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TITLE	**:**	INTELLIGENT VOLUME CONTROL FOR MOBILE PHONES IN THE PRESENCE OF BACKGROUND NOISE

ABSTRACT

In this thesis, Intelligent Volume Controller (IVC) is designed for mobile phones that can automatically adjust the caller's voice according to the background noise level. The mobile with IVC provides improved speech quality even in the presence of high background noise levels such as car noise, market noise, and train noise. The research work focuses to explore models for the best noise parameter estimates (MFCC-Mel Frequency Cepstral Coefficients, LPC-Linear Predictive Coefficients, and RCEP-Real cepstral parameters) to design an efficient noise classifier and noise level detector based on Artificial Neural Network (ANN). The output of noise classifier and noise level detector is utilized for designing IVC (Fuzzy Logic–FL, Simulink-SL, and Active Noise Control-ANC based) to be used with mobile phones.

In this work, 1000 noise data samples are collected for each of the four types of audio data (internet) noises i.e. car, train, office and market noise from website as well as real data (original) noises from the environment with the help of a microphone connected to a personal computer. Thus, a total of 8000 noise samples were stored in the computer memory for noise analysis and simulation results implemented on MATLAB are presented in this thesis. These noise data samples have been processed by extracting their features in the form of three coefficients representing the noise parameter estimates through three models i.e. MFCC, LPC, and RCEP.

Two models (LPC and RCEP) are based on built-in and the third model MFCC on a user-defined program in MATLAB. Based on the coefficient outputs obtained through above three models, three background noise classifiers have been designed using ANN. Also, their performances have been compared on the basis of their classification accuracies & confusion matrix. This work also compares conventional PI-like, PD-like, and PID-like controllers versus neural and fuzzy controllers. The controller performances are obtained in terms of Rise time (tr), Settling time (ts), Maximum Peak-overshoot (Mp), Steady-state error (ess), Integral absolute error (IAE), Integral square error (ISE), Integral time multiplied absolute error (ITAE), and Integral time multiplied square error (ITSE) using MATLAB simulink.

The MATLAB simulation results authenticate that out of three noise parameter estimates under consideration, MFCC are robust features in noise parameter estimation for background noise classification. It has also been found that fuzzy volume controller is more efficient as compared to conventional and neural controllers for mobile phones.

On the basis of above considerations, it is proposed that in future the present IVC model in presence of background noise for mobile phones should exploit a technique, which makes use of a hybrid of SC aspects, i.e., GAs, NNs, and FLs. It has to possess a good learning capacity, a better learning time than that of pure GAs, and less sensitivity to the problem of local extremes than NNs. In addition, it has to generate a fuzzy knowledge base, which has a linguistic representation and a very low degree of computational complexity.

Other issue that remains to be addressed for future research is the choice of more number of inputs extended to online n-class classification using the same proposed model. Moreover, there are other parameters, i.e. PSD (Power Spectral Density), ZCR (Zero Crossing Rate), auto-correlation, co-variance, time etc., which need to be added in the future model in order to observe its effect on signal-based processing systems of next generation mobile phones.