cad Laboratory

speechometer

Northeastern University
Personal Health Informatics

A Heads-On Speech Monitoring System To Increase Speech Clarity For Disordered Speech

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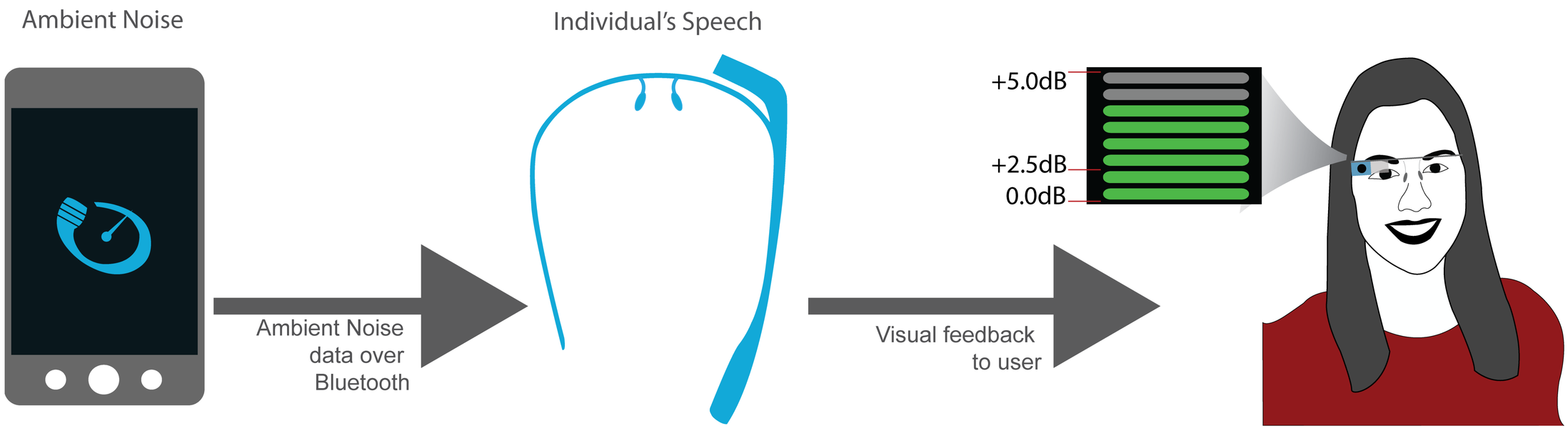


Abstract

We developed SpeechOmeter - Google Glass application - to improve speech clarity for individuals with speech impairments due to neuromotor disorders such as Multiple Sclerosis, Cerebral Palsy and Parkinson's disease.

Background

More than 2.5 million individuals in the U.S. are estimated to present with soft and slurred speech due to Parkinson's disease, multiple sclerosis, cerebral palsy and stroke alone. The impaired speech hinders speech clarity and restricts interpersonal interactions[1]. For many individuals the inability to communicate is one of the most difficult aspects of their speech impairment[2] and require speech therapy to cope[3].

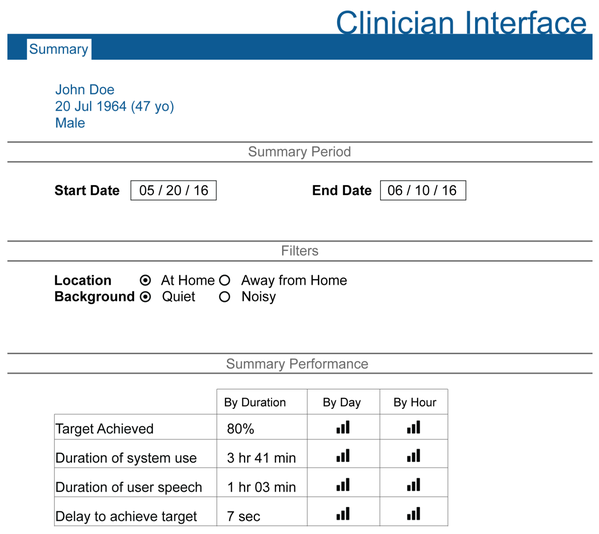
Adherence and generalizability of existing treatments is limited by:

- Lack of feedback cues in regular conversations
- Lack of adaptation to situational context
- Lack of adherence and performance reports

Approach

- Provide realtime feedback in absence of clinician cues
- Adapt target loudness to ambient noise level
- Enable clinicians to monitor performance and adherence to treatment between consultations

Clinician Report


Clinician Interface

Summary

John Doe
20 Jul 1964 (47 yo)
Male

Summary Period

Start Date 05 / 20 / 16 End Date 06 / 10 / 16

Filters

Location At Home Away from Home
Background Quiet Noisy

Summary Performance

	By Duration	By Day	By Hour
Target Achieved	80%		
Duration of system use	3 hr 41 min		
Duration of user speech	1 hr 03 min		
Delay to achieve target	7 sec		

Usability Study

In a 6-week usability study, 10 individuals with MS increased vocal loudness by an average of 4.67 dB during feedback. This increase is comparable to the average 4.68 dB increase achieved after traditional intervention[4]. Participants with a baseline loudness of under 70 dB increased their loudness by 9.01 dB.

Next Steps

- Implement speech rate monitoring
- Develop adaptability layer to personalize interfaace for specific client needs (eg fatigue, level of speech impairment)
- Implement remote personalization of training
- Automatic identification of scenarios with higher difficulty in maintaining speech targets

References

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[2] T. K. Pitcairn, S. Clemie, J. M. Gray, and B. Pentland. 1990b. Non-verbal cues in the self-presentation of parkinsonian patients. The British journal of clinical psychology / the British Psychological Society 29 (Pt 2) (May 1990), 177–184.
[3] Joseph R. Duffy. 2012. Motor speech disorders: Substrates, differential diagnosis, and management. Elsevier Health Sciences.
[4] L. O. Ramig, S. Countryman, C. O'Brien, M. Hoehn, and L. Thompson. Intensive speech treatment for patients with Parkinson's disease: short-and long-term comparison of two techniques. Neurology, 47(6):1496–1504, Dec. 1996.