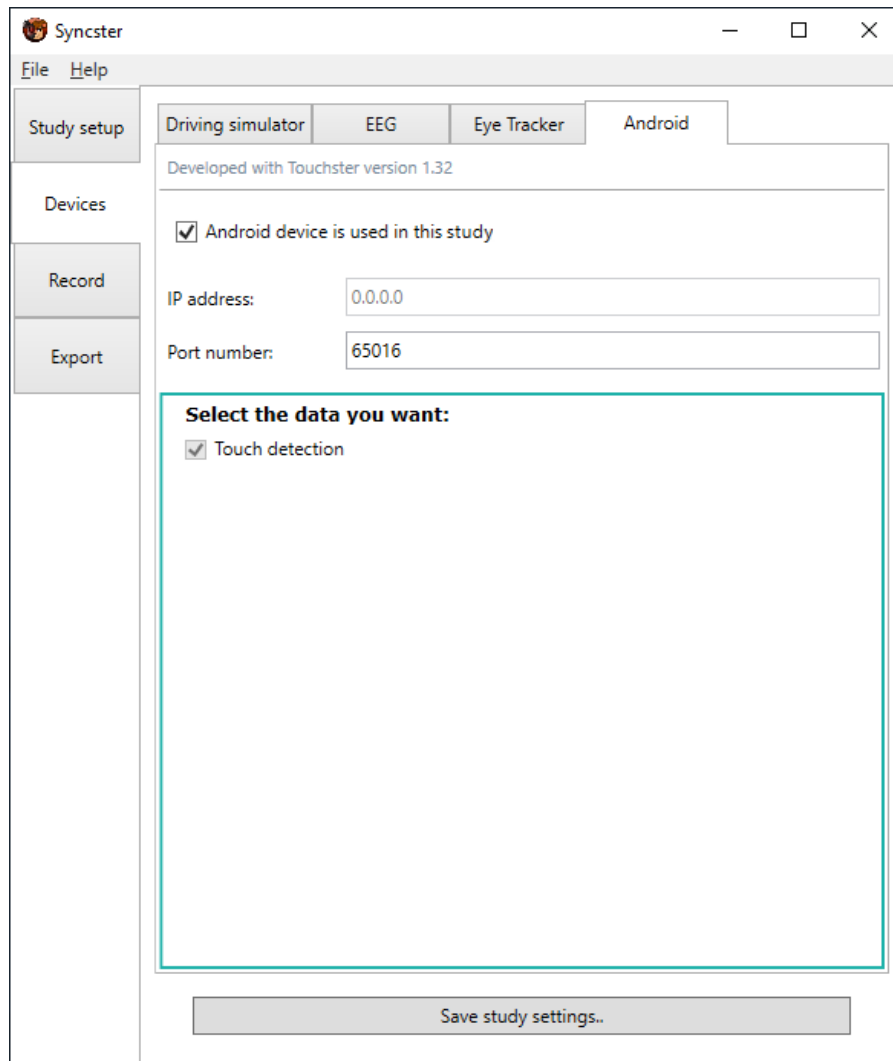


Figure 4. Android module settings example

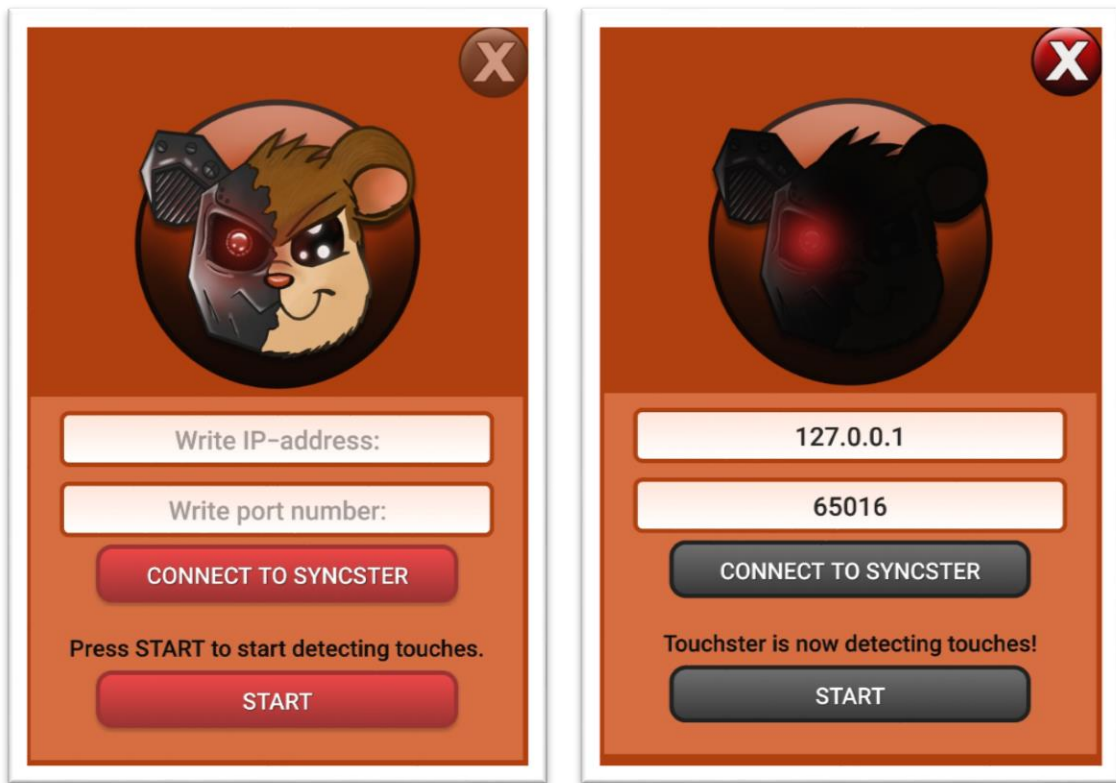


Figure 5. Touchster's default (left) and working (right) state

- 4) Connecting to Syncster requires you to write Syncster PC's IP address and a port number to Touchster's text fields. Make sure to use the same port number that was used in Syncster's Android tab's port number (for example in figure 4, the port number would be 65016).
- 5) Connect devices in Syncster. If Touchster can't connect:
 - a. Check that the IP address and port number are correct.
 - b. Check that the port number is opened in PC's firewall rules.
- 6) You can start detecting touch data by pressing the *Start* button. Starting touch detection will be different with different Android devices:
 - a. If your Android version is 8.0.0 or higher, you need to give Touchster permission to draw over other apps (without this permission Touchster will show a message saying *Touchster needs permission to draw overlay!*). Go to your device's application settings and look for Touchster. From there you can give Touchster permission to draw over other apps.

- b. If your Android version is between 6.0 – 7.1, you need to give Touchster permission to draw over other apps. Your device will ask for this permission automatically when you press *Start*.
 - c. If your Android version is lower than 6.0, Touchster doesn't need permission.
- 7) After you have connected to Syncster and started detecting touches, Touchster should look like the right picture in figure 5. At this point both *Connect to Syncster* and *Start* button are inactive.
- 8) After you are done using Touchster, you can reset it by pressing the red "X" (*reset*) button located in the top right. Pressing this button will open a window (figure 6), which asks your permission to reset Touchster. Resetting disconnects Touchster from Syncster, stops detecting touch data and deactivates the reset button.

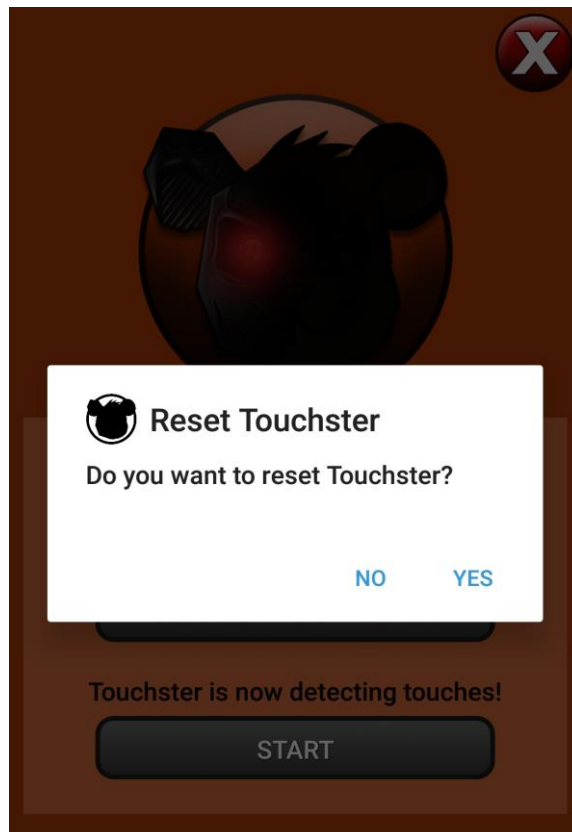


Figure 6. Resetting Touchster

Recommended procedure when using this device:

- 1) Connect devices from Syncster.
- 2) Connect Touchster to Syncster.
- 3) Start detecting touches from Touchster.
- 4) Start recording from Syncster.

Recording process...

