

# WiP Abstract: Smart-bin using Ultrawideband Localization to Assist People with Movement Disabilities

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## I. INTRODUCTION

Smarthome has been developed for enhancing convenience and safety, and robots are one of the major parts of the smarthome. The robots assist the elderly and disabled people by helping specific tasks such as drug delivery or following human commands to control smarthome devices (1)(2). They perform daily activities instead of humans for improving quality of life in the smarthome. Even though throwing away trash is one of daily activities and a simple task, it is sometimes difficult and inconvenient especially when a trash bin is far away from people with movement disabilities. To provide convenience in the task, we propose a smart-bin robot platform. Main function of the smart-bin is to deliver the trash bin close to a user. To provide the delivery service, a high accurate indoor localization technique is required. Various indoor localization techniques have been developed with advances in sensor technologies and wireless communications. Location Based Services (LBS) is provided through the use of radio technologies such as Wi-Fi, Bluetooth, Zigbee, Ultrawideband (UWB), Radio-frequency identification (RFID), Infrared(IR) and ultrasound (3). Appropriate localization sensors should be selected according to a research purpose. We used UWB sensors since they provide centimeter level accuracy and can be used as ground truth data for the future indoor localization researches. In this paper, we propose a basic robot platform delivering a trash bin in smarthome. The robot platform has been installed in our smarthome testbed and to demonstrate how the smart-bin can be helpful to people with movement disabilities.

## II. SMART-BIN ROBOT PLATFORM

Smart-bin is a robot platform based on Arduino. It is connected to a server via Wi-Fi, and the server can control position of the robot in real-time. For tracking robot position, a UWB tag is attached on the robot platform for tracking indoor position. 6 UWB anchors are installed in smarthome testbed, and track the UWB tag position as shown in Fig. 1-(a). We used a commercial UWB sensor set which is called a Precision Location Ultra Wideband System (PLUS) from Time Domain company, and it is a Real-Time Location System (RTLS) that provides a precise location in real-time. Fig. 1-(b) shows the smart-bin robot platform. A demo scenario is that a user can check a smart-bin position on a smartphone, and command the robot to come close to the

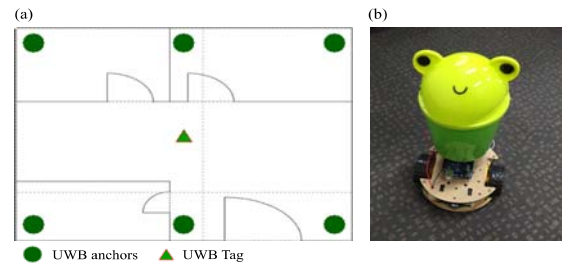


Figure 1. Smart-bin robot platform; (a) Smarthome testbed with ultrawideband sensors (b) Moving robot with trash bin

user by tapping a position where the user wants it to move. After the robot performs the user command, it goes back to the original position.

## III. CONCLUSION AND FUTURE WORK

Smart-bin robot platform is a simple and basic assisting robot in smarthome. The platform is designed to deliver some items especially in a trash bin for people with movement disabilities. Normal people also feel more convenient and useful when a trash bin comes close to them since it lessens troublesome activity such as going to the trash bin. We plan to add robot arms to our robot platform to provide other applications in smarthome, and furthermore other localization sensors will be considered to reduce the cost of UWB sensors. We expect that assisting robots will be widely used in future smarthome and help many daily activities to improve quality of life.

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## REFERENCES

- [1] M. Chan, D. Estève, C. Escriba, and E. Campo, "A review of smart homes present state and future challenges," *Computer methods and programs in biomedicine*, vol. 91, no. 1, pp. 55–81, 2008.
- [2] H. Wang, J. Saboune, and A. El Saddik, "Control your smart home with an autonomously mobile smartphone," in *Multimedia and Expo Workshops (ICMEW), 2013 IEEE International Conference on*, pp. 1–6, IEEE, 2013.
- [3] D. Stojanović and N. Stojanović, "Indoor localization and tracking: Methods, technologies and research challenges," *Facta Universitatis, Series: Automatic Control and Robotics*, vol. 13, no. 1, pp. 57–72, 2014.