

Sleep-Disordered Breathing Detection by Using Non-Contact Ultra-Wide Band Sensor

¹Wei-Kuan Wang, ¹Chun-Hung Chen, ¹Rung-Hung Su*, ²Ching-Lung Liu

¹SEDA Chemical Products CO., LTD., ²MacKay Memorial Hospital

Objective: To detect the sleep-disordered breathing such as obstructive sleep apnea (OSA) and snoring without wearable sensors.

Methods: Ultra-Wide Band (UWB) technology was offered from the Industrial Technology Research Institute (ITRI) in Taiwan. UWB can detect slight movement without any contact. Besides, the electromagnetic wave is very slight, and the power is extremely lower than that of the cellphone. Therefore, the detection process will not cause any effects on human. A UWB device is inserted into a foam mattress in order to detect the subject's of chest and abdominal movements. If the movements become faint or develop slight vibrations, indicating OSA or snoring events, UWB signal waves can be detected and recognized.

Results: Figure 1 and 2 show the patterns of a subject's breathing signals in the LABVIEW system. Figure 1 shows the low frequency signals of breathing (0.1Hz-0.8Hz), and the sin wave (normal breathing signals) become smoother (abnormal breathing signal), namely an OSA event. Figure 2 shows the high frequency signals of breathing (10Hz-30Hz), which the amplitude becomes larger when the subject is snoring.

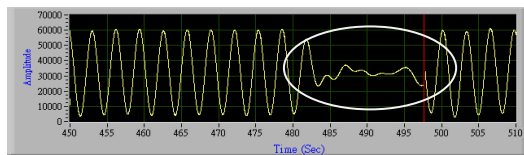


Figure 1. OSA event

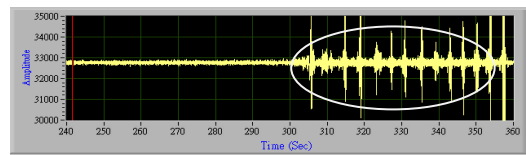


Figure 2. Snoring event

Conclusion: According to the UWB low and high frequency signal waves, we can simply define an algorithm to automatically detect OSA and snoring events.

Discussion: We had compared the data with in-lab polysomnography (PSG) that the sensitivity of the algorithm is 49.3% [Wang, et al. 2014]. In future work, more comparative experiments will be implemented for verifying the accuracy.

Reference: WK Wang, CH Chen, WC Huang, RH Su, YW Liu. A tether-free obstructive sleep apnea syndrome (OSAS) detection mattress. *Gerontechnology* 2014;13(2):301.

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中文題目：透過非接觸超寬頻感測器偵測睡眠呼吸障礙

作者：¹王為寬，¹陳純弘，¹蘇榮弘*，²劉景隆

服務單位：¹世大化成股份有限公司，²馬偕紀念醫院