- 5) Stop recording from Syncster.
- 6) Reset Touchster.
- 7) Disconnect devices from Syncster.

NB: Connect Touchster to Syncster after you have pressed *Connect devices* button in Syncster. Touchster's device module in Syncster won't actively show heartbeats. Heartbeats show up only when user touches device's screen. It is recommended that before you start recording with Syncster, check that heartbeats are coming to make sure the connection is formed.

It is recommended that you reset Touchster before you disconnect devices from Syncster. Disconnecting before resetting doesn't break anything, but Touchster can't visually indicate that it isn't connected anymore to Syncster. It will stay in the state presented in the right picture in figure 5.

3 Using Syncster

In the chapter we go through step-by-step instructions on how to use Syncster. Subchapters 3.1 – 3.4 tell how to make and save study settings. Subchapters 3.5 – 3.6 describe the recording and exporting processes. Lastly subchapter 3.7 presents Syncster's menu bar and its activities.

3.1 Text field validation

Many of Syncster's text fields have an ability to check if their content is valid. If you try to use characters that are not allowed, text field's text and border color will turn red to inform that content is invalid. You cannot start recording if there are text fields with invalid content in them that are needed in the recording process (i.e. all text fields in *Study setup* tab and IP address and port number text fields from devices that are used). It is recommended to fill all required information correctly to avoid unnecessary confusion when trying to start recording. Figure 7 shows an example of text field that has invalid content in it.

Study name:

Figure 7. Example on characters that are not allowed

3.2 Study details and result folder

Before recording you need to set up study details and result folder in the *Study setup* tab. Result folder can be selected by pressing *Open* button on the Result folder section (point 2 in figure 8). All recordings will be saved into this folder, so it is important that it holds enough space. If result folder runs out of space, the recording process will fail and you will lose data. You also need to have write access to the result folder.

