

Development of a Novel Communication Device

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Outline

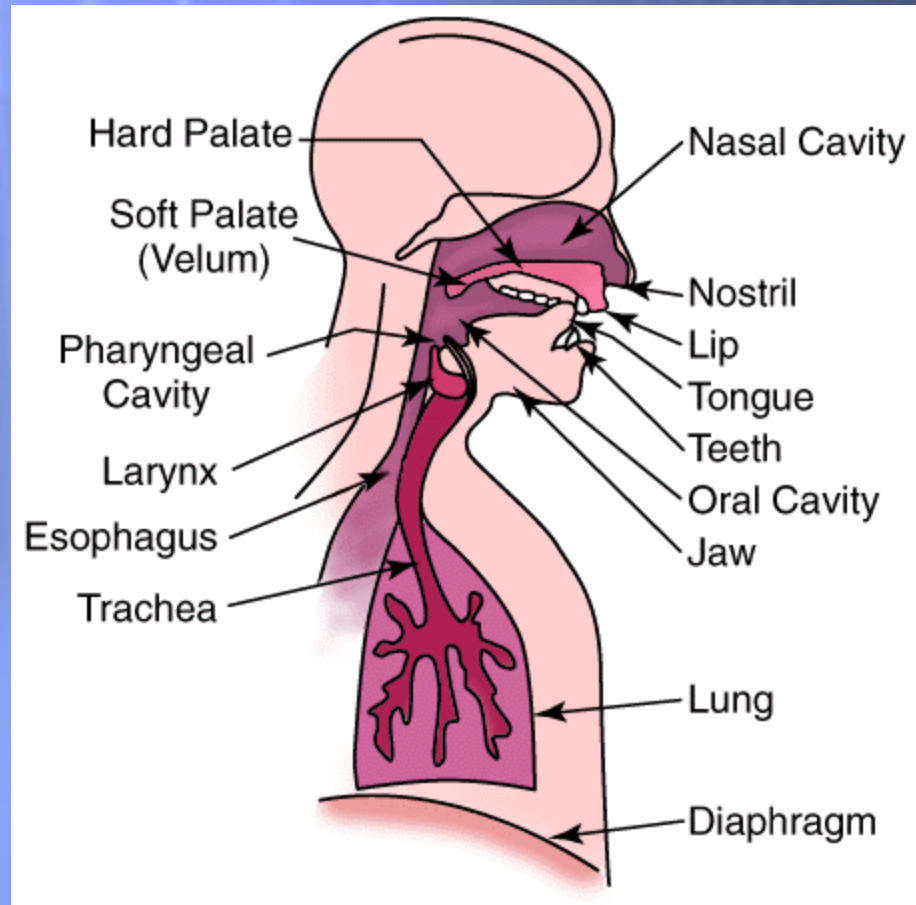
- Problem Definition
- Physiology
- Device Function
- Previous Work
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- Problems Faced
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Problem Definition

- To design a device that allows people with communicative disabilities but who maintain motor function to speak and express emotion with their voice. The device must provide immediate output, and it must be intuitive and accurate.
- Existing Devices
- US Market:
 - 7.5 million people have trouble using their voices
 - Stroke, Cerebral palsy, laryngectomy, paralyzed diaphragm, general aphonia

Physiology

- Lungs
- Vocal Folds
- Articulators
 - Linear Filters
 - Throat
 - Nose
 - Mouth

