CruX Team 2 - RC Car

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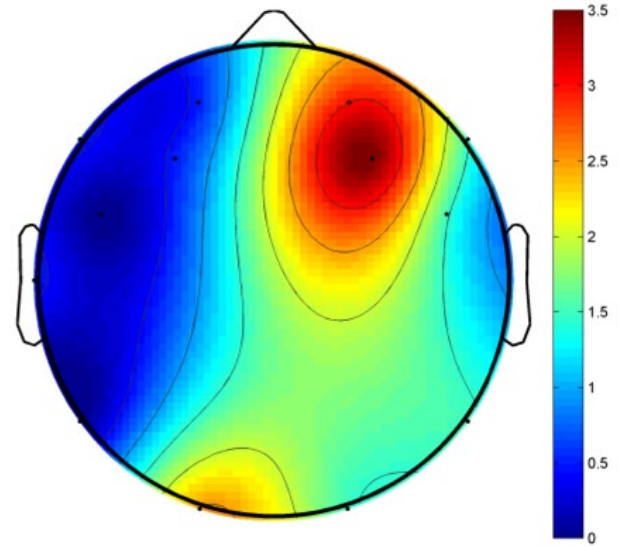
Narrative

Model car ~ wheelchair

Steady State Visual Evoked Potential (SSVEP)

SSVEP classification -> model car control

Significance

Paraplegic Application

SSVEP Research

Overall Aim

Develop a brain-computer interface (BCI) that can control the movement of a model car.
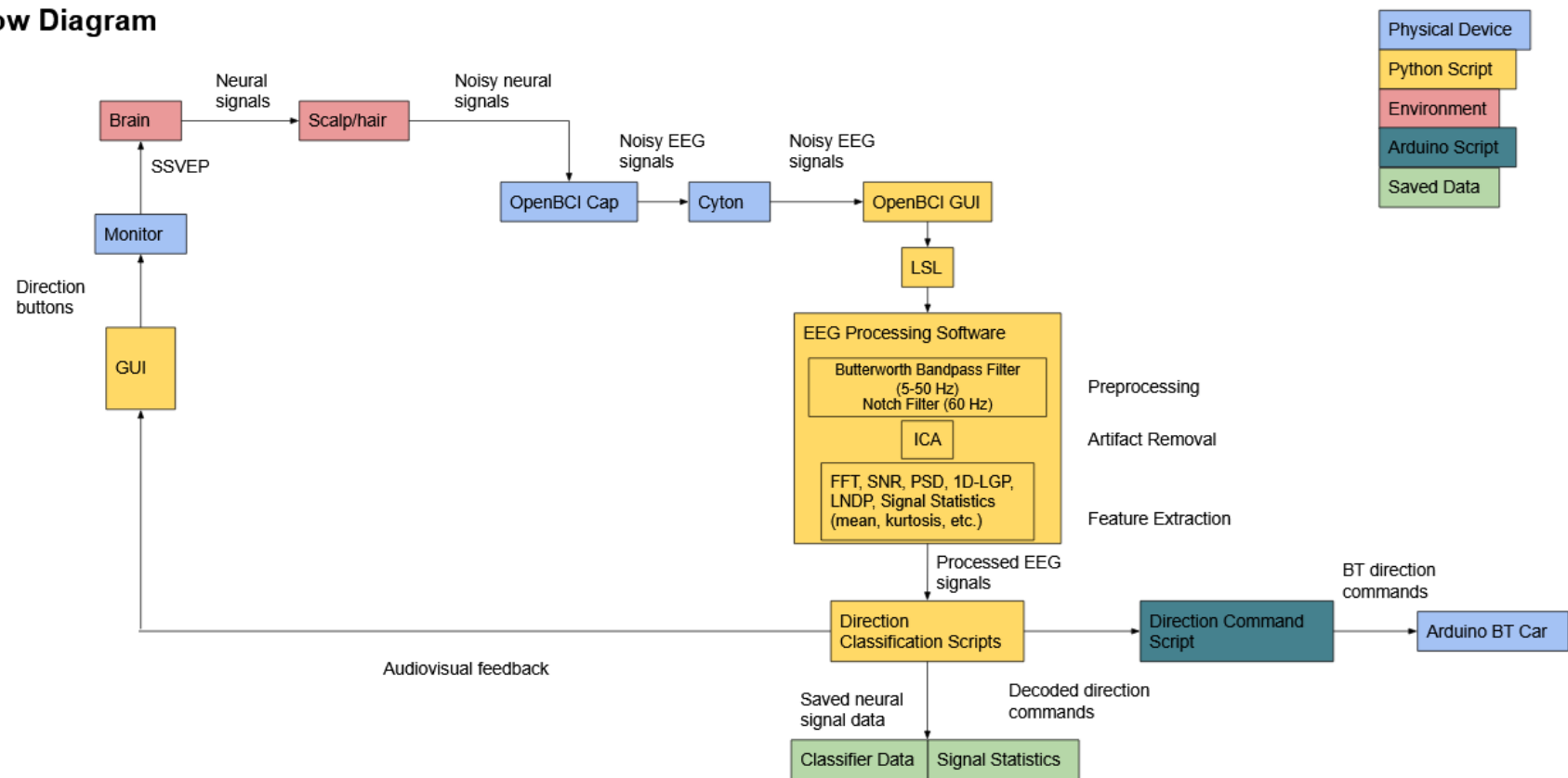
Specific Aims

