

Technical Documentation

Robust Real-Time Implementation of Adaptive Feedback Cancellation using Noise Injection Algorithm on Smartphone

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We propose a novel low latency smartphone-based application that demonstrates the real-time operation to cancel the negative effects of acoustic feedback arising from the coupling between the speaker and the microphone of the smartphone or similar device utilizing the robust Noise Injection (NI) method. We make use of multiple noise injections of short durations to estimate the filter coefficients of an appropriate order between the speaker and the microphone, in order to perform the feedback cancellation effectively in real-time. Our motive behind the development of this application is to perform an effective acoustic feedback cancellation irrespective of the position of speaker and the microphone on the platform under consideration. With the proposed application, we can estimate the transfer function between speaker and microphone in the changing room acoustics making the feedback cancellation very effective. Objective tests were conducted and results of the proposed real-time application indicates significant acoustic feedback suppression in the presence of varying environmental conditions.

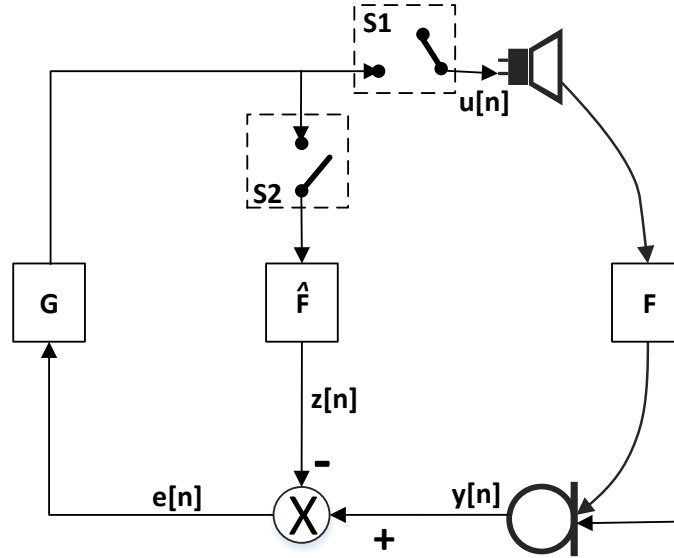


Figure 1 Block Diagram of Noise Injection based AFC Method

Experimental Results and Analysis:

In this section, we provide several simulation experiments and their results to support and justify the improvements in the proposed method.

A. Experimental Setup

- Frame Size = 30 msec
- Sampling Frequency = 48 kHz
- Static Feedback Path - FIR filter of order 88.

- AFC FIR filter order for Google Pixel = 475

B. Simulation Results

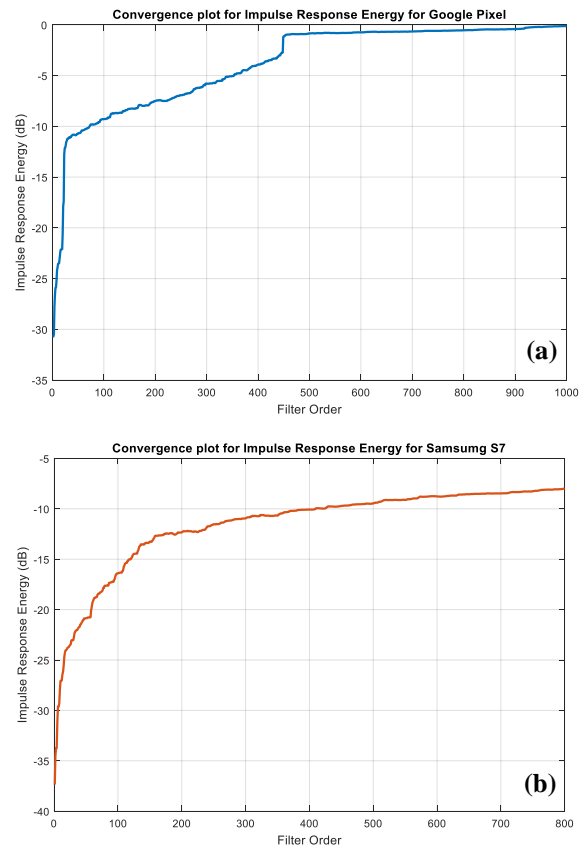


Figure 2 (Top to bottom) Convergence plot for Impulse Response Energy for a) Google Pixel b) Samsung Galaxy S7.

