BrainRecordIR Walkthrough

**Software Requirements:**

Matlab 2018a or better.

Signal processing toolbox

Statistics toolbox

I intend to compile this to stand-alone which will then not require any dependencies, but I need to finalize the debugging a bit first.

**Setup**

**1) Data folder**

The data will be saved/organized into a default data folder (see next section) that should already exist on the computer. This data folder should contain subfolders for investigators and studies. This is used to populate the “register subject” menu.

E.g.

Data / Huppert / MyFirstStudy /

/ MySecondStudy/

TechEn / DemoStudy1/

etc.

Inside of the study folder, a probe file needs to be located. This can be created by SDGUI (Homer2) or my code. I will give an example of this (I forgot to include this, but it will just go to a default for now).

2) System.config file.

In the same folder as the matlab code, there is a (matlab) file called system.config. This sets the default folder location, default data type for saving (.nirs and/or snirf ) and the system type. Currently it is set as the “Simulator”. See the matlab function “restore\_default\_settings.m” included in the code.

3) Matlab path. The “BrainRecordIR.mlapp” file needs to be in the path (all else is checked and dynamically added). The NIRS-toolbox ([www.bitbucket.org/huppertt/nirs-toolbox](http://www.bitbucket.org/huppertt/nirs-toolbox)) needs to be installed as well.

**TODO.**

1. Check that the nirs-toolbox and all other dependencies are there.
2. Include example of probe files
3. Modify the restore\_default\_settings code to include the Bluetooth, CW6, and Wireless systems

To launch. Type “BrainRecordIR” from matlab. This will take a few moments (~30s) to load fully.

The newly loaded interface will look like this.



2) First, register the subject and select the investigator/study. This is the File>> Register New Subject . This will launch the register subject window. Select the Investigator and Study from the pull-downs. These options are read dynamically from the subfolders of the default DATA folder. The probe on the right will update based on the study selected. (I need to provide examples of probe files; currently it is using the default probe).

The Subject name (plus time-stamp) will create a subfolder in the study folder where the data will go.



The comments and demographics fields are optional and will be stored in the file.



**Interface components:**

**Detector panel.**



TODO:

1. Remove controls based on size of instrument
2. Autogain button does not work
3. Show Noise Map needs to be modified
4. The “LED”s above each detector are meant to show noise levels and needs to be coded

**Sources Panel**

“Link colors” will link the control of the wavelengths (e.g. 690/830nm) so the lasers/leds are linked

The up/down numbers control the laser power (disabled in Cw6 system).

The toggle button turns on/off each source. The LED turns red if the source is on.



TODO.

1. Autoadjust does not work yet
2. Remove controls based on the size of the instrument
3. Change the number of controls per source to match number of wavelengths for instruments with >2 wavelengths

**Events Panel**

The pulldown selects which event is being controlled by the mark and toggle switch. This name can be edited/types in the pulldown and is specified for each study (need to provide example of how to do this). The button puts a mark. The toggle switch is used to mark blocks (turn on and then turn off).

The LEDs light based on the aux channels and/or digital line (needs to be coded), The table will populate as events occur and can be edited to change/remove/add events manually in real time.



TODO.

1. Fix LED links to aux/digital data
2. Add button to launch more elaborate Stimulus Utility GUI (modified one in NIRS-toolbox)

**Real-time Panel**

The data is automatically converted to dOD and hemoglobin in realtime. A band-pass filter (on the dOD level) is implemented in real-time and toggled by the check/edit boxes. This can be changed in real-time without starting/stopping the code.



TODO.

1. Add motion correction code and enable button
2. Add real-time GLM code and better label the GUI buttons. See Barker et al paper for details about the “tune”. (Basically, this is that process noise in the Kalman filter).
3. Error checks on filter values to make sure doesn’t exceed Nyqust

**Files Panel.**

This lets you review already collected data as well as reload files and run analysis (using the NIRS-toolbox). This uitree is populated as data is collected or loaded. The Run Analysis button will process all the loaded/recorded data and create file-level and study-level statistics maps. This control is disabled while the instrument is actually running. Between acquisitions, clicking on the file name will bring up the old data for review.



TODO.

1. Add GUI controls to change the default analysis pipeline.

**System Panel.**

Allows change of the sample rate of the instrument.

Allows change in hardware filters/settings

Allows change (review) of the COM port connection (this is automatically found for the Cw6 and wireless instruments). Adds system message information to the window



**Probe and acquisition controls**



Probe is the standard “HOMER” view and interactive. Use right-click to multi-select lines

The Mark Event button is replicates the button on the event panel (and the label is changed by the same pulldown on that panel). The sources rocker switch is the “All on/off” button. The LED above will be red if ANY source is on. The comment button will place a mark in the data (but ignored by the statistics code).

The “Draw mode” allows select of standard (2D view), a 10-20 map, or a 3D view of the probe. These are also interactive lines. The 3D and 10-20 views are only available is the probe is registered using “AtlasViewer” (HOMER2), my toolbox, or Phoebe (working on this). The registered probe is loaded from the study folder upon register subject or digitized after registration via Pheobe. (working on this).

**Data View**



The pulldown allows selection of raw, dOD, or hemoglobin data

Window data – windows the time axis



TODO. Add backprojection image of SO2 here (spatial map of SO2 over head)

In “clinical view” it plots SO2.

TODO:

1. Heart-rate needs to be coded.
2. ROIs need to be adjustable (currently only supports left/right sides of probe).
3. Change colors on the SO2 time course (bottom) to allow identification of ROIs
4. Change color of SO2 text above/below level ?
5. Fix the y-axis (currently static 50-100% range).

**Stats view**



TODO: Add HRF time-course

TODO.

1. Make the probe fill the entire window
2. Add the time-course to the bottom left corner (currently, I use the “research panel” to display the HRF curve, but I don’t like that and so I am going to move it to the same panel as the stats maps