

Detextroke



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Detexroke



Purpose: assist patients with **little to no verbal or motor functions**

Function: act as an **emergency assistance** using **brain signals**



Benefits of the Device

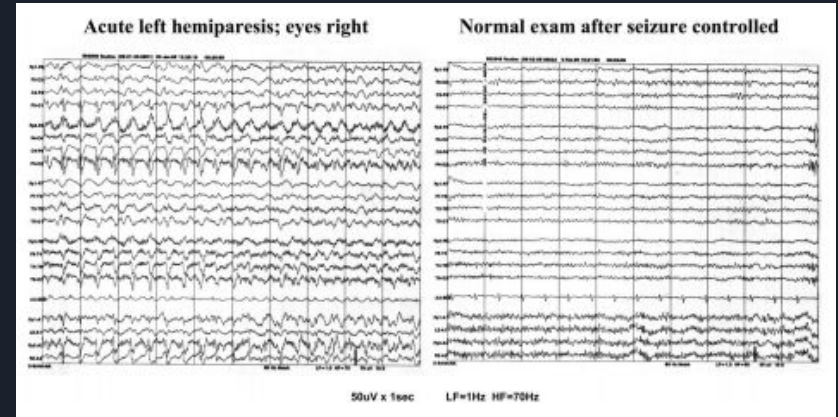
- Elderly and Disabled users with ALS, Spinal Cord Injury can control device without use of mechanical linkages in the body
- - Detect life threatening conditions and autonomously calls emergency contact and send data to clinic.
 - Commercially available without need of complex structures
 - Adaptation Algorithms to improve performance and accuracy
 - Can be used to control external devices (i.e. phone)

Drawing of the Device



Stroke Detection using EEG

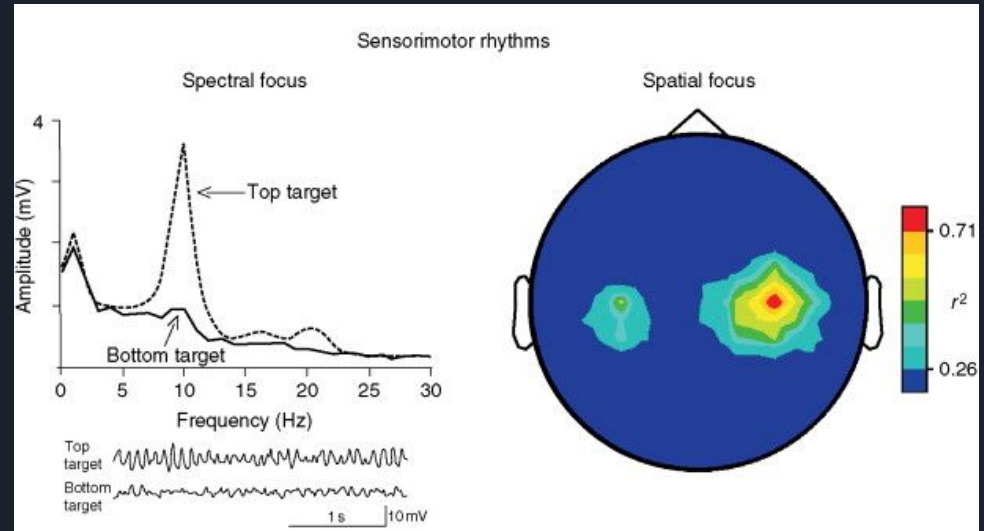
- Main frequencies used to detect a potential stroke:
 - Delta (1-4 Hz)
 - Alpha (8-15 Hz)
 - Beta (16-31 Hz)
- Signs of stroke include:
 - increased alpha frequencies in conjunction with lower delta activity
 - Noticeable decrease in activity of all EEG frequencies
 - Ipsilateral loss of both beta and alpha activity
 - Overall uncharacteristic beta activity



EEG of Stroke vs. After Stroke

SMR

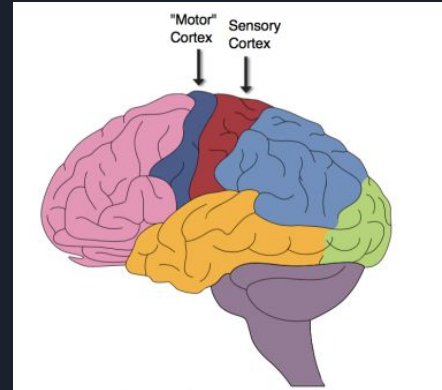
- Imagine motor movement suppresses the mu-rhythm (8-12 Hz), often mixed with a beta (around 20 Hz) and a gamma component (around 40 Hz)
- Signals are measured over the primary motor cortex in the frontal lobe
- Commonly used for movement rehabilitation for patients with impaired motor function (e.g. ALS)



Example of suppressed mu-rhythm using SMR

SMR Application

- When baseline signal differs from patient's monitored signals by a subtle amount, the patient will be asked to imagine right/left arm movement as a method of testing for consciousness.
- Imagined arm movement utilizes **mu and beta rhythm (8-20 Hz)** in **C3, Cz, and C4** regions of **sensory cortex**.
- Detection of frequencies outside of this range are considered to be unstable.
- If patient is unable to imagine arm movement, emergency message will be sent to the patient's chosen contacts.
- If patient can confirm imagined arm movement, patient can choose whether to contact emergency contacts or return to monitoring.