Every recording session requires a study name and at least one task that will be performed. Create a study name by writing it on the *Study name* text field (point 3 in figure 8). Create a new task name by writing it on the *Add a task name* text field. After writing a task name you need to add it to tasks by pressing *Add* button next to text field (point 4 in figure 8). Alternatively, pressing the *Enter* key adds the task. Multiple task names can be added at once by separating the tasks with a semicolon (e.g. `task1;task2`). After adding, the tasks will be shown in *Task names* list above. You

can create as many tasks as is needed. Tasks can be removed by selecting a task, right-clicking it to open the context menu and selecting *Remove*.

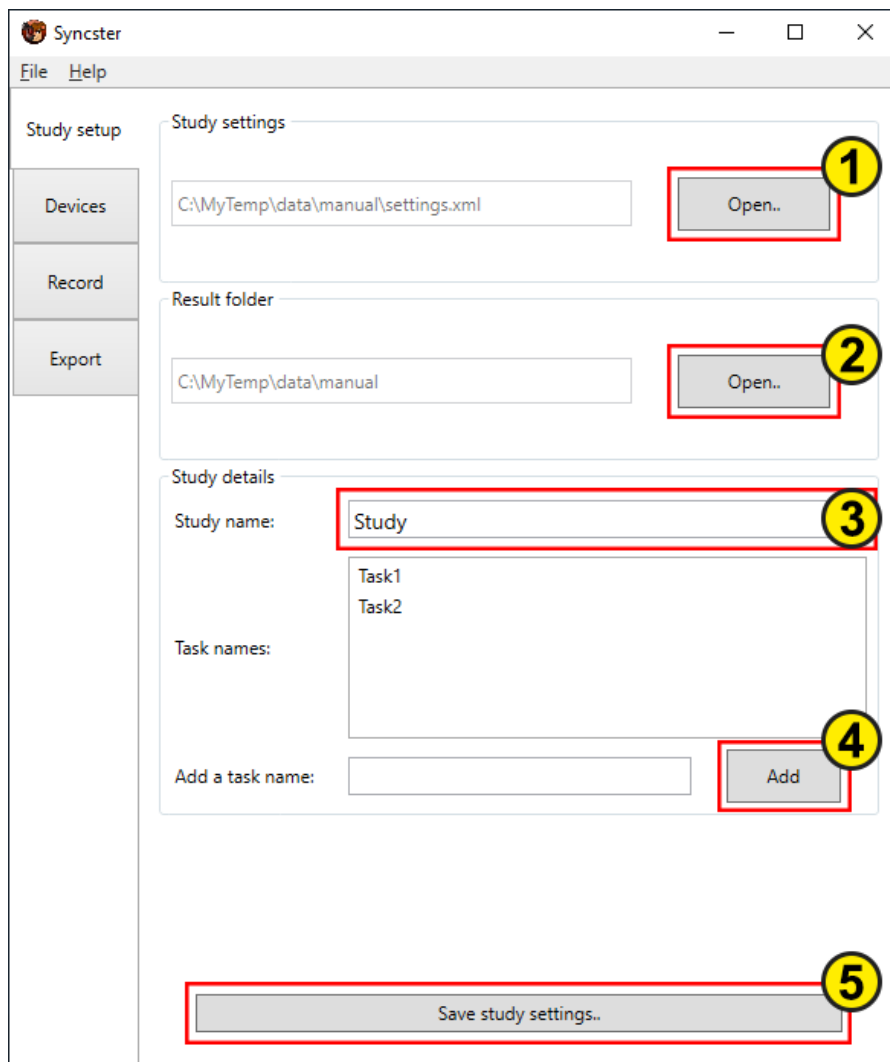


Figure 8. Study setup

3.3 Selecting devices

To select devices, you need to go to the *Devices* tab. From there you can find all devices that Syncster supports. Each device has its own tab.

You can select a device by checking the *<device name> is used in this study* checkbox. Then you can select what data you want and fill text fields for IP address and port number. Some IP addresses cannot be changed (e.g. driving simulator and EEG). All obligatory data for used devices must be filled before you can start recording. Every

device has different types of data that you can choose to have in your recording. You can choose as much data as you want in your recording. Currently, Syncster does not stop you from recording with no data selected, so be sure to make the data selection. You can find more information about devices and how to set them up in chapter 2.

3.4 Saving and using study settings

The fastest way to fill all information before recording is to use a settings file that you have created earlier. To save your settings, press the *Save study settings* button that can be found on the bottom of *Study setup* and *Devices* tabs (point 5 in figure 8). This will open a dialog that allows you to name your file and choose a directory. You need to have write access to this directory.

You can use open a settings file in the *Study setup* tab's *Study settings* section. Press *Open* button to find and use a settings file (point 1 in figure 8). Syncster will automatically fill all study setup and devices information present in the settings file. After this you can still edit current settings as much as you like. Currently there is no way of clearing all settings in Syncster. If you wish to start anew, you should restart Syncster.

3.5 Recording

The subchapter presents the recording process in Syncster. We outline things to do before recording, as well as starting and stopping the recording.

3.5.1 Before recording

Once you have filled all obligatory setup information and chosen at least one device, you can start recording with Syncster. To start recording you need to go to the *Record* tab. The most significant area here is the *Device names, heartbeats, and statuses* section. Devices that you have chosen earlier are highlighted here with a sea green border. Heartbeat shows different number values when Syncster is receiving data from the

device. Essentially heartbeat tells you how many rows of data has been received in the last 500 milliseconds. Status ellipse indicates device module's current state. Grey color indicates that a device is not yet connected. Figure 9 shows an example where we have selected some devices, but we haven't connected them yet.