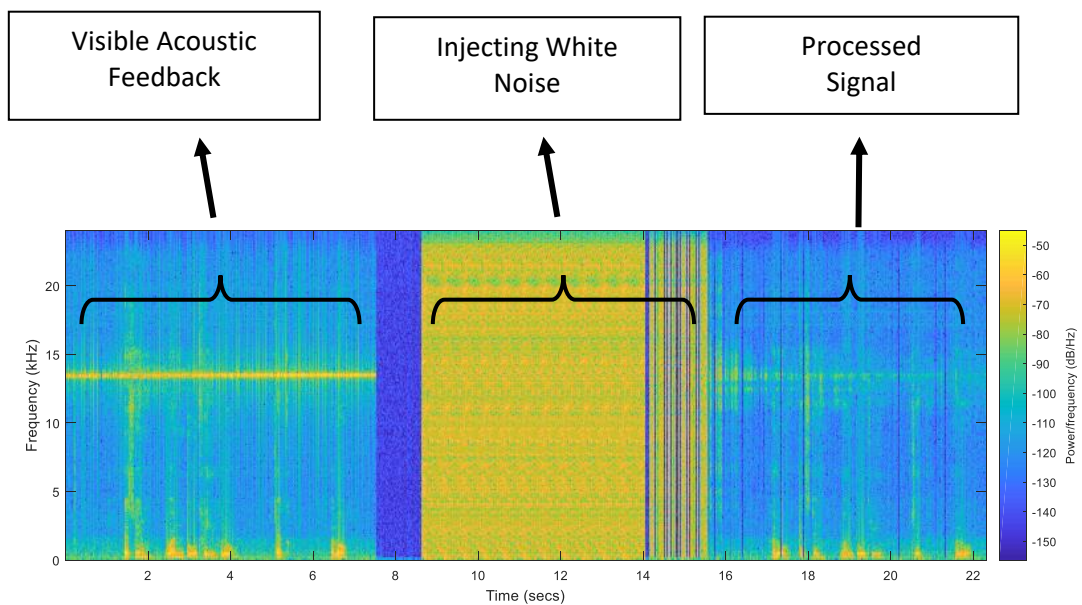


Figure 3 Spectrogram plot for the smartphone speaker output obtained using proposed AFC Application.

