스마트홈을 위한 AllJoyn 프레임워크 기반 센싱 시스템

판지탕O, 양현식, 김영한
숭실대학교 정보통신공학과
thangecp@gmail.com, yangun@dcn.ssu.ac.kr, younghak@ssu.ac.kr

A Sensing System based on Alljoyn Framework for Smart Home

Thang Phan DuyO, YoungHan Kim, HyunSik Yang
School of Electronic Engineering, Soongsil University

Abstract

Nowadays, the term "Smart Home" is more familiar with people. There are many intelligent solutions integrating into Smart Home to improve quality of human's life. Besides, the combination of WSN and Smart Home is necessary for automatic interaction with continuous change of environment. Many efforts have focused on building systems having integration of WSN into Smart Home. However, these still have some limitations about scalability as well as standardization. To address these problems, in this paper, we propose a sensing system based on WSN and Alljoyn framework for Smart Home. A prototype was also deployed to demonstrate the feasibility of system.

1. Introduction

Nowadays, with improvement of people's living standard, demand of using smart home is also increasing. The combination of WSN and smart home is necessary for automatic interaction with various states of environment. Many studies have been done for the purpose of finding solutions to integrate WSN into intelligent home [1] [2]. However, the proposed solutions still have some problems such as low scalability and no standard. In this paper, we present a sensing system architecture model using WSN and based on Alljoyn framework which is an IoT software framework standard from Qualcomm. By taking advantages of Alljoyn, sensing data can be used simultaneously by various smart devices on smart home and it is easy to scale up as well as integrate. In addition, with attendance of many companies and organizations in Alljoyn community, our system has potential being suitable to many kinds of hardware equipment. To demonstrate the feasibility of system, we deploy a prototype in indoor environment. The main technical solutions used for this implementation are CoAP protocol in 6LoWPAN WSN and Alljoyn framework.

2. Alljoyn Framework

AllJoyn is an open, universal, secure and programmable software connectivity and services framework that enables companies and enterprises to create interoperable products that can discover, connect and interact directly with other AllJoyn-enabled products [3]. Practically, application based on Alljoyn is divided two types: Alljoyn service and Alljoyn client. Furthermore, Alljoyn provides service advertisement and discovery mechanism used by Alljoyn service and Alljoyn client, respectively. A client app can discover the service app through an announcement being sessionless signal which contains the list of object paths and service framework interfaces to allow the client to determine whether the app provides functionality of interest. Alljoyn offers the following main mechanisms:

- Discovering of proximal devices and applications;
- Ability to adapt the framework to specific devices;
- Data transport between devices through peer to peer system over Wi-Fi, Ethernet, Serial, Power Line;
- Interoperability between different operating systems;
- Efficient and secure data exchange through D-Bus.[4]

3. Sensing System Architecture

The sensing system architecture comprises of four

layers in fig.1. Physical layer represents sensor nodes which collect many types of sensing data from environment. Virtual service layer consists of the logical representations of each sensor executing sensing service tasks (e.g. temperature, humidity, light ...). A middleware layer called Service agent layer connects Virtual service layer with Overlay layer. Depending on type of sensing service, Service agents will get sensing data from sensors and provide them to entities in upper layer. Overlay layer includes Alljoyn peer to peer networks. On these networks, basically, Alljoyn services are service agents from Service agent layer and each Alljoyn service advertises its sensing service to Alljoyn clients which are devices using sensing data such as smart phone, computer, air conditioner for specific purposes.

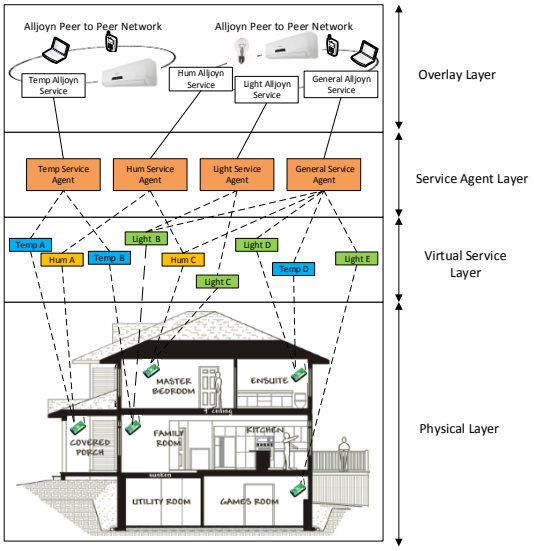


Figure 1. Sensing system architecture

4. Prototype Implementation

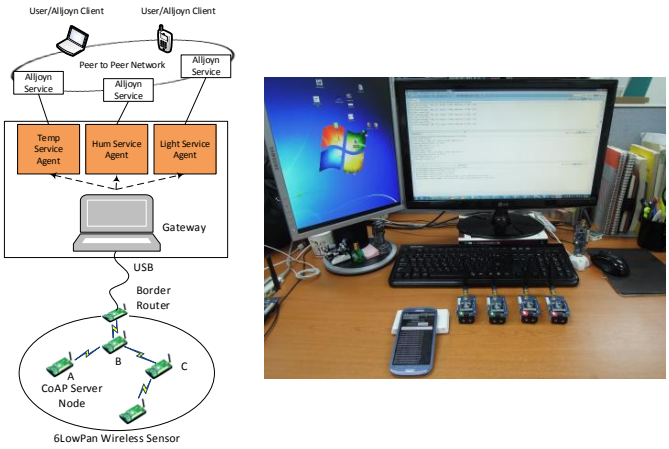
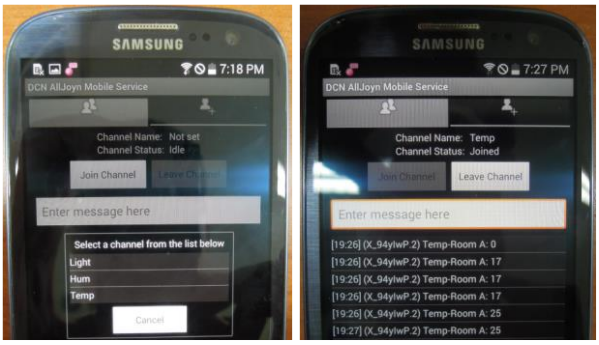


Figure 2. Sensing System Prototype

Based on sensing system architecture, we deploy a prototype to demonstrate feasibility of proposed system. The detail is showed in fig.2. Sensor nodes run contiki 2.7 OS with 6LoWPAN stack. The border router node connects to gateway through USB port. Sensors use CoAP protocol to exchange sensing data to outside. We use jcoap [5] an open source Java implementation of CoAP for gateway to communicate to sensor nodes. Each sensor simultaneously collects many types of sensing data as logical representations at Virtual service layer to provide to service agents. In this implementation, gateway is responsible for not only receiving data from sensor nodes but also being device where Alljoyn services run on. The gateway connects to Ethernet network to create an Alljoyn peer to peer system. Besides using Alljoyn framework to build services on gateway, we also develop a client app on android mobile for testing. Smart phone connects to Ethernet and can discover services advertised by Alljoyn services from gateway in fig.3.a. Fig.3.b shows operation of receiving temp values after selecting temp service.



a. b.

Figure 3. Implementation result

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