You can launch Syncster's selected device modules by pressing the *Connect devices* button. Device's status color shows green when Syncster has launched the module successfully. Be aware that some devices won't start showing heartbeat right away. For example, driving simulator will show heartbeat only when you are driving in the simulator. Also, Android will show heartbeat only when device's screen is touched.

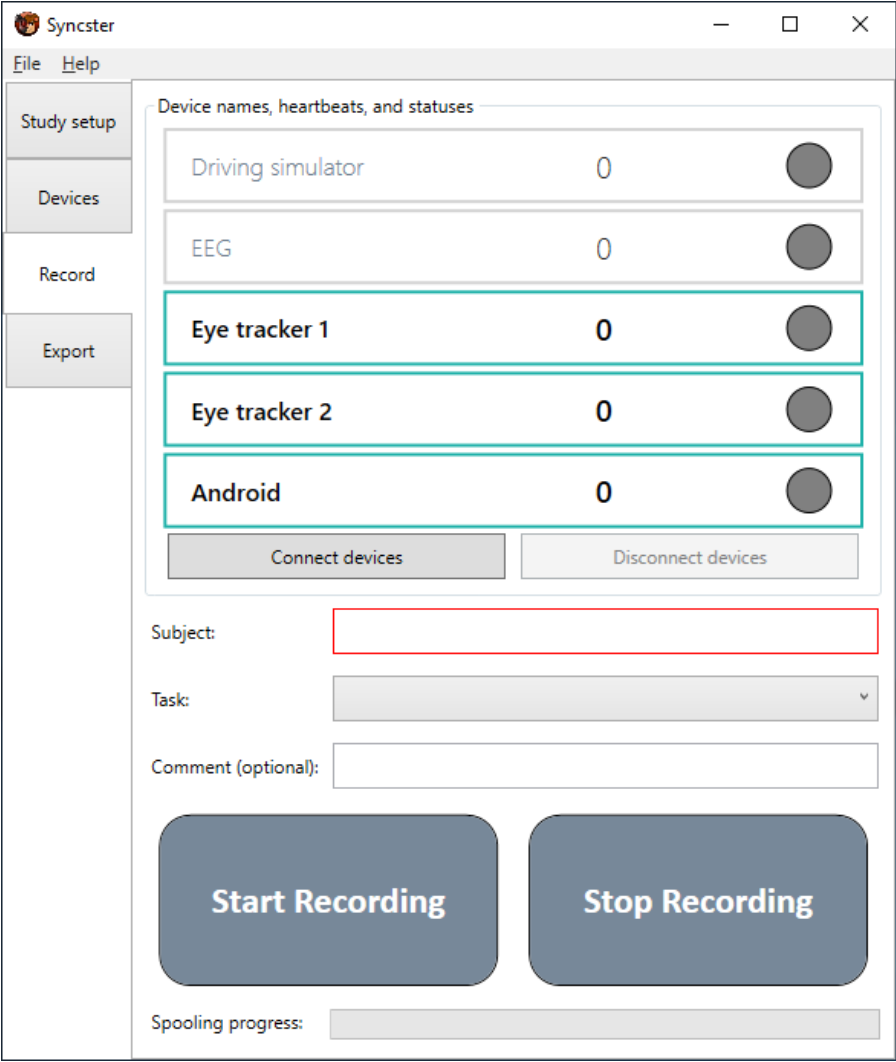


Figure 9. Devices before connecting

Next you need to fill the *Subject* text field and select a task from the *Task* dropdown menu. Below these, there is also an optional *Comment* text field, where you can write a comment about the recording. You can write a comment before you start recording or while the recording is going on. You cannot write a comment after you have stopped recording, because Syncster will use the comment text when recording is stopped. *Comment* text field also has a validation check which it must pass before comment can be used. If comment is not valid when recording stops, Syncster will not use the comment or might only use a portion of it.

Figure 10 shows an example where devices have been connected successfully. All devices are sending data, because heartbeats are showing a number other than zero. *Subject* text field and *Task* are also filled.

