A Novel Treatment of Obstructive Sleep Apnea Using Continuous Wave Interferometry Radar

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In recent years, radar technology has gained significant interest in its application in detecting vital signs. It has the potential to play a crucial role in identifying obstructive sleep apnea (OSA), a serious condition that disrupts breathing during sleep that can lead to cognitive impairment and cardiovascular diseases. Studies show that Positional Therapy offers an effective and low-cost treatment for OSA. While Positional Therapy is a promising treatment for OSA, it often requires manual intervention, limiting its accessibility. There remains a gap for the automatic detection and treatment of OSA. This project proposes a novel approach to address this gap by integrating a system that uses continuous wave (CW) Doppler radar for the detection of OSA and the application of Positional Therapy. The proposed system employs a K-band 24-GHz CW Doppler radar module to monitor chest wall motion, identifying OSA events based on signal amplitude variations. Data Acquisition device and a laptop for real-time signal processing. When OSA is detected, an air pump inflates an airbag worn by the patient, prompting a shift of sleeping position. Experimental simulation validation using a bench-top setup demonstrated that the system reliably detects OSA and effectively intervenes by repositioning the subject, with clear distinctions observed in time-domain respiratory waveforms, pre- and post-OSA-treatment. The results confirm that this radar-guided Positional Therapy approach can improve OSA management by reducing apneic events without requiring professional intervention. This novel solution offers an alternative to conventional OSA treatments, thereby improving the accuracy of diagnosis and the effectiveness of treatment.

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