A Home Sleep Apnea Screening Device With Time-Domain Signal Processing and Autonomous Scoring Capability

Current solutions of sleep apnea diagnosis require the patient to undergo overnight studies at a specialized sleep laboratory. Due to such inconvenience and high cost, millions of sleep apnea patients remain undiagnosed and thus untreated. Based on a micro-electro-mechanical systems (MEMS) sensor and an effective apnea detection algorithm, we propose a low-cost single-channel apnea screening solution applicable in the comfort of patients' homes. A prototype device was designed and assembled including a MEMS sensor for measuring the patient's nasal air flows, and a time-domain signal processing IC for apnea detection and autonomous scoring. The IC chip was fabricated in standard 0.5-$\mu$m CMOS technology. The proposed device was tested for both respiratory rhythm detection and sleep apnea screening under clinical environment. Apnea-hypopnea indices (AHI) were scored to indicate severity of sleep apnea conditions. Test results suggest that the proposed device can be a valuable screening solution for the broader public with undiagnosed apnea conditions.