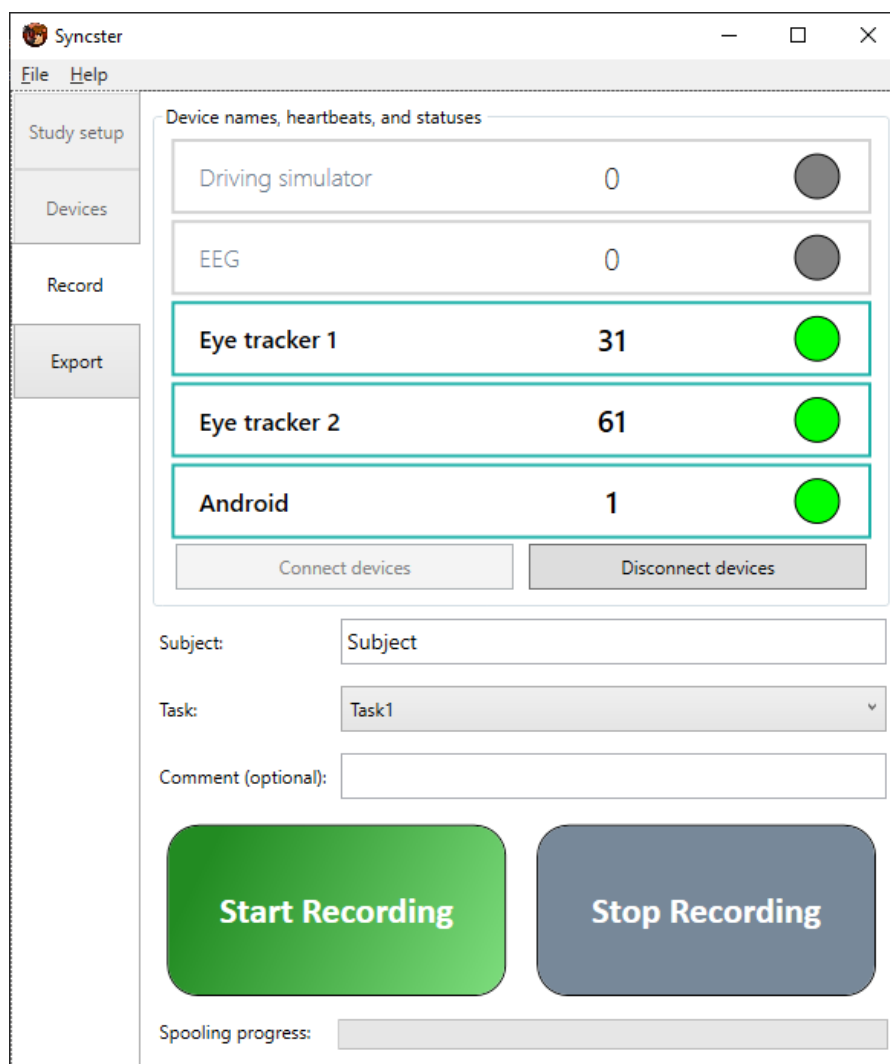


Figure 10. Devices are connected

3.5.2 Starting and stopping recording

After all required information has been filled, *Start Recording* button will change its appearance from grey to green (figure 10). You can start recording by pressing this button. If button's appearance won't change, disconnect devices and check for possible validation errors from earlier tabs. Remember to check each device's own tab.

Figure 11 shows an example where recording has been started. When devices have been connected, you can't go to *Study setup* and *Devices* tabs. During recording you cannot modify the subject or select a different task. You can still write a comment

about the recording to make it more recognizable or to add some information of how the recording went.

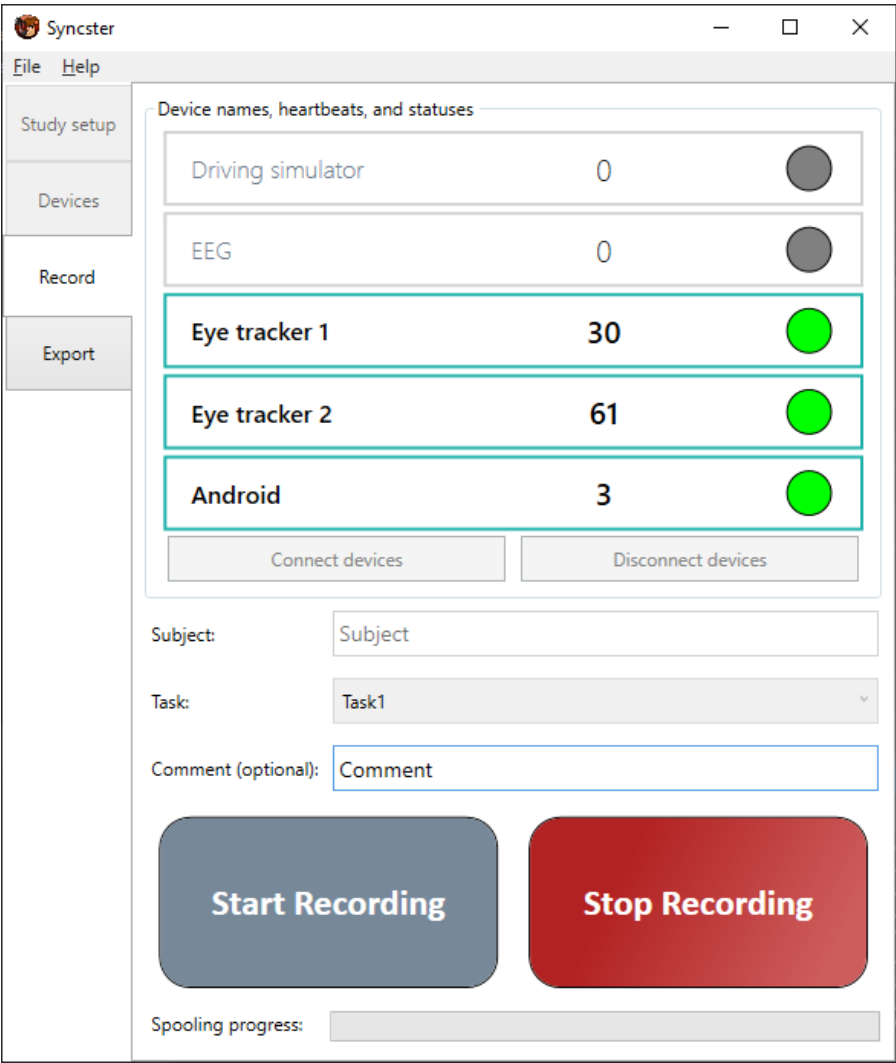


Figure 11. Syncster is recording

When you are done with recording, press the *Stop Recording* button. Syncster will automatically start writing temporary files from each recorded device. Depending on the length of your recording and devices used, this process might take time from a couple of seconds to multiple minutes. You can follow the progress of this process from the *Spooling progress* bar, which is in the bottom of the *Record* tab. Syncster will inform you when temporary files have been created. Figure 12 shows an example where recording has been stopped and Syncster has finished creating temporary files.