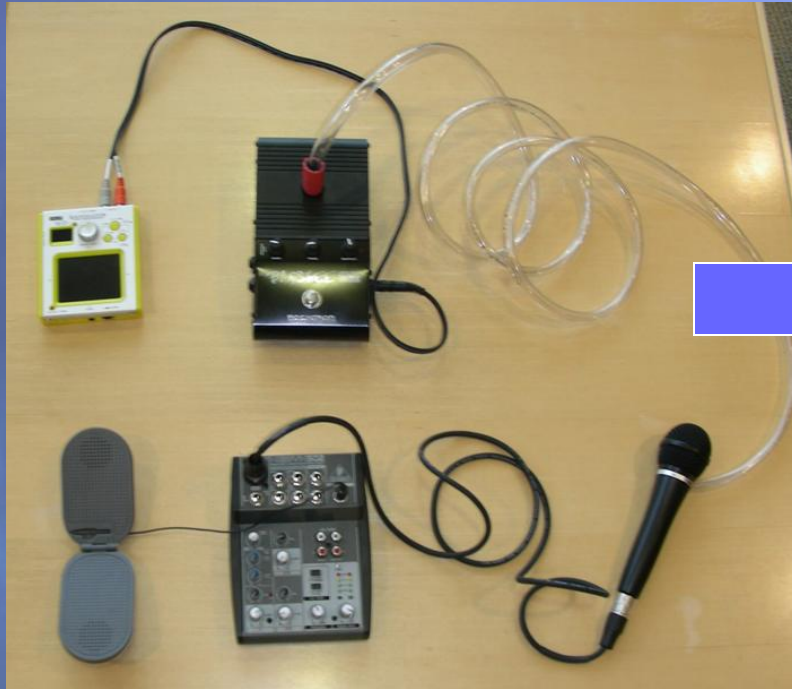


Device Function

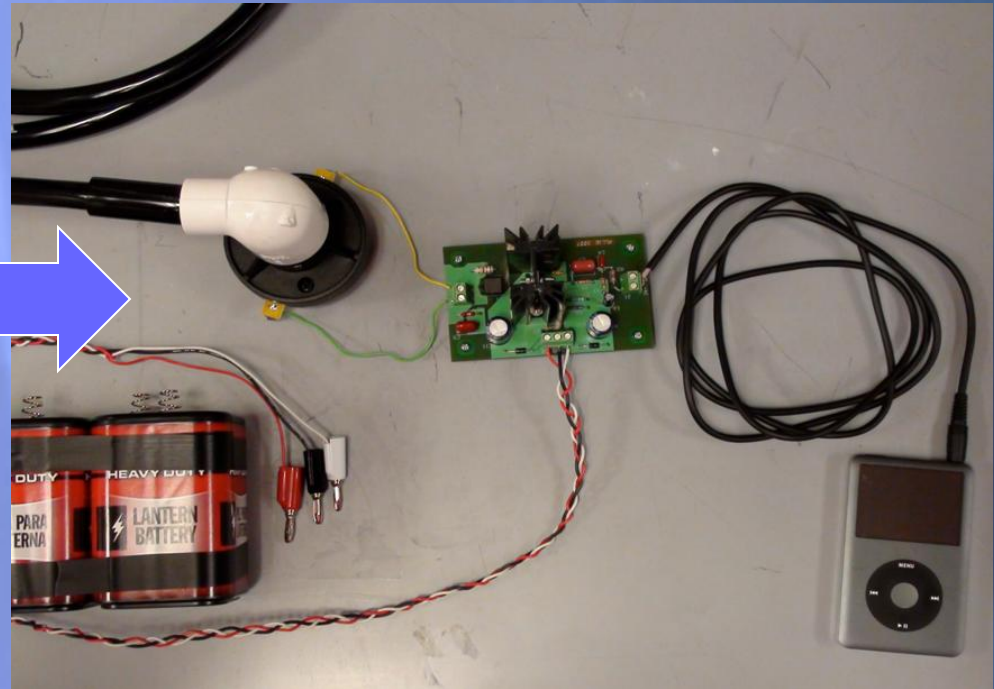
- Device mimics the diaphragm, lungs and vocal folds
- Still requires functionality of the lips, tongue and facial muscles



Previous Work



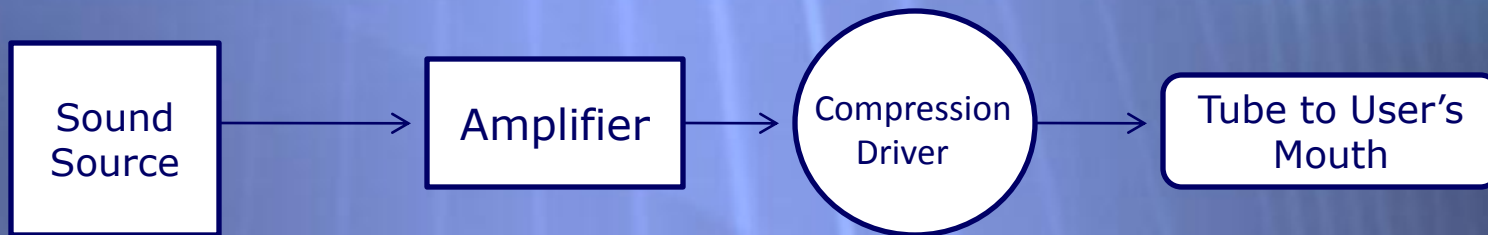
Spring 2009



Fall 2010

- Musical Large-Scale prototype
- Miniaturized design with custom components and 3.8mm jack interface

Technical Specifications

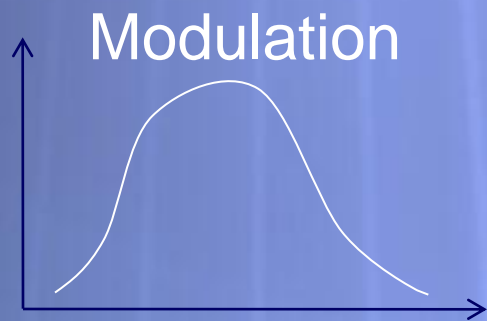


- Output current at the amplifier: 1.3 mA
- Amplifier Gain = 21
- Battery used: Two 9 V batteries
- Battery life: 11 days of continuous use
- Input signal frequency: 0.8 – 2 KHz
- Compression Driver: 150 W, 8Ω

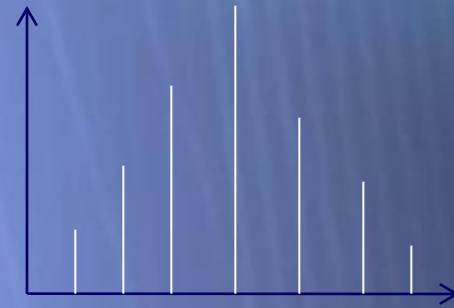
Problems Faced

- Power supply (convenience)
- WARF - novelty
 - July 2010
- Large compression driver
 - Tube connection
- Sound source

Future Work



Frequency Response of the Mouth



Output signal is amplified or attenuated according to the shape of the mouth

- Characterize Compression Driver output
 - LabVIEW FFT comparison of human and device sounds

Future Work

- Characterize tubing ranges/properties (WARF)
- Convert to rechargeable battery
- Interface with TI class D amplifier (miniaturization)
- Interface with iPhone/Android app for high quality sound output

Works Cited

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- ✦ Brigham, E. Fast Fourier Transform and Its Applications. Prentice Hall. 1988.
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- ✦ Blumstein, S.E., Stevens, K.N. Acoustic invariance in speech production: Evidence from measurements of the spectral characteristics of stop consonants. J. Acoust Soc. Am. 66:4. 1001-1018.

Questions?