

USING A GAME CONTROLLER FOR ONLINE WIRELESS RECORDING OF POSTURE AND ACTIVITY

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ABSTRACT

Consumer electronics like game controllers have very advanced technical properties available at very low cost. These properties could be used for various scientific and medical purposes. In this study we examined the accuracy of the recently introduced Wii game controller (Nintendo) for online wireless recording of posture and activity. Daytime and night-time Wii game controller accelerometer data was compared to synchronously recorded accelerometer data of a medical sleep recorder. High agreement between the systems ($r=0.97$) was found. With further software development the system could be used as a low cost online wireless posture and activity recorder with online feedback.

KEYWORDS

sleep, posture, position, activity, consumer electronics

METHODS

The Wii game controller (Nintendo) was connected to a Windows XP using a standard bluetooth interface. Embletta (Embla) sleep recorder with a two axes accelerometer was used as the reference signal. With the Embletta, two orthogonal accelerometer channels (while standing both axes are parallel to the earth surface) were recorded with a 10 Hz sampling rate. The Wii controller was fixed to the Embletta unit (Figure 1). Wii controller data was recorded using the human interface device (HID) protocol by adapting publicly released source code (http://thekrf.com/projects/wii/cWiiMote_v02.zip accessed 4.1.2007). The recorded data was resampled and synchronized with the Embletta data.



Figure 1 - White Wiimote placed on top of Embletta and attached Nunchuck (not used in this study). On left 20 cm ruler.

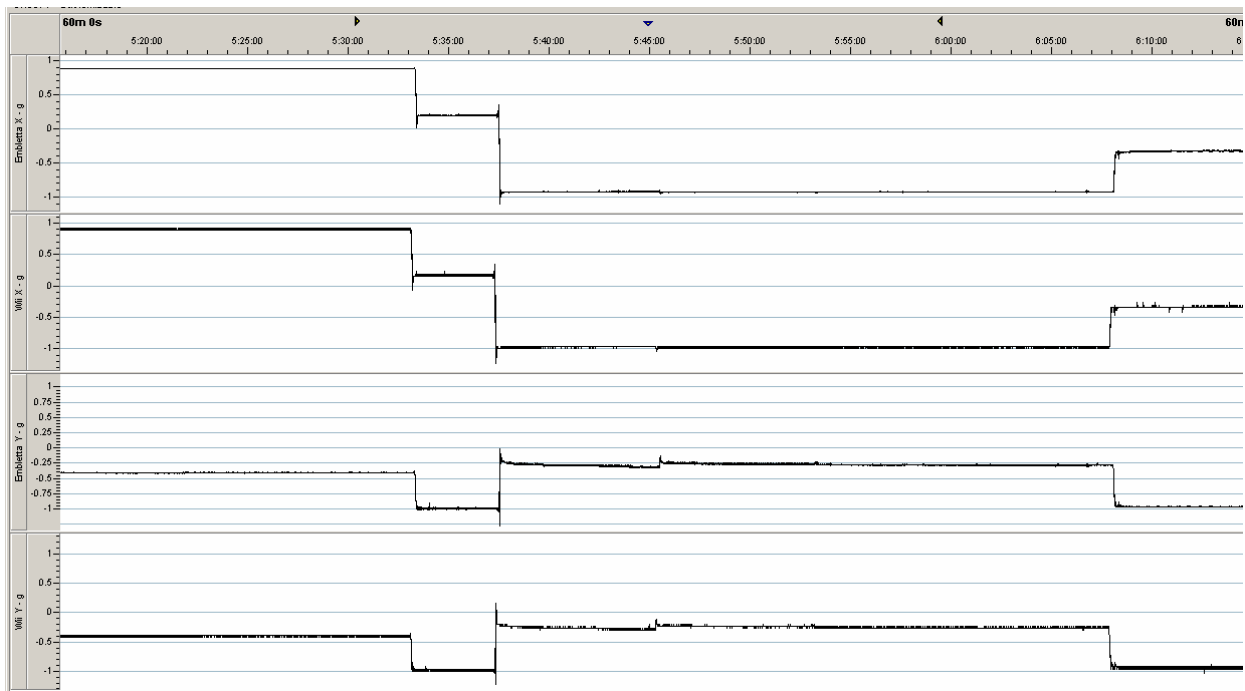


Figure 2 - Example one hour recording showing comparison. Top trace is Embletta-x followed by Wii-x, Embletta-y and Wii-y.

RESULTS

A total of 46 hours of daytime and night-time data from a single subject was recorded and analyzed. Figure 2 displays an example recording. When comparing Wii controller data to the Embletta data, the combined average difference between two accelerometers was 0.04 ± 0.15 g. Respectively combined cross-correlation between two accelerometers was $r=0.97$.

DISCUSSION

Accelerometers can provide position and activity with the same sensor [1]. There exist also wireless actigraphs [2]. The used Wii controller has a price of about 40 €. The controller can be connected using the standard bluetooth protocol to e.g. Windows PC. Here we demonstrated the high accuracy of the accelerometer data with respect to a standard medical device. The Wii remote provides also a third accelerometer axes. This data was not used in this study but could provide additional information for e.g. in a pedometer or in energy expenditure applications.

The Wii remote also has an extension port to which an additional controller (Nunchuck, Nintendo) can be connected to add a second three axes accelerometer to the wireless setup (Figure 1). This could be used to for e.g. recording periodic limb movements simultaneously with posture. The basic controller is equipped with 12 buttons that could be used as event triggers, an image processor, an audio speaker, and force feedback. Force feedback could be used for providing tactile feedback alarms with e.g. supine positions with apnoea patients.

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