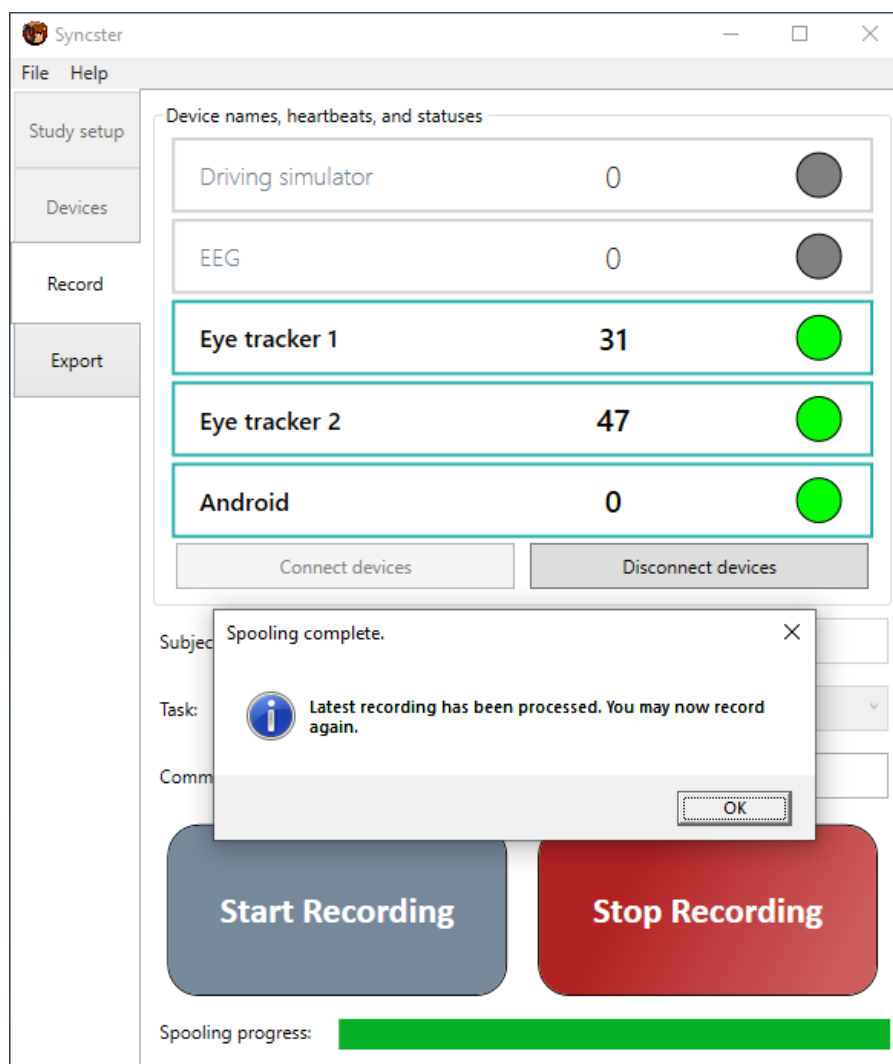


Figure 12. Syncster has stopped recording

3.6 Exporting

The subchapter presents the exporting in Syncster. We describe the exporting process, ways to export and how to import D-Lab data to your recordings. Lastly, important remarks about exporting are disclosed.

3.6.1 Exporting process

The exporting process creates one CSV-file per recording that includes all recorded device data. This file can be then opened in other programs like Excel for further use. To start exporting you need to go to the *Export* tab.

First pick a folder where your temporary files are. If you are exporting right after recording, Syncster will automatically use the result folder that you have chosen before recording. However, if you open Syncster just to export earlier files, you need to pick the right folder. To do this, press *Change folder* button located in the top of *Export* tab (point 1 in figure 13).

After picking the right folder, Syncster will list all recordings it holds. These are visible for the user in a data grid located in the middle of *Export* tab. You can filter recordings by pressing *Study name*, *Subject*, *Task name*, *Start time*, *Duration* and *Comment* fields on top of the grid (point 2 in figure 13). You can select a recording by pressing its row in the grid. Syncster will show its information in the *Current selection* section. Here you can see what devices were used in the recording and how much data each device provided (point 7 in figure 13).

3.6.2 Ways to export

Syncster offers two ways to export recordings:

1. Export one recording by choosing it from the grid and pressing the *Export selected* button (point 3 in figure 13). This option allows you to choose your own file name and save directory, but Syncster will offer a default file name. Press *Save* to start the exporting process.
2. Export all recordings from the grid by pressing the *Export all* button (point 4 in figure 13). This option won't allow you to choose file names, but uses the default file name Syncster provides. You can choose a save directory for all CSV files that will be created. Press *Save* to start the exporting process.

You can hide an unwanted recording by choosing it from the table and pressing the *Hide selected* button (point 5 in figure 13). You can unhide all hidden rows by pressing the *Unhide rows* button (point 6 in figure 13).

