

무선신호 센싱을 통한 디바이스 제어 기술 개발

주스투스 셀레스틴 음웨메지, 리카 롱, 김동민*
순천향대학교

justus.selestin@sch.ac.kr, likalong@sch.ac.kr, *dmk@sch.ac.kr

Development of Device Control System through Wireless Signal Sensing

Justus Selestine Mwemezi, Lika Long and Dong Min Kim*
Soonchunhyang University

Abstract

In this research we present device control system through wireless signal sensing that aim at utilizing available Wi-Fi signal to control electronic devices. This research has technical contribution as well as social impact in ensuring livelihood of elderly people.

I. Introduction

The availability of modern health facilities and technology has significant contributions in increasing life expectancy of elderly people. The population of aged above 60 years will increase by 50% in the year 2050 [1]. This sharp increase poses an alarm of ensuring the availability of basic facilities that support lives to these aged people. Aging is accompanied by so many factors which are inevitable, among of the factors associated with aging is losing ability to perform normal home chores, memory loss and flexibility to move [2]. Elderly people face significant challenges associated with their livelihood such as expensive paying helpers to assist their home chores, loneliness, and health facilities to track their daily indoor behaviors.

Technologies have identified to be the best contributors of helping elders to perform their basic needs specifically, those which require movements such as turning on light and other electronic appliances. More ever technologies have significant contributions of recording indoor activities and communicate with authorities for tracking if there are any emergency attention to these old inside their homes.

The wireless technologies have gained popularity for the recent trend in indoor information gathering and controlling and the most prominent wireless technology used was Bluetooth Low Energy [3]. The maturity of Wi-Fi is considered to be the best solution for indoor electronic device controlling due to the fact that Wi-Fi is available for the most of the building and it has enhanced features compared to the previous existed technologies. Most lives of human being is spent indoor, so development of applications that harnesses human activities detection, tracking and controlling of electronic appliances in the indoor

environment has great contributions in current technological trend [4].

Compared to conventional approach, controlling equipment using Wi-Fi signal have numerous advantages such as energy saving, preventing spread of communicable diseases, and safeguard lives of people and property that might be resulted from uncontrolled electronic devices.

This paper proposes the use of Wi-Fi signal generated from access points located inside the building to control the light basing on the location of the person.

II. System Implementation

This project was conducted inside Media Lab of Soonchunhyang University. This research is basically the proof of concept of using commercial Wi-Fi access point to extract the signal and use extracted signal to control electronic equipment. The study was accompanied by identification of the room structure to conduct the experiments, configuration of two access point, and reading signal from access point using Wi-Fi signal reader, filtering the signal and lastly controlling the light basing on the signal detected by signal reader. In the implementation of two-access point (AP) responsible for producing wireless signal on Window side (Window AP) and another for Door position (Door AP) were identified as it is featured in Fig. 1.

a) Reading signal from access point

The signal from two APs were captured using Raspberry Pi. All two APs propagated signals as it was expected. In this approach, target signal reader with unknown location read RSS values from Aps (Fig. 1). The distance from each AP is estimated from measured RSS values using radio propagation model suitable for indoor environment.

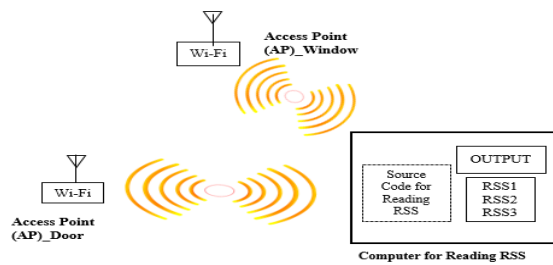


Figure 1. Reading RSSI Signal

b) Signal Communication and control

Wi-Fi signal were received from two access point located 3.5 meter apart. Detection object responsible for receiving signal are situated in any part of the building, Wi-Fi signal from any access point propagated to the wireless signal reader and send the control signal to the controller (Fig. 2).

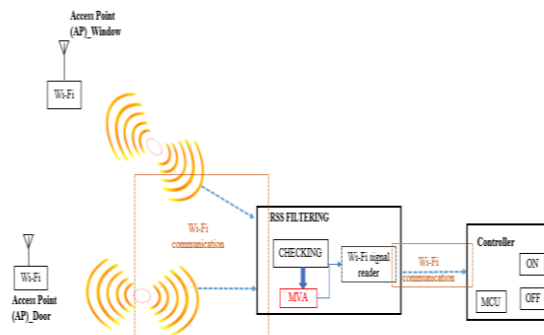


Figure 2. Signal Communication and Control

c) Signal filtering

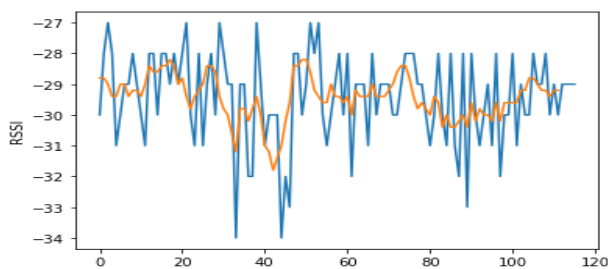


Figure 3. Filtered Signal (Window=5)

The Received Signal Strength learned to comprises noise due to multipath of human interference and furniture inside the lab. This study opted moving window average by taking window size of 5. The filtered signal is featured in Fig. 3.

III. Conclusion

In this system we have proposed the use of Wi-Fi signal generated from Access Point to control the electronic components. Device free detection incorporating deep learning would be the best research work in future.

ACKNOWLEDGMENT

This research was supported by the MSIT (Ministry of Science and ICT), Korea, under the ICAN (ICT Challenge and Advanced Network of HRD) program (IITP-2021-2020-0-01832) supervised by the IITP (Institute of Information & Communications Technology Planning & Evaluation). This work was also supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. 2019R1G1A1100699).

Reference

- [1] K. Nisar et al., "Indoor roaming activity detection and analysis of elderly people using RFID technology," *Proc. of the International Conference on Artificial Intelligence and Data Sciences (AiDAS) 2019*, Ipoh, Malaysia, Sept. 2019.
- [2] O. Andrieieva et al., "Effects of physical activity on aging processes in elderly persons," *Journal of Physical Education and Sport*, vol. 19, no.4, Jul. 2019.
- [3] G. Ruiz-Garcia, J. M. Flores-Arias, F. J. Bellido-Outeirino, A. Moreno-Munoz, E. J. Palacios-Garcia, and M. A. Quero-Corrales, "Home Lighting controller based on BLE," *Proc. of the IEEE International Conference on Consumer Electronics (ICCE) 2017*, Las Vegas, NV, Jan. 2017.
- [4] A. Sanchez-Comas, K. Synnes, and J. Hallberg, "Hardware for recognition of human activities: A review of smart home and AAL related technologies," *Sensors*, vol. 20, no. 15, Jul. 2020.