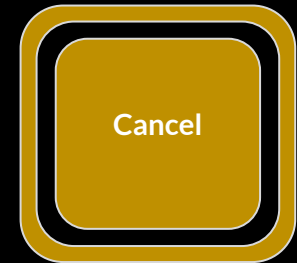


SMR Design

Screen 1



Screen 2



SMR Design

Screen 1



Screen 2



SSVEP

- Visual stimulus applied to the subject via a computer screen
- People which are afflicted with neurological conditions or neurodegenerative diseases can't control own muscles by neural pathways.
- The best response for these stimulus are obtained for stimulation frequencies between 5 and 20 Hz



Example of spelling using SSVEP

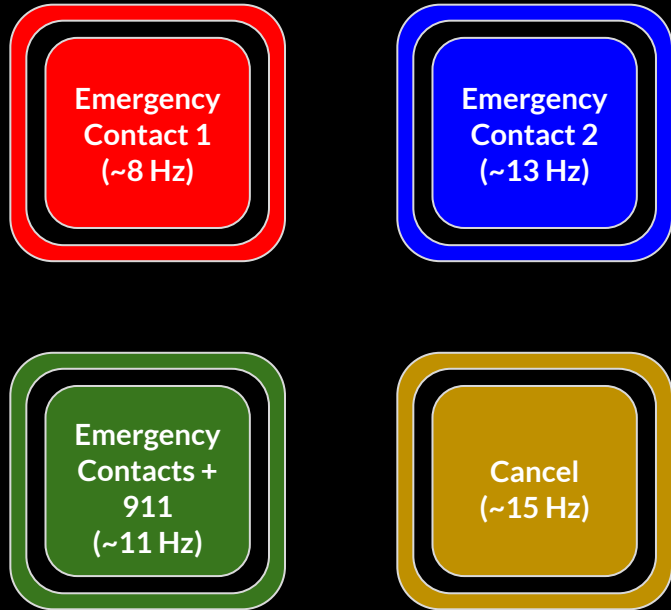


SSVEP Application

- For integration of SSVEP for our device will be the screen will be split up into 4 squares with different colors and flashing them in different frequencies.
- Using natural responses for visual stimulation at specific frequencies will connect to the contact without any vocal muscle and using brain signals
- The brain signals will be able to recognize what part of the screen the patient is looking towards and make the appropriate call

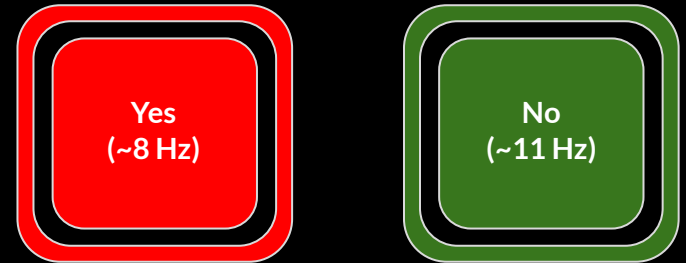
SSVEP Design

Screen 1



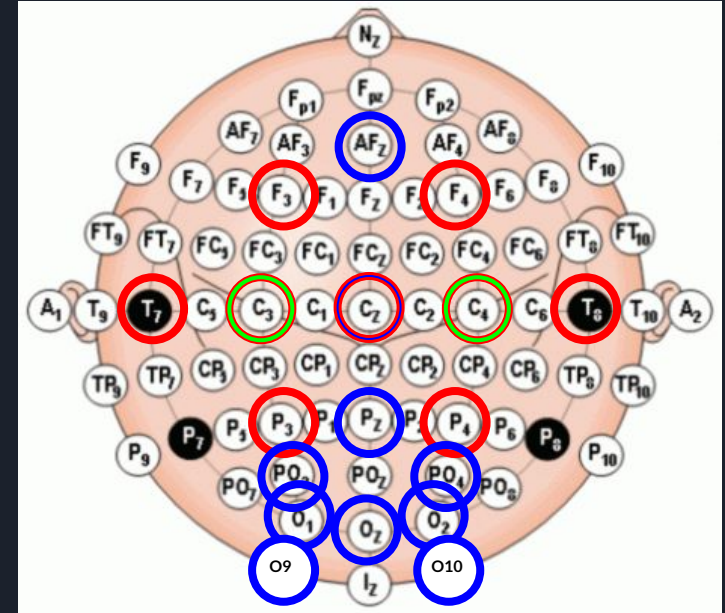
Screen 2

Proceed with call?