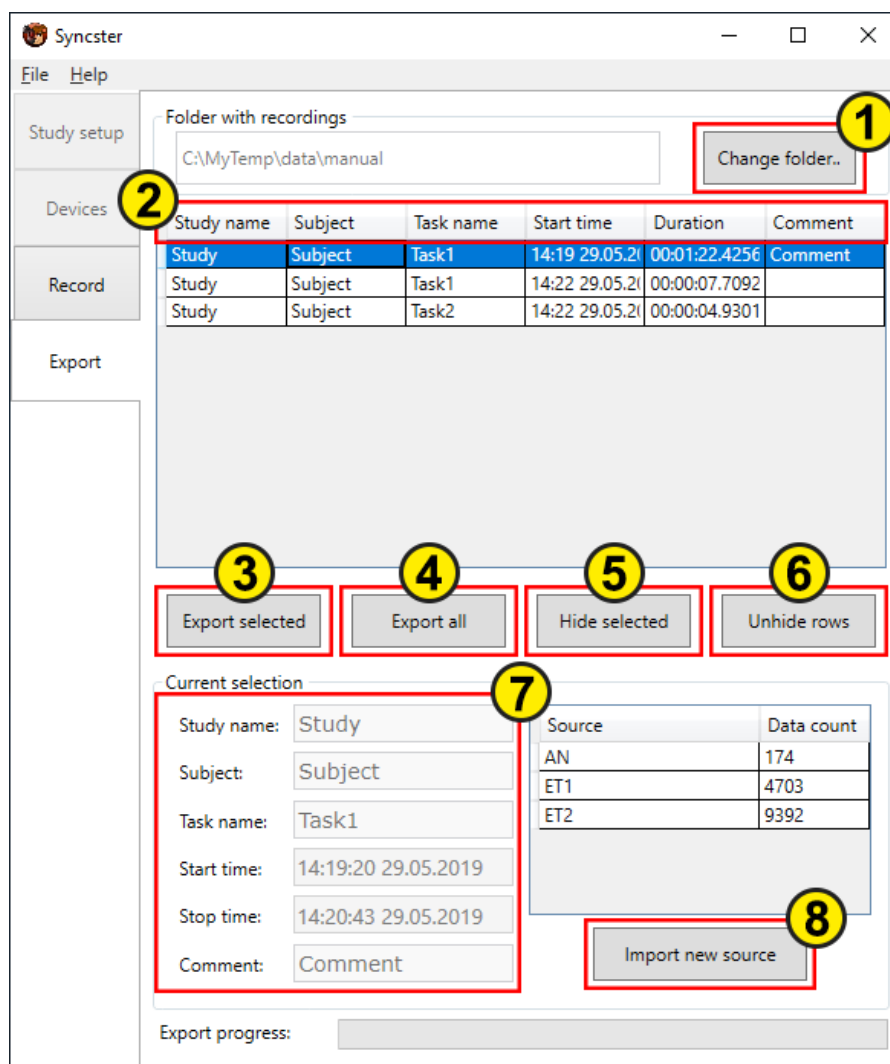


Figure 13. Export tab

You can follow the progress of exporting from the *Export progress* bar, which is in the bottom of the *Export* tab. Syncster will inform you when exporting is done. Notice that you need to have write access to the folder you are exporting to. Figure 14 shows an example where Syncster has exported all visible recordings. The ensuing message box tells the user if any of the exports have failed.

