An automatic monitoring system for obstructive sleep apnea

H-C. WU, H. TING, M-H. TSENG. ***Design and implementation of an automatic monitoring and correction auxiliary system for patients with obstructive sleep apnea syndrome.*** *Gerontechnology 2014;13(2):307;* doi:10.4017/gt.2014.13.02.218.00 **Purpose** Sleep quality is essential to physical and mental health. Older adults, in particular, experience varying levels of sleep disorders. Estimates show that about 52% of Taiwanese snore, and more than 450,000 people in Taiwan suffer from Obstructive Sleep Apnea Syndrome (OSAS)[1]. The objective of this study is to develop a low-price portable prototype system for the automatic monitoring and correction of patients with OSAS. **Method** We focus on the design and implementation of the proposed system by integrating a blood oximeter[1,2], system chip, stimulus module, communication module, and memory module to monitor and record the user's blood oxygen level while sleeping. If the system detects that sleep-disorder related breathing occurs, the system will immediately cause the stimulus module to change the patient sleeping posture and improve her/his respiratory pattern[3,4]. *Figure 1* shows a block diagram of the proposed system. We also compare four indices[5] for automatically detecting sleep apnea events, develop an improved detection index using the optimization of thresholds, and illustrate the performance of the improved method. **Results & Discussion** *Table 1* lists the performance of five indices for OSAS detection by using the blood oxygen signals of 554 patients who had received an overnight polysomnography test because they had been diagnosed with clinical symptoms or experienced screening for OSAS. The results show that the improved oxygen desaturation index's (ODI) correlation is 0.75 and stands between the measured AHI (apnea-hypoapnea index) and the predicted AHI; its performance is better than other indices employed in previous studies[1,2,5]. For patients with sleep disorders related to breathing, it can be an effective, lower-cost, and convenient way to improve the sleep quality. The system's design also features a long-term continuous record of oxygenation status allowing calculating AHI. It can simplify the traditional, time-consuming, and costly polysomnography testing process, and could help provide supplementary information for sleep therapy units.

References

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Keywords: housing & daily activities, OSAS, monitoring and correction auxiliary system

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*Table 1. Performance and results of 5 indices for Obstructive Sleep Apnea Syndrome (OSAS) detection; *=present study*

Detection Index	Correlation
DI_β[5]	0.32
TI_α[5]	0.28
Delta[5]	0.35
ODI-B-D-L[5]	0.64
Improved ODI*	0.75

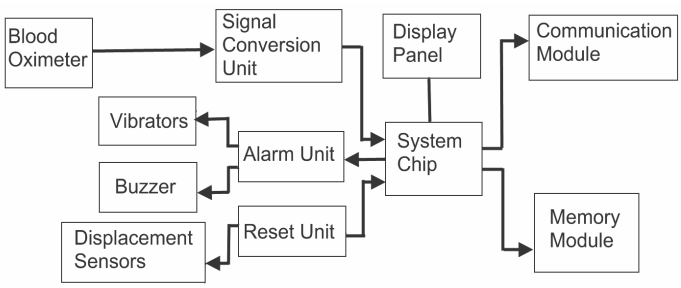

Figure 1. Block diagram of the proposed system