**Introduction and Motivation**

**Amyotrophic Lateral Sclerosis (ALS)**
- Progressive neurodegenerative disease causing loss of muscle control
- Approximately 20,000 people in the U.S. have the disease at any given time

**Locked-in Syndrome (LiS)**
- Advanced stages of ALS lead to LiS
- Individuals experience body paralysis with loss of speech (aphonia)
- Cognition, vertical eye movement, and blinking classically preserved

**Primary Objective:**
- To give ALS patients with LiS a means to voluntarily alert their caregivers in times of need

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**Limitations of Current Products**

<table>
<thead>
<tr>
<th>Method</th>
<th>Advantages</th>
<th>Disadvantages</th>
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<tbody>
<tr>
<td>Call Bell/Alert Device</td>
<td>- Allows for rapid access to caregiver.</td>
<td>- Voluntary control of limbs and diaphragm</td>
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<tr>
<td></td>
<td>- Inexpensive</td>
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<td>Call Bell Communication Hybrid</td>
<td>- Wearable and adaptive to posture.</td>
<td>- Requires a large cognitive load</td>
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<td>- Establishes a mode of communication.</td>
<td>- Sensitive to eyelid drop</td>
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<td>- Some require voluntary control of limbs.</td>
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<td>- Expensive</td>
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**Our Product**

- Raspberry Pi (not in direct contact with patient) provides alert sound to caretaker at >55 decibels (competitors offer ~40) and watch type unit on patient provides haptic feedback back to wearer
- Utilizes EOG technology that is not yet used commercially, but is more accurate and less error prone (ex. is not vulnerable to drooping eyes or changes in posture
- >97% sensitivity to urgent distress calls with <3% false negative
- Battery life >8 hours
- Can generate signal within 20 seconds of distress (ex. choking, cardiac arrest, hypoxic brain injury)
- Calibration will use fourier transform as basis for alert signal
  - Allows for better calibration and more reliable distress signal
  - Rapid motion of eyes will cause spike in certain frequencies, triggering alarm

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**Value**

**Improves quality of life for ALS patients**
- Provides a means for communicating urgent needs.
- Inexpensive compared to competing products.
- Able to be used in a home setting.

**Reduces cognitive load for use**
- Only requires ocular movement, which is often all that is retained in later stages of ALS.
- Activated with simple gestures like vertical eye movements.
- Ocular movement detection can be calibrated to each patient.

**Can be expanded to other neuromuscular disorders**
- Guillain-Barré syndrome, myasthenia gravis, and poliomyelitis can all exhibit Locked-in Syndrome

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**References Available Upon Request**