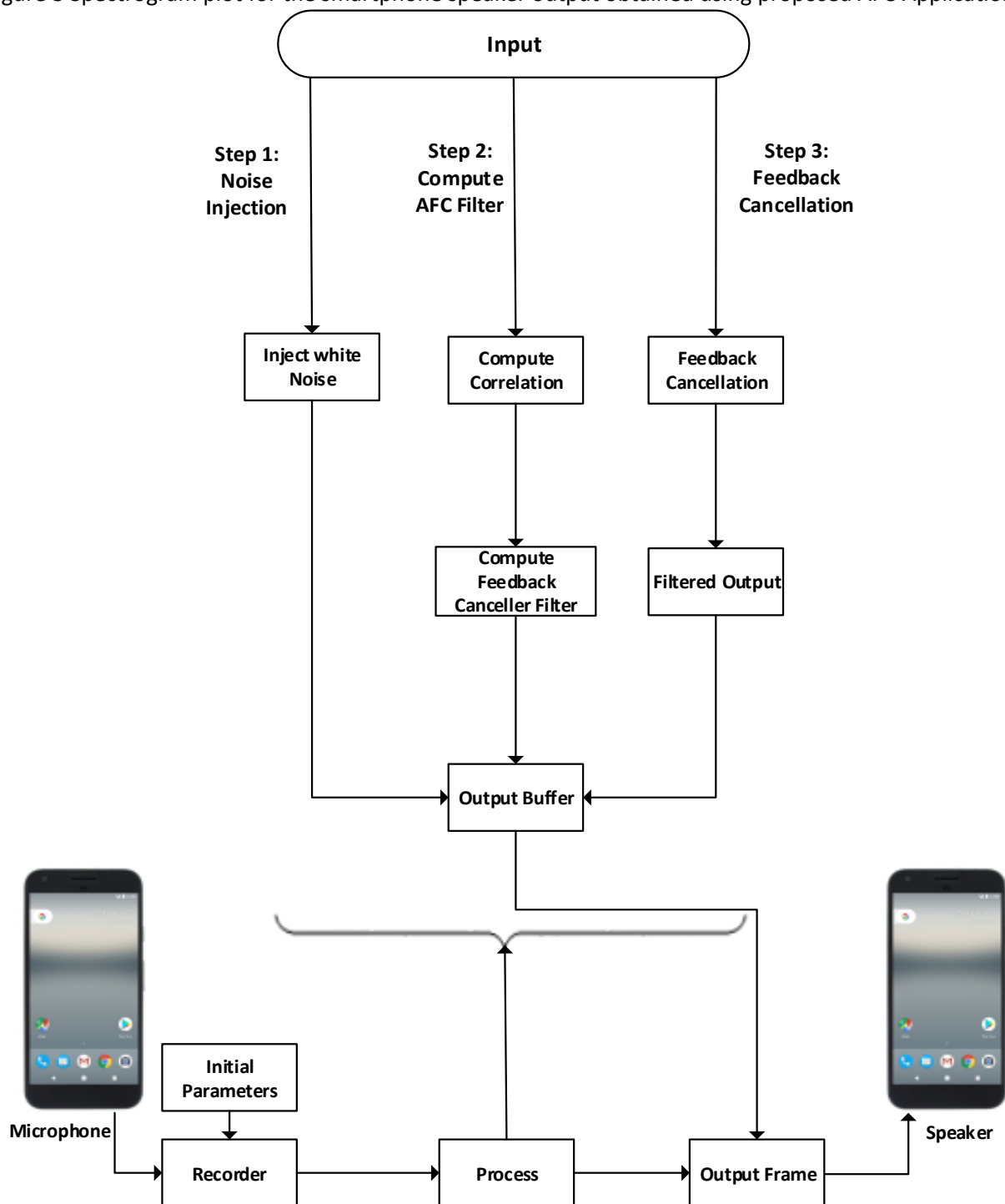


Figure 4. Real time processing pipeline for the proposed AFC Application.

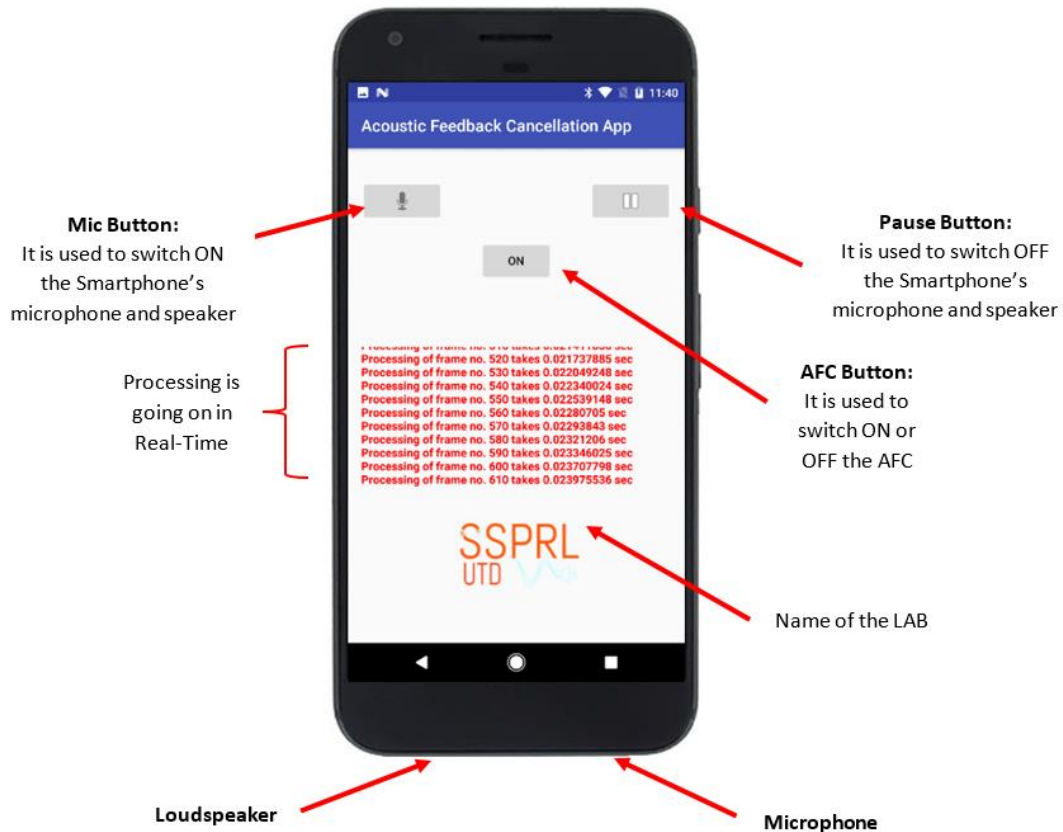


Figure 5. Screenshot of the proposed AFC Application

For more information please refer the following paper:

Parth Mishra, Serkan Tokgoz and I. M. S. Panahi, " Robust Real-Time Implementation of Adaptive Feedback Cancellation using Noise Injection Algorithm on Smartphone", Proceedings of Meetings on Acoustics, Acoustic Society of America (ASA 2018), Minneapolis, MN, May 2018.