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Design of an Easy-to-Use Bluetooth Library for Wireless Sensor Network on Android

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Abstract

In this paper, we present a lightweight library to develop Bluetooth related applications in Android environment for wireless sensor network. Bluetooth based communication can be applied by some basic steps including enquiry, authorization and connect. Currently, Google provides a Bluetooth handling API as an Android SDK and a tutorial, however the development with this APIs may be still difficult for beginners. Considering these, for easy-to-use APIs in Android Platform, we design a standard library which is called "MoscaBluetooth", to help developers develop Bluetooth application easily.

Keywords: Android, Bluetooth, MoscaBluetooth, Android Bluetooth Library

1 Introduction

A concept of "Internet of Thing" (IoT), which forms a network by sharing information of each sensing object, has recently been spotlighted over the world [1]. The MWC 2014 and CES 2014 exhibitions have presented lots of devices and services related to IoT [2]-[3]. Moreover, a variety of hardware, software and networks with interworking services for IoT have developed. In IoT environment, Bluetooth network can cooperate with smartphone and LAN for wireless sensor network [4]. Additionally, a Bluetooth related research has been underway to provide a variety of services using Wireless Personal Areal Network (WPAN) [5]-[6].

Developers are required to have a thorough grasp of Bluetooth knowledge and handle a variety of tasks to develop a Bluetooth related application on Android environment. Hence, the Bluetooth app development may be somewhat difficult to

beginners. Thus, simple API set for convenient development is essentially required. In this paper, we present a lightweight library to develop Bluetooth related applications in Android environment for wireless sensor network. The designed MoscaBluetooth library are totally composed of three classes with an understandable definition in accordance with their defined names.

2 MoscaBluetooth Library Design

Standard Android Bluetooth library can be classified into three groups according to the roles of the classes. We design the proposed library using three group. In this design, we have three groups; MoscaBTController, MoscaEventListener and MoscaEventList classes. Figure 1 shows the construction diagram of components of the MoscaBluetooth library.

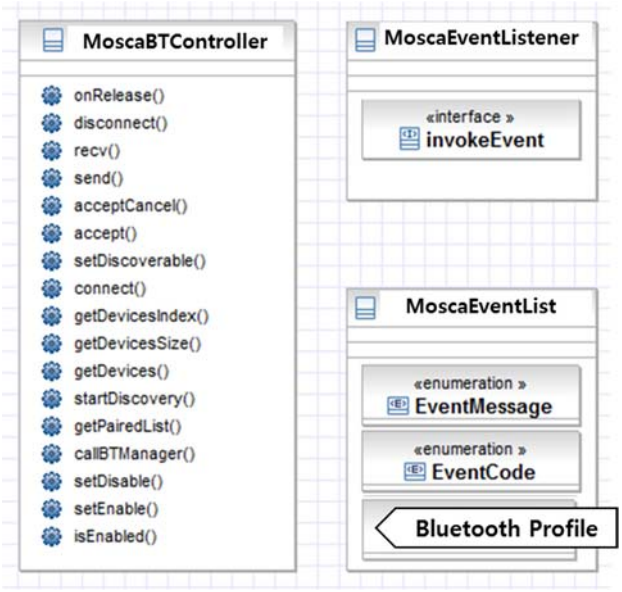

Fig. 1. Construction of the designed MoscaBluetooth library

3 MoscaBluetooth Library Development

MoscaBluetooth library is designed with three classes. MoscaBluetooth library has different from organization of Android standard Bluetooth library. Table 1 lists offered tasks of MoscaBluetoth library.

Table 1. Basic classes of MoscaBluetooth

Classes	Description
MoscaBTController	Control of Bluetooth (e.g on/off, discovery, etc.)
MoscaEventListener	Call-back method
MoscaEventList	Event message List

MoscaBluetooth Class contains necessary methods for handling Bluetooth connection on Android environment. With this class, developers can easily control Bluetooth devices on Android environment. Developer can process error message with “throws” command against occurring error because defined methods in MoscaBluetooth class are contained error exception sentence.

The MoscaEventListener class has an interface for listening generated events of Bluetooth equipment to process by callbacks. Defined interface method “invokeEvent()“ is used call-back in main activity via Implement and Override.

When the MoscaEventListener is invoked, the information about the events can be confirmed by calling callbacks to check the corresponding parameters. A message about the event is defined in the MoscaEventList class as a type consisting of two attributes, and stored on the Bluetooth profile.

4 Exemplary app development using the proposal API sets

We develop a test app using Bluetooth for testing the MoscaBluetooth library. In this example, we use a Samsung Galaxy S4 to connect a PC using Bluetooth dongle. Figure 2 shows the examples where a Bluetooth based communication application using the MoscaBluetooth library on a smartphone to connect and transmit data to a PC.

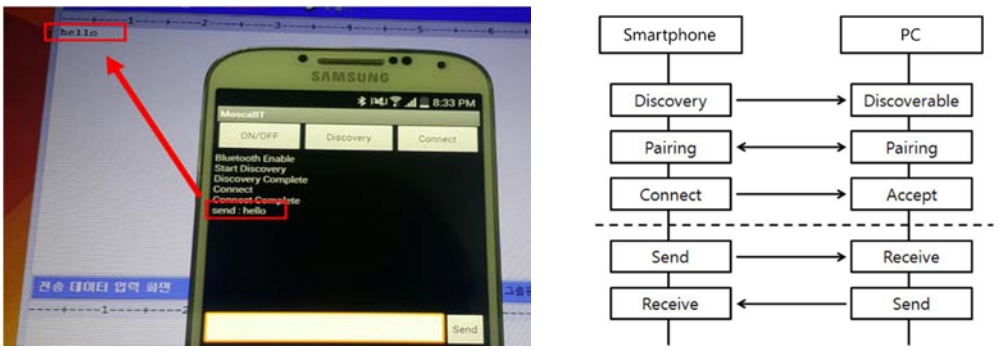

Fig. 2. Test App and Communication flow

As can be seen table 2, the MoscaBluetooth significantly decreases the number of required APIs for controlling Bluetooth. The MoscaBluetooth offers 15 APIs for controlling Bluetooth, whereas, an Android standard library is required at least 61 APIs. Table 2 shows some fundamental APIs of the MoscaBluetooth and Android Standard libraries for controlling the Bluetooth unit.

Table 1. The number of required standard method for MoscaBluetooth

Process	MoscaBluetooth Library's Method	The number of Standard Library Method
Device Enable	isEnabled()	1
	setEnable()	3
	setDisable()	3
	callBTManager()	2
Discovery	startDiscovery()	2
	getDevices()	1
Connection Request	connect()	8
Accept Connection Request	accept()	11
	accept() : TimeOut	7
	acceptCancel()	5
Disconnection	onDisconnect90	2
Discoverable	setDiscoverable()	7
Data Send and Receive	send()	2
	recv()	5
Total	15	61

5 Conclusion

In this paper, we proposed a lightweight Bluetooth library to provide a convenient Bluetooth service related development tool on Android platform. We also implemented a simple test app that communicates to a PC using Bluetooth. Because the developed library abstracts Android standard library, the number of methods is relatively small, and therefore, Bluetooth app development can be faster and more convenient. We show the validity and applicability of the proposed method with an exemplary app which connects PC and smartphone.

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