HIROSHIMA INSTITUTE OF TECHNOKOGY

A WRIST-MOUNTED ARTERIAL PULSE INTERVAL AND MOVEMENT RECORDING SYSTEM

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INTRODUCTION

It is expected that one-fourth of the population of Japan will become elderly persons by 2015. To support their safety of life, a physiological parameter and activity monitoring system is required for grasping their detailed daily health condition.

In this study, we developed a wrist-mounted arterial pulse interval and movement recording system for monitoring 24-hour health and circadian rhythms. The piezoelectric sensor records movements produced by the arterial pulse and wrist flexing. The arterial pulse interval is detected when the wrist is not moving for 5 seconds. When the wrist is moving, an activity measurement is obtained by summing the sampled data for 5 seconds. These data are stored to EEPROM

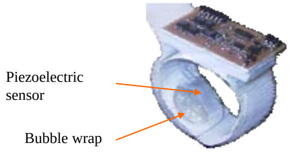

Figure 1.The arterial pulse interval and wrist movement recorder. The sensor consists of a piezoelectric film (Pennwalt, Kynar Piezo Film) and an air cap made of bubble wrap air cellular cushioning material, which is used for increasing the sensitivity of the sensor.

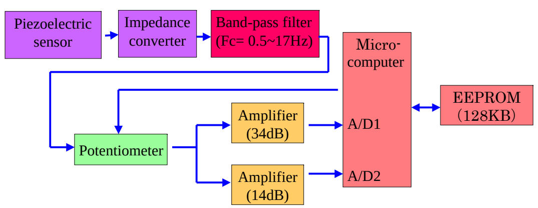

Figure 2. The arterial pulse interval and movement recording system. The recorder consists of a piezoelectric sensor, an impedance converter, low-power active filters, two low-power amplifiers with a different gain, and a low-power 8-bit single chip microcontroller (Micro chip Technology, PIC16LC711).

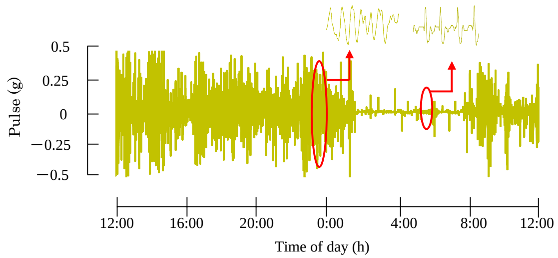

Figure 3. The original wrist movement recorded on normal age 22 male subject for 24 hours. The recorder was used a 128MB compact flash memory instead of EEPROM. The subject wore the recorder on their left wrist, over the radial artery. The small amplitude signals show the pulse waves, and the large amplitude signals reflect the large wrist movement.

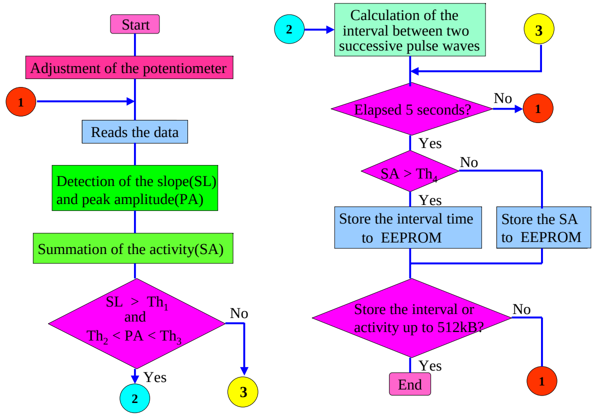

Figure 4. The flowchart of the wrist-mounted arterial pulse interval and movement recording system. The pulse waves are detected from the slopes and peak amplitudes. The interval between two successive pulse waves is detected in 4 ms resolving time. Activity is obtained by summing the sampled 14dB amplifier output for 5 seconds. When the wrist is not moving, the interval time is stored to EEPROM. When the wrist is moving, then activity is stored to EEPROM.

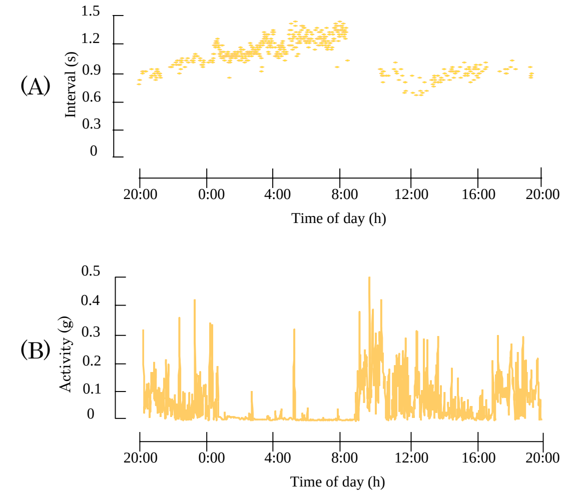

Figure 5. The arterial pulse interval (plot A) and activity (plot B) for one day. The mean arterial pulse interval was 1 seconds in an awake condition from 20:00 to 00:00. During sleep, from 00:00 to 9:00, the interval increased gradually to 1.2 seconds. In daytime around 12:00, the interval decreased to 0.8 seconds. The major activity level was recorded during wakefulness from 12:00 to 24:00. This result indicates that the activity during sleep was extremely low level.

CONCLUSION

A wrist-mounted arterial pulse interval and movement recording system, which consists of piezoelectric sensor, impedance converter, band-pass filter, potentiometer, and two amplifiers, has developed for monitoring 24-hour health and circadian rhythms. Significant information about the subject's general health condition and living patterns may be obtained from these pulse interval and activity data.

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