

A tether-free Obstructive Sleep Apnea Syndrome detection mattress

W-K. WANG, C-H. CHEN, W-C. HUANG, R-H. SU, Y-W. LIU. **A tether-free Obstructive Sleep Apnea Syndrome (OSAS) detection mattress.** *Gerontechnology* 2014;13(2):301; doi:10.4017/gt.2014.13.02.390.00 **Purpose** Obstructive Sleep Apnea Syndrome (OSAS) may lead to daytime lethargy. More severe OSAS may decrease memory and attention, and may even cause death due to hypoxia. Currently, obstructive sleep apnea affects 4-5% of the general population, and often occurs in obese and elderly adults^{1,2}. To our knowledge, the majority of products currently on the market can only detect snoring by microphone sensor. However, similar methods are ineffective for OSAS, as the condition is soundless. OSAS monitoring devices typically monitor chest movement as a result of breathing for signs of faintness; however, these monitors are uncomfortable and may affect sleep quality. This paper presents the development of an OSAS detection mattress, WhizMattress, which allows for the detection of OSAS events without wearable sensors. **Method** Ultra-Wide Band (UWB) technology can detect slight movement without contact. The detection process also does not affect human health. Note that the electromagnetic wave of UWB is lower than the 1 ppm of typical cell phones. Furthermore, UWB can pass through liquid and solid states. Therefore, we inserted a UWB sensor into a memory foam mattress (IMAGER-37). The detection area is between the user's chest and abdomen. If movement in this area becomes faint, an OSAS event is recognized. *Figure 1* shows the pattern of breathing in the Labview system. From *Figure 1*, breathing becomes smoother when OSAS occurs. In order to determine the accuracy of WhizMattress, a comparative clinical test between WhizMattress and Polysomnography (PSG) was implemented. A healthy adult (40-year-old male, overweight with a BMI of 26.4) was recruited for sleep data collection. The subject wore a PSG sensor and lay on the WhizMattress for 423.1 min (*Figure 2*). Thirty six OSAS events were detected by both devices, and 37 by PSG alone. Therefore, the sensitivity of the WhizMattress (i.e., the probability of WhizMattress and PSG judge OSAS event under PSG judge OSAS event) is $36/74 = 49.3\%$. Note that the subject sometimes laid on the non-detection area. In these cases, the breathing was undetected. **Results & Discussion** WhizMattress not only can detect OSAS without wearable sensors, but also can provide a sleep quality evaluation in home healthcare. In future work, more comparative experiments will be performed for verifying the mattress' accuracy.

References

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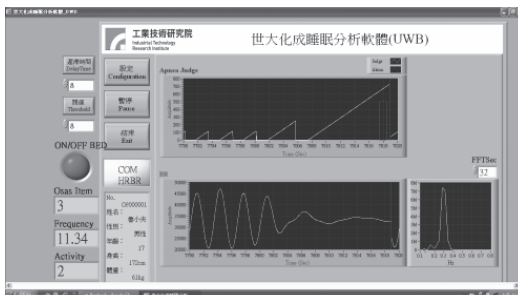


Figure 1. Pattern of an OSAS (Obstructive Sleep Apnea Syndrome) event



Figure 2. Set-up of the comparison test