

Development of eco-friendly and ubiquitous health-care system

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Abstract

Nowadays, “Health-care” and/or ”Eco-friendly” systems are required for the next highly-aging society to solve a rising medical expenses and energy-saving environment problems etc. Our research is aiming to develop the compact high-performance eco-friendly/healthcare systems by means of both hardware and software approaches. Concretely, developments of two systems are introduced here, i.e., (1)low-power consumption LED lighting system using adiabatic technique and (2)ubiquitous health-care system using LED photo-plethysmography.

#1 Low-power LED lighting system:

The dimming system in LED lighting system has been designed and implemented with both the conventional silicon CMOS PWM(Pulse-Width-Modulation) logic circuits and newly developing adiabatic CMOS logic circuits(ADCL). The energy dissipation of both systems is compared and evaluated with measured and simulated results.

The ‘adiabatic’ circuits mean to use an adiabatic charging/discharging and to reuse the charge. The experimental results of the implemented 3-bit PWM circuits on PCBs @33kHz-clock/10V-supply. have shown that the power consumption of ADCL is much lower than that of CMOS at all input bit patterns. Furthermore, simulation results have shown that the advantage of ADCL’s power lowering merit grows extensively with increasing multi-bit PWM circuits in the future highly-functional LED dimming system.

#2 Ubiquitous health-care system:

The ubiquitous health-care system using LED photo-plethysmography has been developed. It consists of LED pulse sensing unit, wired/wireless data transmission, and data processing low-power MPU. The developed system utilizes the ‘sensor agent.’ The features are;

+Low-power compactness for wearable/portable, and

+Unconsciousness of measurement for acquisition of undisguised usual vital signs.

The usages in case of operating PC, smartphone, portable game, etc., are supposed. The sensor agent devices are named HAL(Healthcare Agent Lavalier), and various HAL devices and systems will be introduced and explained in detail.

Biography

Dr. Michio YOKOYAMA is an associate professor of Graduate School of Science and Engineering, Yamagata University. He received the B.E. degree in electrical engineering from Yamagata University in 1989, and the M.E. degree in electrical and communication engineering and Ph.D. degree in electronic engineering from Tohoku University in 1991 and 1994, respectively. From 1994 to 2001, he joined Research Institute of Electrical Communication, Tohoku University, Sendai, Japan, where he engaged in research on the design and development of RF-CMOS devices for cellular phone system. Since 2001, he has joined Yamagata University, and engaged in development of the ubiquitous health-care system and ultra-low-power LSI system. He is a member of JIEP, IMAP, IEEJ and IEICE.