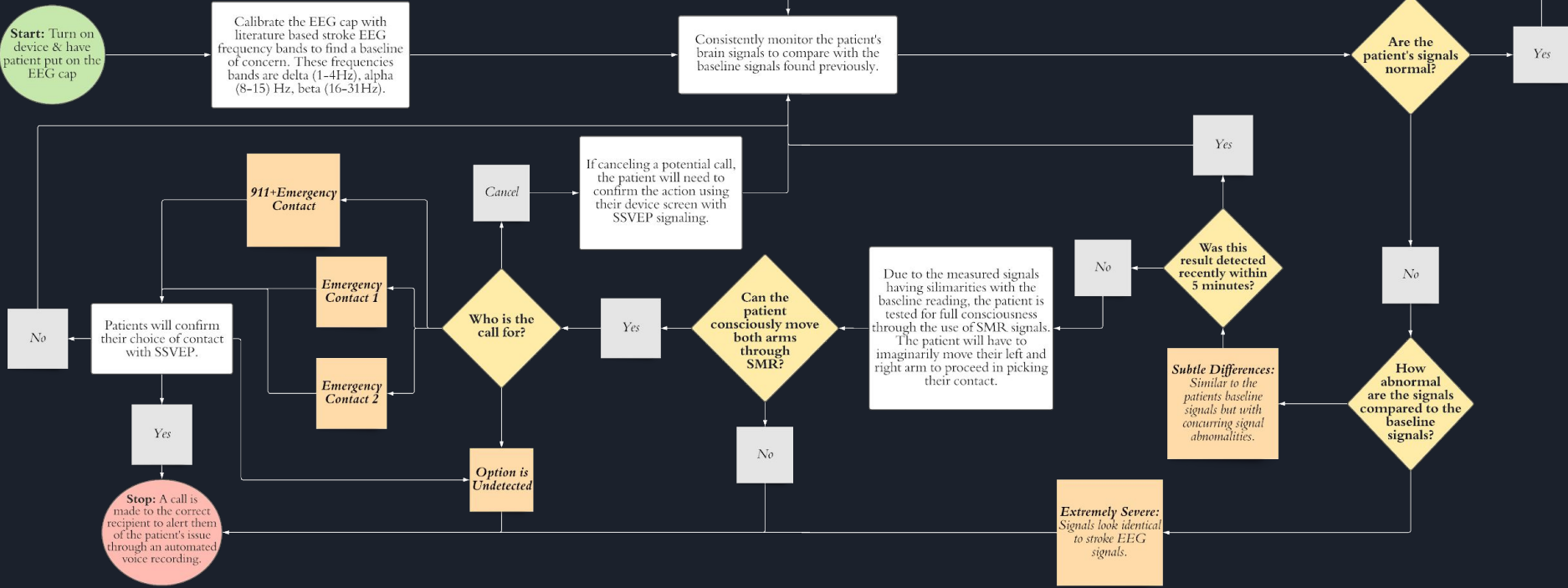
Signal Collection and Processing

- Electrode placement
 - Strokes (Red)
 - F3, F4, Fz, P3, P4, Pz, C3, C4, Cz, T3 and T4.
 - SSVEP (Blue)
 - AFz, Cz, Pz, PO3, PO4, O1, O2, Oz, O9, and O10
 - SMR (Green)
 - C3 and C4
 - 20 electrode cap
- Sampling rate of at least 1000 Hz
- Filters to extract features from data
 - Calibration period required
 - For both sleeping and awake
 - Use smoothing and high/low pass filters
 - Autocorrelation function
 - Welch's Periodogram
 - Power Spectral Density



Placement of Electrodes on International 10/10 system

Flow Chart



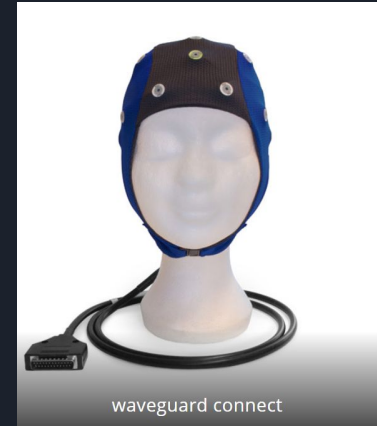
Safety and Feasibility

Safety and Comfort

- EEG cap and external device with screen; no moving parts
- Waveguard Connect EEG cap
 - EEG caps in varying sizes for comfort
 - Electrodes built-in cap
 - Soft silicone electrode cups
 - Breathable Coolmax fabric
 - Hidden wiring
 - Repair kit available

Feasibility and Accuracy

- SSVEP requires little to no training
- Different colors and frequencies per selection
- Auditory feedback for improved performance
- Designed comfort for long lasting usage
- Confirmation options for ensured feasibility



Screen 1



Detexroke

Target Audience: patients with little to no speech and motor control (specifically: Acute Ischemic Stroke).

Functions: detection of life threatening conditions (stroke or seizures).
Ability to call emergency contacts or services.

Signals used:

SMR measures signals to determine how detrimental is the patient's state.

SSVEP determines who to contact using flashing lights and used to clarify decision (preventing false positive).



Thank you



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