Accurate Estimation of Bluetooth RSSI and Distance

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Abstract—**The Bluetooth wireless standard has been established as one of the most widespread protocol implemented for Personal Area Network (PAN). Network applications designed for communication and connectivity provide the facility for people to reach anywhere at any time using mobile network fabric. The work done demonstrates the viability of using Bluetooth in Android for estimation of Received Signal Strength (RSSI) value and Distance between two phones connected. The availability of always on communication has tremendous implication as the Bluetooth devices help to connect to each other in a Local Area Network (LAN). In this paper we propose a software application which will accurately estimate the Received Signal Strength (RSSI) value and Distance between the two smart phones connected via Bluetooth.**

Keywords—Bluetooth; Received Signal Strength; Distance; Personal Area Network; Smart Phones

I. INTRODUCTION

In recent years, the presence of portable devices ranging from traditional laptop to fully fledged smartphones has introduced low cost, always on network connectivity to significant swaths of society. Network applications designed for communication and connectivity provide the facility for people to reach anywhere at any time in mobile network. Digital Communication, such as texting and social networking, connect individuals with ever expanding overflows of information.

Bluetooth used for connecting two smartphones in a Personal Area Network (PAN) is mainly designed to consume less battery power. It is mainly used to connect and exchange data among devices within close vicinity and does not require high Bandwidth. Unlike Wi-Fi network discovery of Bluetooth devices are simplified by pairing up the devices to be connected.

In recent years not only smart phones but many Personal Computer (PC) and Laptop accessories such as mice, keyboards, headsets and printers also make use of Bluetooth as wireless communication. With an increasing number of Bluetooth enabled devices becoming more common in our daily life, device discovery and understanding the Received Signal Strength (RSSI) value is extremely important.

Since smart phones have become the popular pervasive computing platform, it is logical to estimate and display the RSSI and Distance between two connected phones accurately. With the advent of Android smartphone platforms, the Application Programming Interface (API) to read RSSI is open and the work in this paper is based on the same.

II. BACKGROUND

Android is an open source operating system for mobile devices e.g. smartphones and tablets. Its is based on Linux Kernel. Applications are programmed in Java but instead of running Java bycote, Android runs Dalvik bycote which is produced from Java bycote. In Dalvik, instead of having multiple .class files as in case of Java, all the classes are packed together in a single .dex file.

Android applications are made of four types of components:

- Activities.
- Services.
- Broadcast receivers and
- Content providers.

These application components are implemented as classes in application code and are declared in the AndroidManifest.

AndroidManifest is a binary XML file, which declares the application package name, a string that is supposed to be unique to an application and the different components in the applications. The AndroidManifest is written in human readable XML and is transformed to binary XML during application build.

III. SYSTEM MODEL

A Phone Monitor application is developed. The application collects Bluetooth data including estimation of RSSI value along with Distance between two devices connected. The estimated RSSI value is stored is MySQL Database. Unfortunately, to protect users from people trying to hack into their phones, phones with Android 2.3 and above do not allow automatic Bluetooth discovery. Thus we have paired the devices to be used for this experiment.

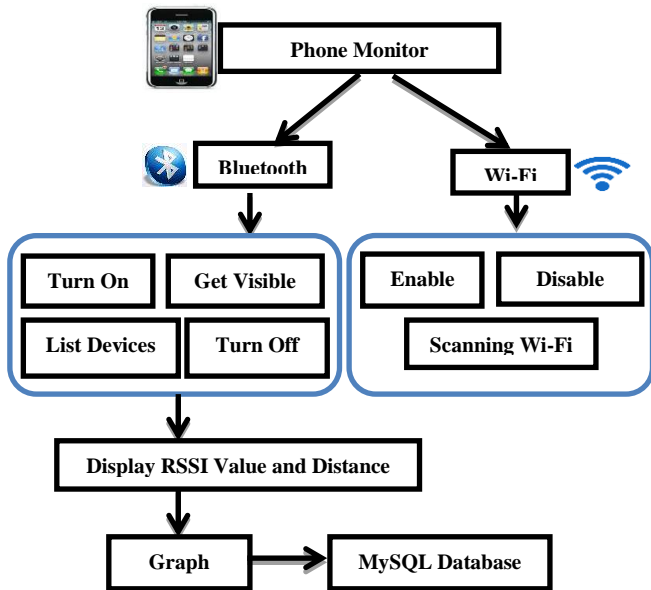In this section we present the architecture diagram of the Phone Monitor Application.

Figure 1. Block Diagram of Phone Monitor

The Phone Monitor Application is designed which estimate and display the RSSI value and the Distance between two phones connected. The data collected stored in MySQL Database. The Phone Monitor has two sections namely, Bluetooth and Wi-Fi.

The Bluetooth section consists of

- Turn On.
- Get Visible.
- List Devices.
- Turn Off.
- Display RSSI value and Distance.
- Graph.

