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Introduction and Motivation

Myotrophic 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

Limitations of Current Products

Method	Advantages	Disadvantages
Call Bell/Alert Device	<ul style="list-style-type: none"> • Allows for rapid access to caregiver. • Inexpensive 	<ul style="list-style-type: none"> • Voluntary control of limbs and diaphragm
Call Bell Communication Hybrid	<ul style="list-style-type: none"> • Wearable and adaptive to posture. • Establishes a mode of communication. 	<ul style="list-style-type: none"> • Requires a large cognitive load • Sensitive to eyelid droop • Some require voluntary control of limbs. • Expensive

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

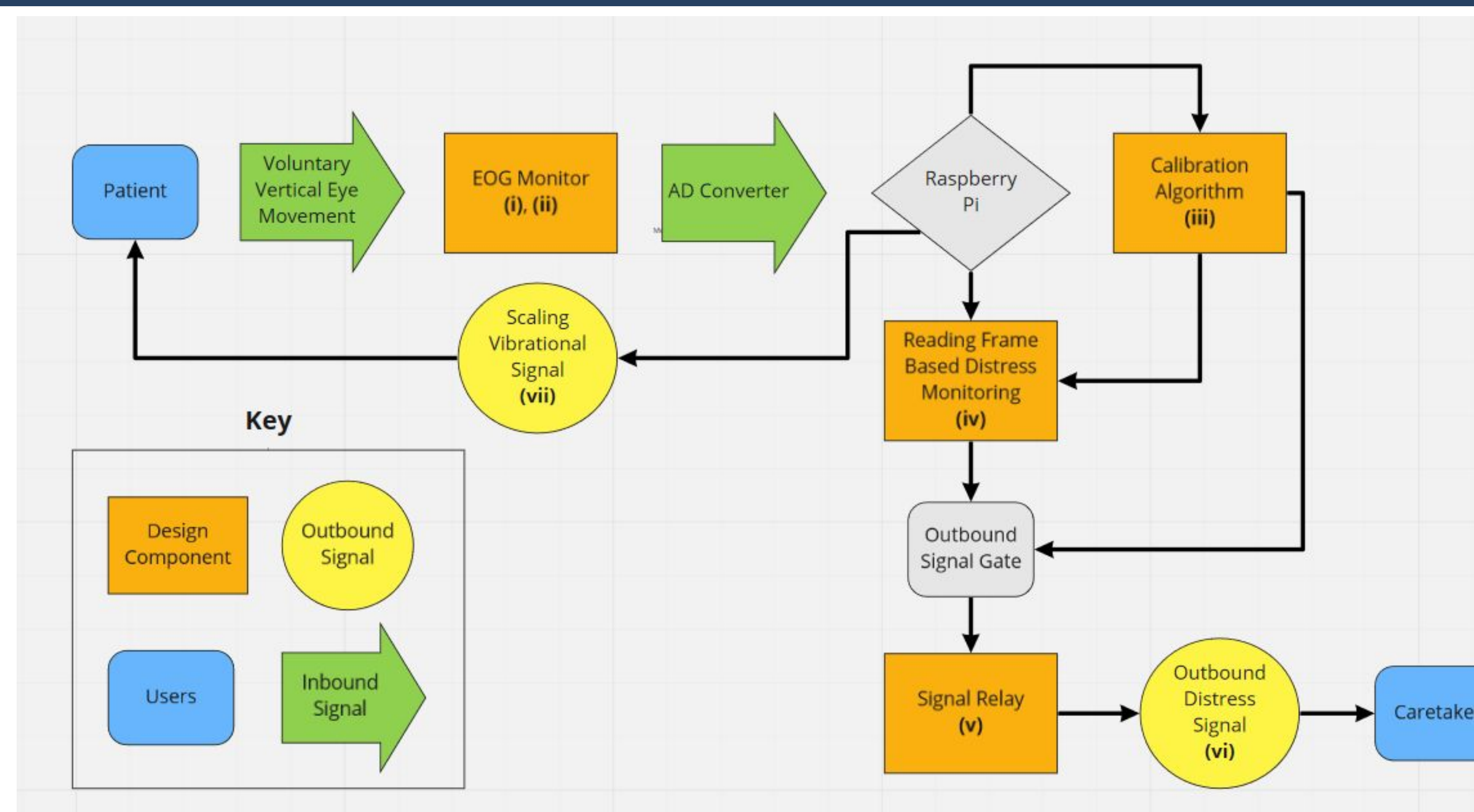
- Only requires ocular movement, which is often all that is retained in later stages of ALS.
- Activated with **simple gestures** like vertical eye movements.
- Ocular movement detection can be **calibrated to each patient**.

Can be expanded to other neuromuscular disorders

- Guillain-Barré syndrome, myasthenia gravis, and poliomyelitis can all exhibit Locked-in Syndrome

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



References Available Upon Request

