Tongue Pressure Sensor System
A Device to Help Elderly People Strengthen Their Tongues

Client: Dr. JoAnne Robbins, VA hospital
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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 tone in the tongue, which can be strengthened through exercise

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 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 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 palatine 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)
- Cleared up code to minimize memory usage
- Designed circuit to implement memory
- Experimented with surface mount clips
- 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

Pressure Sensor
- Force Sensing Resistance
- Small ~ 5k Ohms
- Post processing between resistance and force
- Many pressure sensors for tongue pressure ranges
- Sensitive to normal
- Is embedded in mouthpiece and covered with a thin plastic membrane to protect from the mouth environment

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

Audio and Visual Feedback

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