DREXEL UNIVERSITY
School of
Biomedical Engineering,
Science and Health Systems

Team 9: Electrooculography (EOG) Based Alert System for Aphonic Amyotrophic Lateral Sclerosis (ALS) Patients

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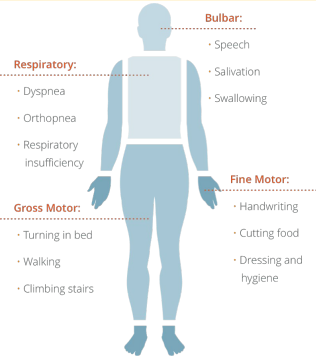**Advisor:** Dr. Dougherty

Problem

Need:
- ALS attacks voluntary muscles - leaving patients paralyzed
- The ability to eat, breathe, speak and move is lost

Design Inputs:
- The device must be fixed to the patient's body.
- >97% sensitivity, >8hrs performance in typical lighting
- >55dB alert audio, >60ft range
- A distress call generated within 20s

Bulbar:
· Speech
· Salivation
· Swallowing

Respiratory:
· Dyspnea
· Orthopnea
· Respiratory insufficiency

Gross Motor:
· Turning in bed
· Walking
· Climbing stairs

Fine Motor:
· Handwriting
· Cutting food
· Dressing and hygiene

Solution

Since vertical eye movement is retained, EOG will be used to monitor for distress signals
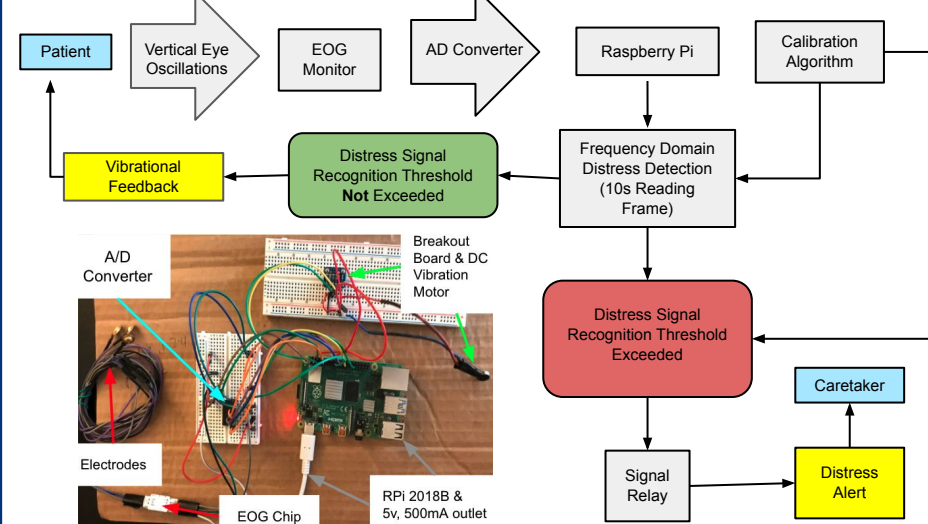
Testing Results

✅ 25 trials yielded 100% distress detections within 20 seconds

✅ Detection times are not impacted by 2 hours of wear

✅ Detection times are not impacted by high and low light conditions

✅ Audio output is audible to 5 test subjects from up to 60 ft away

✅ 3 False positive detections within 45 tests
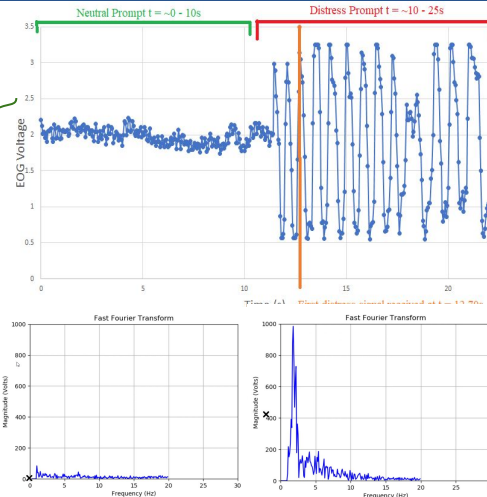
Future Plans

Revisions:
- Improve degrees of communication with an auxiliary input source

Impact:
- Device is fully automated and customized to patient-specific physiology.
- Device is an affordable and reliable means of returning autonomy to patients and caretakers.