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ECG Signal Analysis for Sleep Deprivation Diagnosis with Smart Non-Invasive Ventilation

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A potentially dangerous sleep disease called sleep apnea is characterized by recurrent pauses and starts in breathing patterns. Early on, the physician may prescribe specific medications or use Bilevel Positive Airway Pressure (BiPAP), Automatic Positive Airway Pressure (APAP), or Continuous Positive Airway Pressure (CPAP) devices, which require manual handling by the patient or physician and use pressurized air to support and open the airway while the patient sleeps. The proposed work describes a novel method for assessing sleep apnea by integrating automated non-invasive breathing supply using a low-cost CPAP device with Electrocardiogram (ECG) readings. Early and precise diagnosis is made possible by the ECG-based detection method, which uses sophisticated signal processing techniques to recognize the minute changes in heart rate linked to apneic episodes. After detection, the suggested system turns on a affordable, specially designed CPAP machine on its own. This keeps the patient's airways open and lessens the effects of apnea. In settings with limited resources, this combination of automated CPAP intervention and ECG signal analysis offers an affordable and easily obtainable approach to managing sleep apnea. Results from the experiments show that the CPAP device can maintain the ideal airway pressure and that the system is effective in identifying apnea occurrences with high sensitivity and specificity. Particularly in areas where traditional diagnostic and treatment options are not easily accessible, this work presents a viable avenue for bettering patient outcomes and sleep apnea management.

Keywords: Continuous Positive Airway Pressure, Electrocardiogram, MATLAB, Sleep apnea, Signal processing

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