Fluency Assistive Device (FAD)

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Introduction

Currently, in the world, about 1% of the population (70 million people) have a stutter. Approximately 5% of children stutter for about 6 months and 1% have a long term stutter. This device, originally known as the Edinburg Masker (see Figure 1 below), was created to assist people who have a stutter, but have not been helped by therapy. A stutter has been defined by the American Speech–Language–Hearing Association (ASHA) as a fluency disorder. Few fluency assistive devices exist for this population, and the ones available are highly expensive or unreliable. The Fluency Assistive Device (FAD) team strives to address this deficiency. Our client, Dave Germeyer, serves a niche community of people who rely on a masker. Improvements are needed to update the components and apply new methods recommended by our client. The FAD team will conduct research and testing to develop an upgraded prototype solution. In the future, we will move towards a new design to serve this community more effectively.

Figure 1: Original Edinburgh Masker including throat microphone, headset, and electronics module.

Source: https://www.mnsu.edu/comdis/kuster/edinburghmasker.html

Original Masker Functionality

The Edinburg Masker unit (Figure 1) takes the input audio signal, modifies it, and produces a noise that the user can hear. The triggering electrical input signal comes from the user's throat microphone. When the user talks, the throat microphone picks up vibrations which causes the electronics module to produce a triangular wave that acts as noise. The noise through the headphones masks the user's own speech, allowing the user to speak normally.

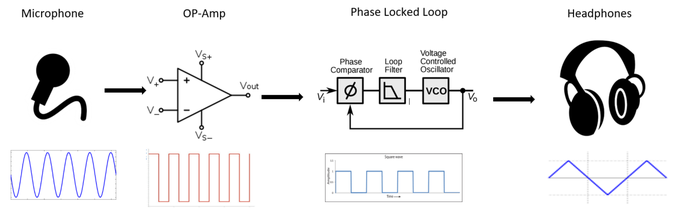

Figure 2: Signal Transformation of the Masker

Planned Upgrades

The FAD team plans to upgrade the masker as follows: 1) replace the CA3078 with the more available 741 Op-Amp as shown in Figure 3 below, 2) replace the current wired PCB board with a wireless fully soldered version to minimize wire breakage during use, and 3) implement IC holders to facilitate troubleshooting, replacement and easier maintenance.

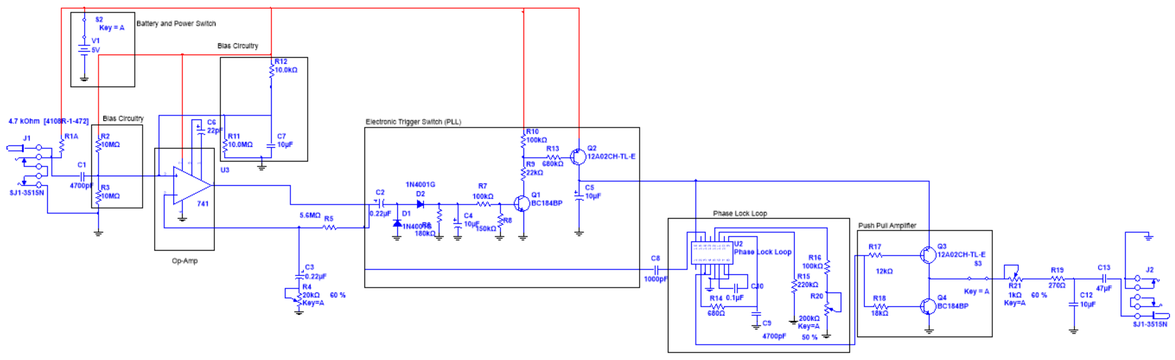

Figure 3: Multisim Schematic of Future Masker Upgrade Circuitry

Future Vocal Resonance Experimentation

The FAD team seeks to find a more comfortable and concealable location for a sensor on the body. To accomplish this, the team plans to gather data using different sensors and resonance points on the human subjects of an IRB approved study. A literature search on known vocal resonance points of the human thoracic structure was conducted to identify the optimal resonant points for our experiment.

The known vocal resonance points of interest are listed here and can be seen in Figure 4 below:

A: near the Hyocervical distance (hy to c3 on A, distance from hyoid bone to the cervical spine)
B: Velopharyngeal opening – vpo (u to ppw on B, opening at the back of nasal cavity)
C: Craniocervical angle (intersection between nsl and evt on C)

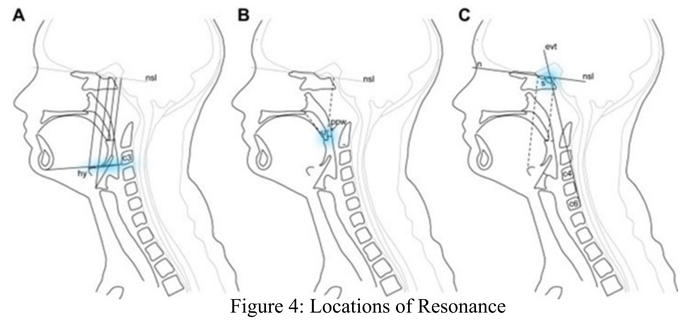

Figure 4: Locations of Resonance

Source: Miller, Nicola A., et al. "Relationships Between Vocal Structures, the Airway, and Craniocervical Posture Investigated Using Magnetic Resonance Imaging." *Journal of Voice*, vol. 26, no. 1, Jan. 2012, pp. 102–109., doi:10.1016/j.jvoice.2010.10.016.

Conclusions

The Fluency Assistive Device (FAD) team has begun to assist a community of people who suffer from a fluency disorder but have not been helped by therapy. FAD seeks to increase the effectiveness and reliability of the masker device through circuit upgrades and more optimal sensor location. Circuit minimization and case redesign based upon client feedback will also facilitate more convenient use and reduced cost.

Client

Dave Germeyer,
Retired Messiah College staff member

Further Information

To find out more about our project, please visit:
https://www.mnsu.edu/comdis/kuster/edinburghmasker.html

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