A Novel Obstructive Sleep Apnea Management System

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This project's purpose was to efficiently and cost-effectively develop an obstructive sleep apnea monitoring and detection device (SMD-1) through the use of sensors and a novel machine learning algorithm. The solution created uses several microcontrollers, pressure tactile sensors, vibratory nodes, a microphone, and an AWS passageway. Obstructive sleep apnea (OSA) is a prevalent sleep disorder, in which breathing ceases due to frequent upper airway collapse. It causes oxygen desaturation and arousal, which disrupts normal sleep. The novel machine learning solution was built using Python generalized linear feature extraction models paired with TensorFlow, to create a trained artificial intelligence module. Using a dataset of 20 audio snoring files from a local sleep clinic, the module was trained while accounting loudness, Mel frequency Cepstral coefficients, formant frequencies, and pitch. When a patient is identified with an AHI (Apnea-Hypopnea Index) greater than 30, local authorities or relatives are alerted through the usage of AWS resources. In addition, the prototype was engineered to track emergency seizure movement, and an implication to track the movement of Alzheimer's patients during their sleep. The algorithm has an average accuracy of 97.3% on the tested dataset. The pressure response and vibratory response were both 100% for the 4 different head positions (while sleeping) and 20 audio files. With a cost of under $65, this device is the future of sleep monitoring and care. After collecting this data, it was concluded that this prototype was an accurate and cost-effective method to detect and monitor obstructive sleep apnea.