Evaluating HCI using functional Near Infrared Spectroscopy (fNIRS)

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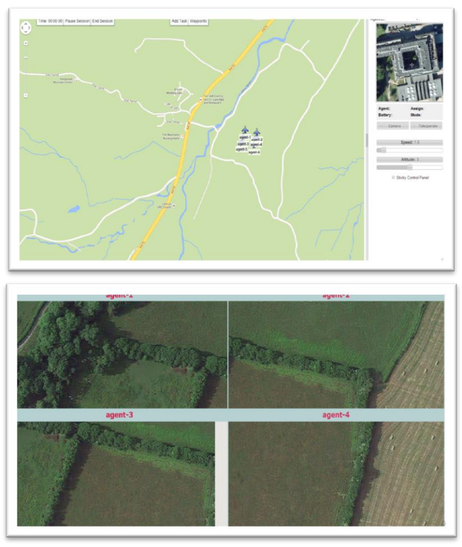
fNIRS

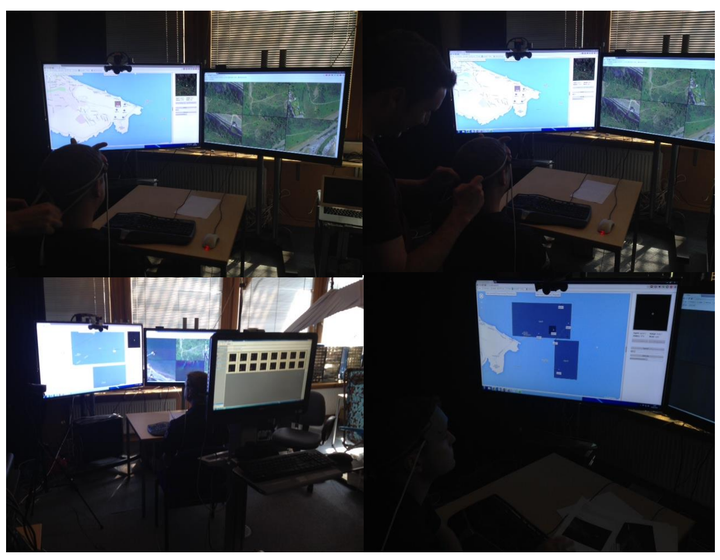
Functional Near-Infrared Spectroscopy (fNIRS) is a non-invasive imaging method for quantifying de/oxygenation levels in the haemoglobin of the human brain.

- Specifically targeting the Prefrontal Cortex – area associated with working memory and decision making
- Believed to be an indicator of mental workload
- Minimal setup, time
- Resilience to motion artefacts

UAV Simulator



We developed a task using the ORCHID UAV simulator. The simulator was modified to include targets to be placed on the terrain, allowing us to set a visual search task during studies. This will allow us to measure the effect on individuals performance whilst increasing the number of UAV's they must control.



UAV + fNIRS Study

The aim of the study is to identify the effects of increasing operator demands upon performance during a visual search task. Participants are given a mission brief and are asked to locate as many targets within the specified region in a set amount of time. The scenarios are typically themed as disaster response, and the targets are representative of humans/animals.

We are additionally interested in understanding the effect of expertise in this given scenario. As such we have teamed up with Rescue Global to utilise trained pilots and disaster response professionals who have real world experience with these kinds of scenarios.

Current legislation restricts a 1 – 1 relationship between pilots and UAV's, we're interested in understanding, through quantitative analysis of the fNIRS data whether this restriction is warranted.

Future Work

We are investigating a number of avenues with this project:

- Machine Learning
  - To automatically classify mental workload, in real time, dependant on fNIRS signal.
- Dynamic Lighting Environments
  - Understand the effect of participants perceiving their own Mental Workload by adapting the lighting in the environment
- Cause and Effect Analysis
  - Using a novel artificial immune to attribute interface changes to effects observed in fNIRS
- Supporting Researchers
  - Who wish to integrate fNIRS into their future studies