Prashant S. Gavanakar, Speech training aid for the deaf, M. Tech. Thesis, Department of Electrical Engineering, Indian Institute of Technology Bombay, 1995.

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Abstract – One of the ways of training the profoundly deaf people to acquire proper articulatory features of speech, is by providing a visual or tactile feedback of vocal tract shape, pitch, and energy level. Such a training aid should be capable of estimating and displaying these parameters in real time on the monitor. The aid should also provide the facility of slow motion review.

The hardware setup of the project consists of analog signal conditioning unit, DSP board PCL DSP25, and PC. The speech signal is input through a microphone, passed through preamplifier and 7th order active elliptic low pass filter with a cutoff frequency 4.6 KHz. The signal is then fed to the ADC of the DSP board. The signal conditioning unit also provides the facility for four different outputs for microphone, tape recorder, test signal, and speaker.

In this project the vocal tract shape is estimated considering it as a cascade of cylindrical tubes. The Le-Roux Gueguen algorithm is used to estimate the reflection coefficients from the autocorrelation coefficients. The area function is calculated from the reflection coefficients on the PC. The pitch and the energy are estimated from the autocorrelation coefficients from the PC. The centre clipping is done to remove the extraneous peaks due to the format structure of the vocal tract. To increase the accuracy of estimated parameters the block overlap technique is implemented. The size of each frame is 256 samples. The algorithm is then tested for various speech files at different intensity levels.

The system can also display the target vocal tract shape. In addition to the real time mode the system offers the facility for slow motion review of the analysis results.