# Modelling and simulation of electroencephalography instrumentation to study the epileptic seizure: a noise analysis approach

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**Abstract:** Electroencephalography (EEG) is extremely useful for diagnosing and treating various brain diseases and disorders. An EEG instrumentation which consists of analogue amplifiers, filters, digitisers, and data acquisition system, plays a crucial role in designing efficient EEG acquisition-hardware for acquiring low-amplitude EEG signals. This paper presents a comprehensive simulation study conducted on the various EEG instrumentation and their noise analysis to design a high gain and low noise EEG amplifier at low-cost. Different EEG-amplifier circuits are developed in NI-Multisim and noise-analysis has been studied to identify the best EEG-measurement system. The simulation results show that the EEG amplifier developed with AD8428 and OP07 shows the highest gain (22 8k), high SNR (70.93 dB), and high CMRR (136 dB) within a low noise level for the EEG signal bandwidth. The present work provides a guideline for designing EEG circuits with high gain and low-noise levels to acquire brain signals for neuroscientific studies.

**Keywords:** epileptic seizures; electroencephalography; EEG; low-cost and low-noise EEG instrumentation; circuit simulation; high CMRR; high SNR; noise analysis.

**Reference** to this paper should be made as follows: Choudhary, S.K. and Bera, T.K. (2024) 'Modelling and simulation of electroencephalography instrumentation to study the epileptic seizure: a noise analysis approach', *Int. J. Biomedical Engineering and Technology*, Vol. 46, No. 1, pp.63–80.

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