Development of a Semi-permanently Usable Self-powered Beacon System For Children

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***Abstract*— With the increasing demand for convenience life, various types of wearable devices that use information and communication technology (ICT) have been launched. Furthermore, wearable energy harvesting technology is used to facilitate the semi-permanent use of such devices. In this study, a self-powered system is designed using a solar panel to facilitate the semi-permanent use of a beacon. As a result, 1-hour self-powered charging produced sufficient power for operating the device for more than 24 h.**

I. Introduction

The demand for safe growing environments for infants, toddlers, and children has increased, and the research and development using ICT is actively underway for this. Various types of wearable devices have been launched to prevent missing children and exposure to crimes [1, 2]. Typically, functions that can check the user information and location are loaded on missing child prevention bracelets, watches, and applications, and the price, durability, and high accuracy of the indoor/outdoor location estimation function must meet the requirements. To meet these functions, self-powered beacon system was developed in this study.

II. System Configuration

The device built for this study uses a 2.4 Ghz chip antenna for wireless communication with the microcontroller unit (MCU) , which has a built-in beacon function. We configured the circuit to charge a 145 mAh-capacity 1-cell Li-Ion battery at a 15 mA maximum and constructed a solar panel for self-power generation.

III. Measurement of Self-Generated Power and Power Consumption

As shown in Fig. 2, the cumulative charging power measured for one minute in an outdoor environment with an illuminance of 3,262 lux was 0.1299 mAh. This means that 7.794 mAh of power can be charged if power is self-generated for one hour using solar heat. As shown in Fig. 3, the cumulative power consumption measured for one minute was 0.0002 mAh. Therefore, the 24-hour power consumption is 2.88 mAh. In this experiment, YOKOGAWA's WT310 model was used to measure the power. The measurement data show that 1-hour self-powered charging provides sufficient power for approximately 3 days of use. Furthermore, the device requires approximately 19 h to fully charge the 145 mAh battery and approximately 50 days to discharge completely without charging. Therefore, self-power generation using solar heat is confirmed to facilitate semi-permanent use.

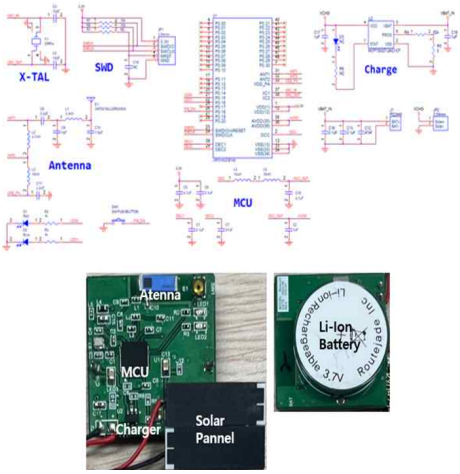
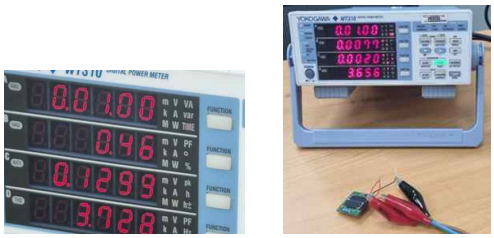


Figure 1. Circuit and hardware configureation.



(a) (b)

Figure 2. Measuring the solar charging power; (a) 1-min cumulative charging power; (b)1-min cumulative power consumption.

IV. Discussion & Conclusion

In this study, we have developed self-powered Beacon and shown that semi-permanent use is possible.

References

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