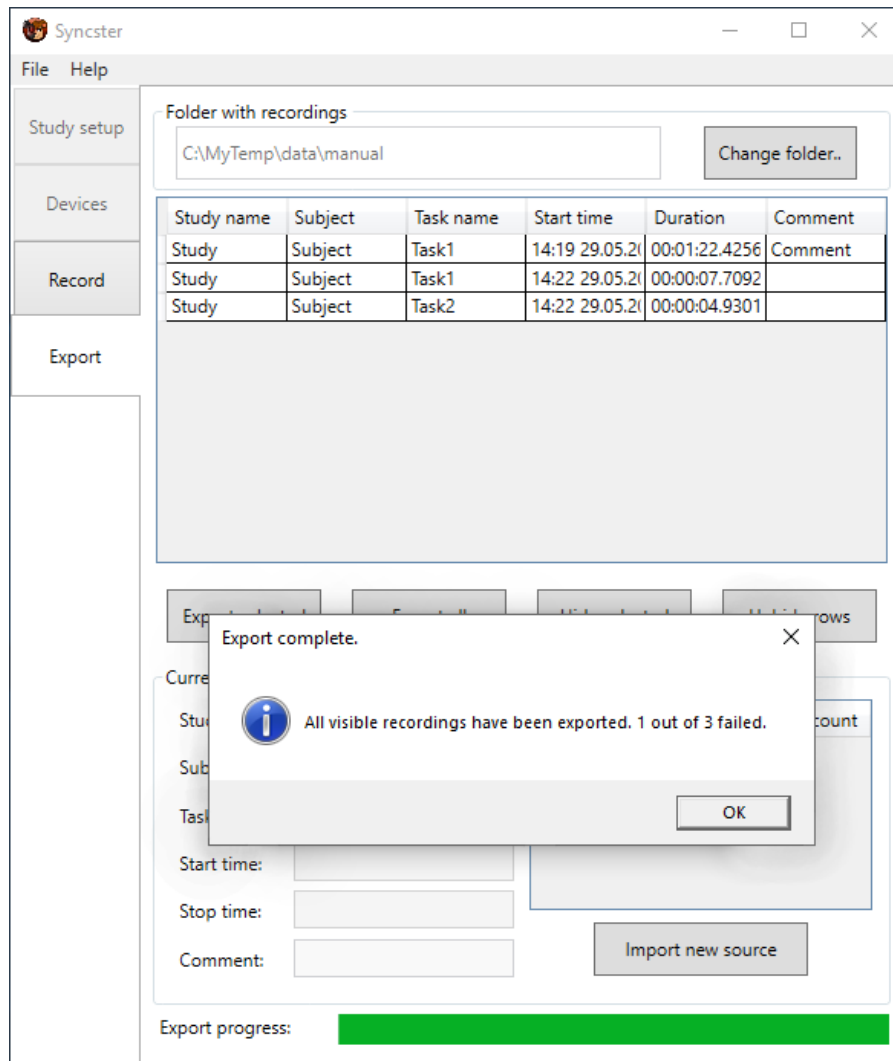


Figure 14. Syncster has finished the exporting process

3.6.3 Importing D-Lab data

Some data cannot be gathered in real time. At the moment Syncster only supports importing eye tracker software's (D-Lab) data, which is recorded at the same time Syncster is recording. To import D-Lab's data to Syncster, first select a recording from the grid and then press the *Import new source* button located in the *Current selection* section (point 8 in figure 13). Find a file which you want to import and open it. Syncster opens an *Import D-Lab data* window (figure 15).

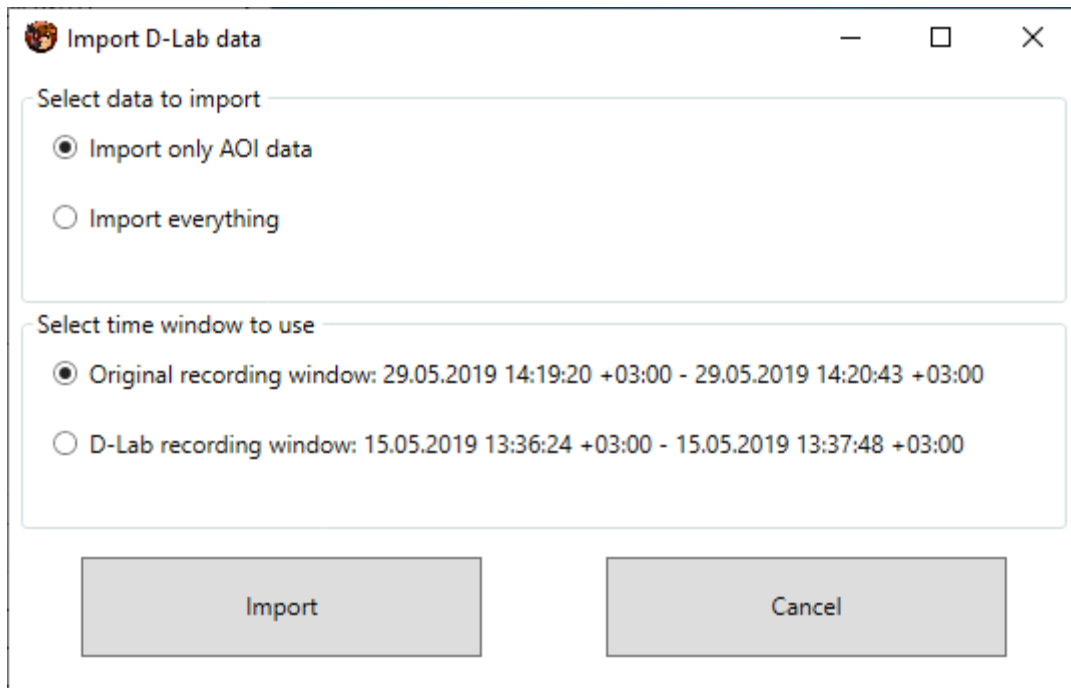


Figure 15. Import D-Lab data window

Syncster will ask you if you want to import all the data or just Area-Of-Interest data. You also need to select whether you want to use the recording window that Syncster used, or the window that D-Lab provides. Assuming that D-Lab's recording is longer than Syncster's, using D-Lab's recording window will add rows that only have D-Lab data in them to the start and end of your exported CSV file. To start importing, press *Import*. After this D-Lab's data is imported and you can start exporting as described earlier. You can see the exported D-Lab data in recording's *Current selection* area (figure 16).

Current selection

Study name: Study

Subject: Subject

Task name: Task1

Start time: 14:19:20 29.05.2019

Stop time: 14:20:43 29.05.2019

Comment: Comment

Source	Data count
AN	174
ET1	4703
ET2	9392
ET	10082

Import new source

Figure 16. Imported D-Lab data highlighted

3.6.4 Remarks about exporting

- 1) You can export multiple different recordings at the same time by starting a new export when the last one hasn't finished yet. However, *Export progress* bar won't show progress correctly. Syncster will still open a dialog window to inform user when each exporting process is done.
- 2) It is not recommended that you export the same recording multiple times at the same time by using the *Export selected* button repeatedly. Doing this might put Syncster into a lock state, and there is no real way of knowing whether any of the exportings have been successful.
- 3) It is not recommended that you export multiple times at the same time by using *Export all* button. Doing this might put Syncster into a lock state, and there is no real way of knowing whether any of the exportings have been successful.
- 4) It is not recommended that you try importing D-Lab data to a recording while you are exporting it and vice versa.
- 5) Exporting process will require a lot of memory if the recording is large (e.g. 700 000 rows of data will take about 9 GB of RAM).

3.7 Menu bar

You can open and save study settings from the menu bar's *File* menu by clicking *Open study settings* and *Save study settings*. You can also exit from Syncster by clicking *Exit* from the *File* menu.

Menu bar also has a *Help* menu that includes *Help*, *Device status help* and *About* menu items. *Help* opens Syncster's instruction manual (you probably have already found that because you are reading this document).

Device status help opens a window that explains the device status colors used in the *Record* tab. From these colors, *Paused* isn't used in Syncster's current modules.

About opens a little window that shows the application name and the last month the application was modified.