Successfully collect EEG signals via OpenBCI headsets.

Create a brain-computer interface to classify SSVEP signals using analytical or ML methods.

Navigate a model car through a maze via a brain-computer interface.

Data Flow Diagram

Legend:
- Physical Device
- Python Script
- Environment
- Arduino Script
- Saved Data

Brain → (Neural signals) → Scalp/hair → (Noisy neural signals) → OpenBCI Cap → (Noisy EEG signals) → Cyton → (Noisy EEG signals) → OpenBCI GUI

Monitor → (SSVEP) → Brain

GUI → (Direction buttons) → Monitor

OpenBCI GUI → LSL → EEG Processing Software

EEG Processing Software
- Butterworth Bandpass Filter (5-50 Hz), Notch Filter (60 Hz) — Preprocessing
- ICA — Artifact Removal
- FFT, SNR, PSD, 1D-LGP, LNDP, Signal Statistics (mean, kurtosis, etc.) — Feature Extraction

EEG Processing Software → (Processed EEG signals) → Direction Classification Scripts

Direction Classification Scripts → (BT direction commands) → Direction Command Script → Arduino BT Car

Direction Classification Scripts → (Audiovisual feedback) → GUI

Direction Classification Scripts → (Saved neural signal data / Decoded direction commands) → Classifier Data | Signal Statistics
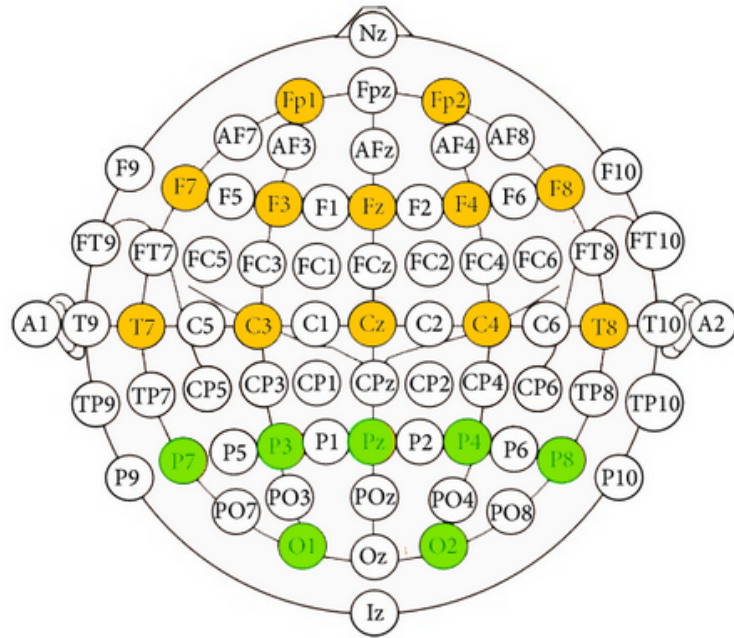
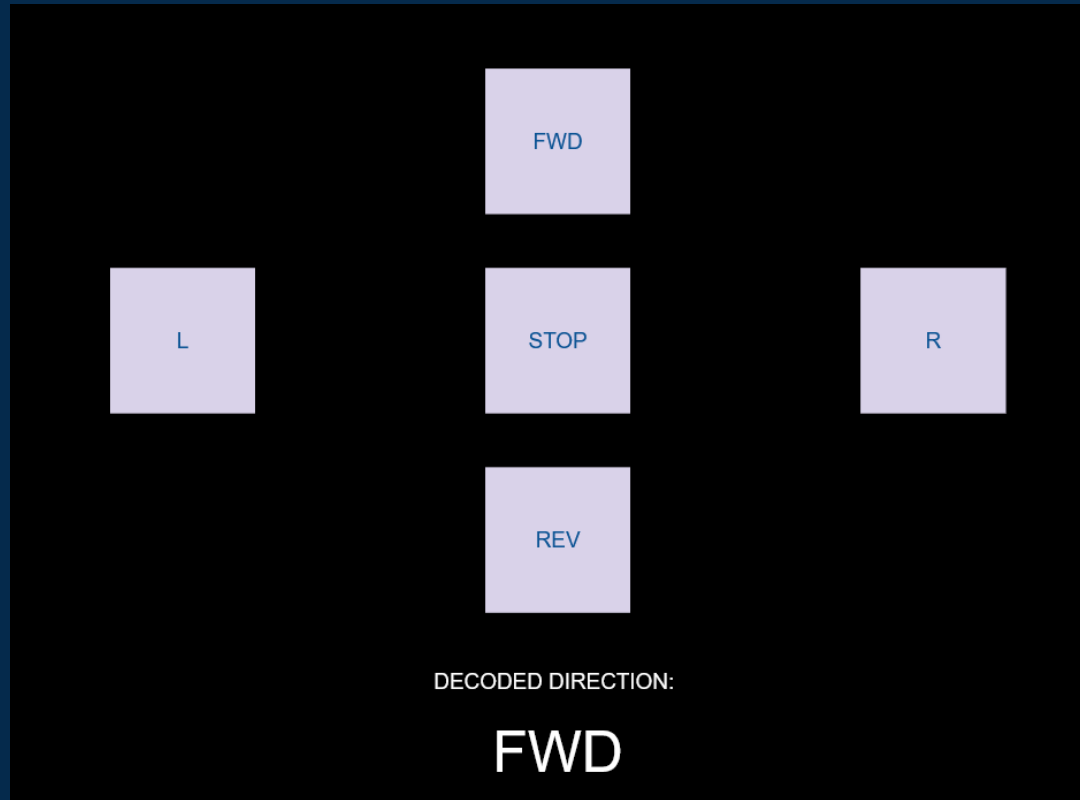Fig. 2 - Electrode Channels of Interest
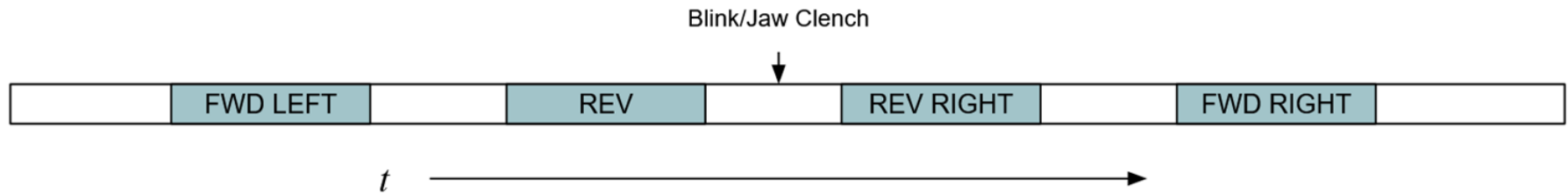
Fig. 3 - Graphical User Interface

