

Tongue Pressure Sensor System



A Device to Help Elderly People Strengthen Their Tongues

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Dysphagia

- A disorder characterized by the difficulty or inability to swallow
- Affects 15,000,000 people in the U.S (mostly the elderly)
- Can cause many secondary problems and even death
- Dr. JoAnne Robbins believes a major cause of dysphagia is decreased muscle mass in the tongue, which can be strengthened through exercises

A Device to Treat Dysphagia

Objectives:

- Create a device to help improve the strength of the user's tongue through exercise
- Can be used by elderly and disabled patients, by themselves at home
- Provide useful visual and auditory feedback to user to monitor progress and technique
- Inexpensive (~\$100 to manufacture)
- Compact size and wireless interface

Polymorph Plastic Mouthpiece

- A polymorph plastic was chosen that meets most of the specifications of the mouthpiece
 - Can be custom fit by the client (to ensure more precise readings from the sensor during exercises)
 - Fairly easy to form
 - Comfortable
 - Durable
 - Inexpensive

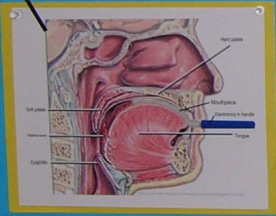
Forming the Mouthpiece to the Patient's Mouth

- Heat water to 60-65 degrees C
- Place the mouthpiece in the water
- Remove the mouthpiece when it is mostly clear
- Put the mouthpiece in the mouth and push it to the palate with the thumb
- Wait until the plastic hardens
- Connect the electronic module. It's ready to use!

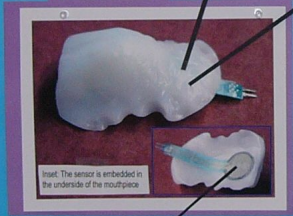
Minimization Process

- Goal was to move from development board to printed circuit board (PCB)
- Cleaned up code to minimize memory used
- Designed circuit to implement design
- Experimented with surface mount chips
- Experimented with 3.3 V power supply
- Finalized with 40 pin DIP
- Implemented to PCB successfully

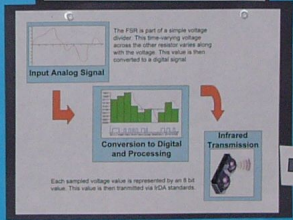
User presses tongue against mouthpiece



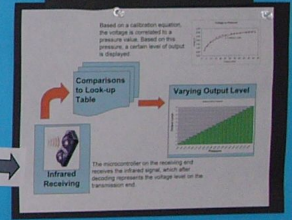
Mouthpiece



Signal pathway in mouthpiece



Signal path in display unit



Audio and Visual Feedback

Pressure Sensor

- Force Sensing Resistor
 - 5mm - 5" circle
 - Has a linear relationship between resistance and force
 - Has pressure sensitivity for tongue pressure range (0.009kPa - 115 psi)
 - Is embedded in mouthpiece and covered with a thin plastic membrane to protect from the moist environment

3.17mm width PCB

Ergonomics

Many users may be elderly or suffer from disabilities. Therefore the device has

- Simple, intuitive controls and interface
- Large knobs
- Looks safe, friendly
- Sturdy construction
- Both audio and visual feedback

Feedback to User

- The display gives useful feedback to the person operating the device
- As the user presses harder, more lights turn on
- When the pressure exerted reaches the target level, a tone sounds