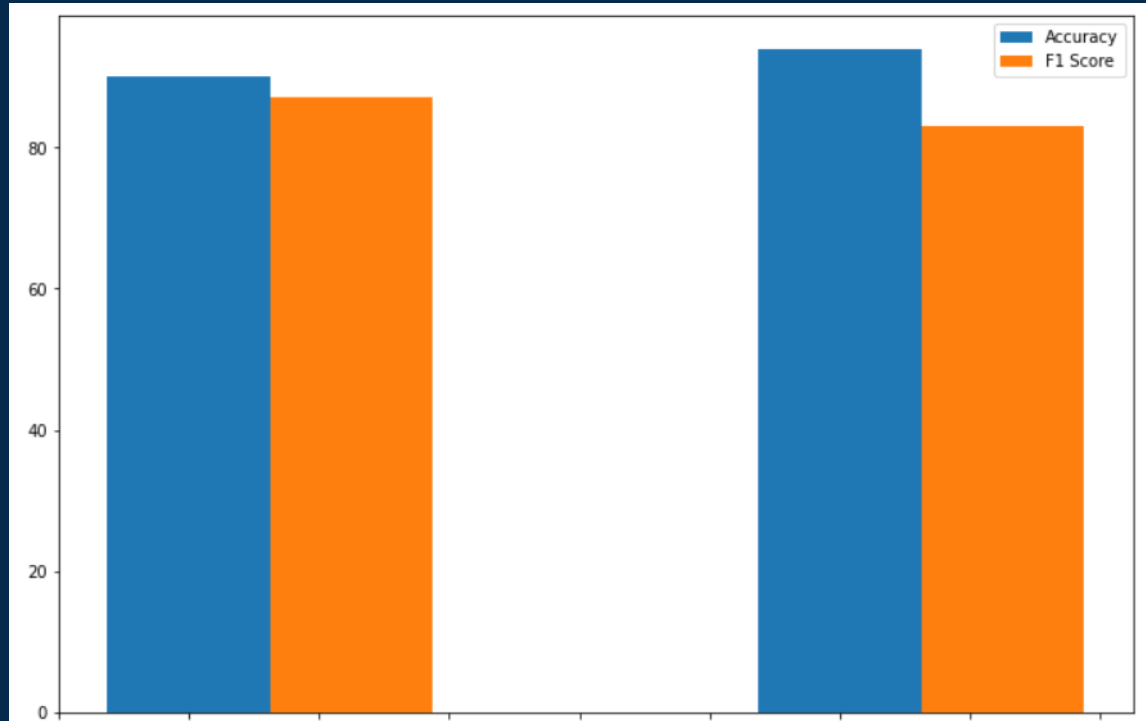Fig. 4 - Training Session Example

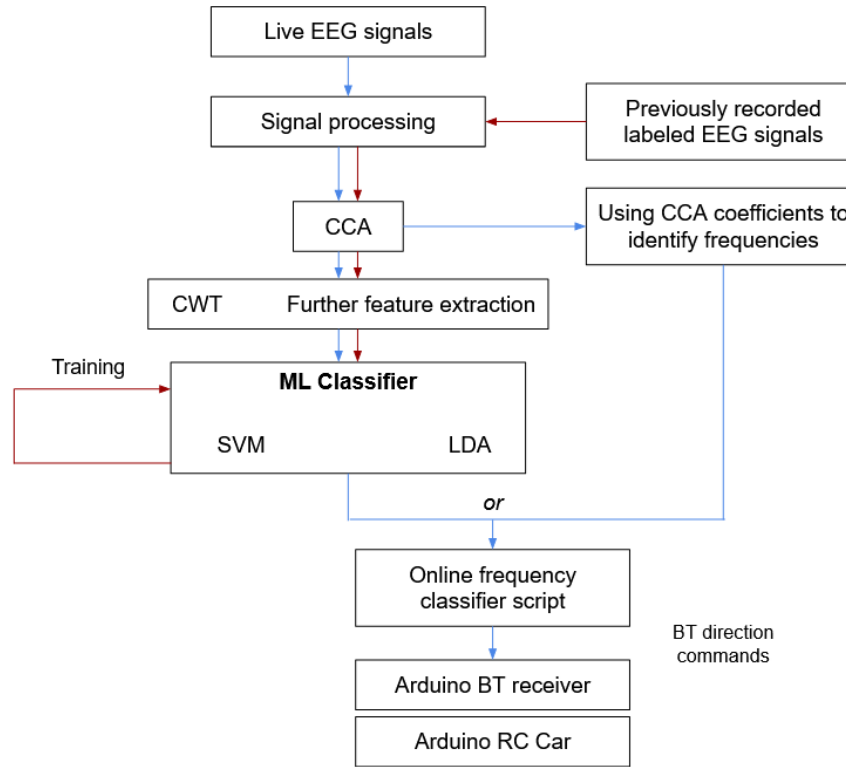Fig. 5 - Simulated Classifier Accuracy and F1 Scores

Fig. 6 - SSVEP Classification Schematic

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