All the values are stored in MySQL Database.

The Wi-Fi section consists of

- Enable.
- Disable.
- Scanning of Wi-Fi Devices.

IV. SOFTWARE IMPLEMENTATION AND RESULTS

The goal of our work is to accurately estimate the Bluetooth RSSI value and Distance between two smart phones connected.

A. *PHONE MONITOR CONTROLL PANEL*

The Phone Monitor Control Panel shown in **figure 2** consists of two sections:
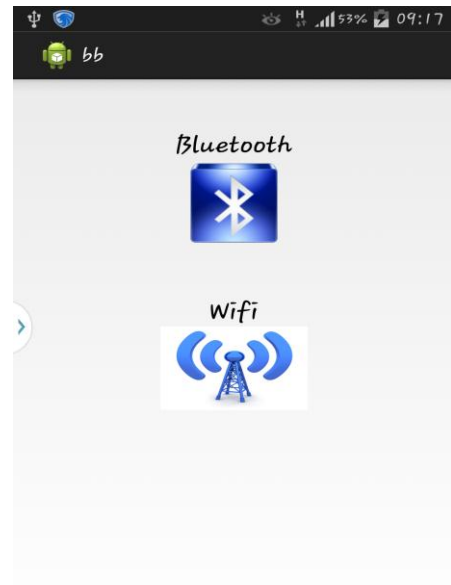
- Bluetooth.
- Wi-Fi.

Figure 2. Phone Monitor Control Panel

The Phone Monitor Control Panel shown in **figure 2** consists of two sections:

- Bluetooth.
- Wi-Fi.

B. *BLUETOOTH CONTROL PANEL*

Clicking the Bluetooth button will take us to Bluetooth Control Panel as shown in **figure 3** consists of four parts:

- Turn on.
- Turn Off.
- Get Visible.
- List Devices.
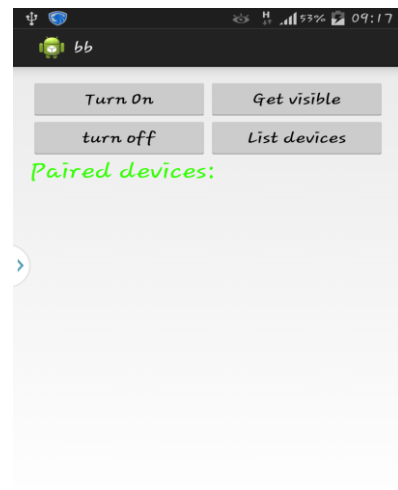
It also shows all the Paired Devices.

Figure 3. Bluetooth Control Panel

Pressing the Turn On button will display a message asking the user to grant permission to turn on the Bluetooth with options 'yes or no' as shown in **figure 4**.
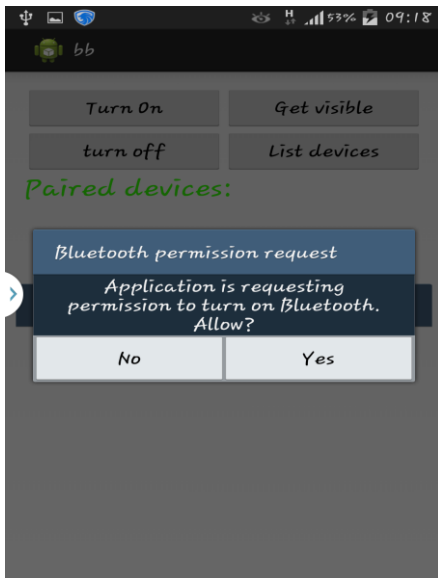

Figure 4. Asking user to grant permission to turn on Bluetooth

Once the Bluetooth is turned on, List Devices will enlist all the paired devices. Get Visible will make the Bluetooth enables device visible to all surrounding devices for 120 seconds as shown in figure 5. The turn off button will switch off the Bluetooth of the device.
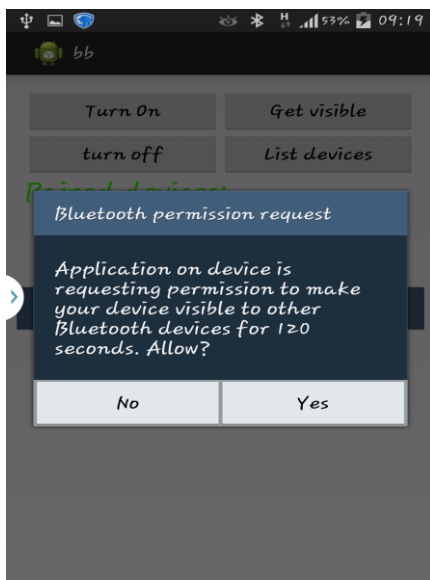

Figure 5. Bluetooth permission request for the device to be visible to all for 120 seconds.
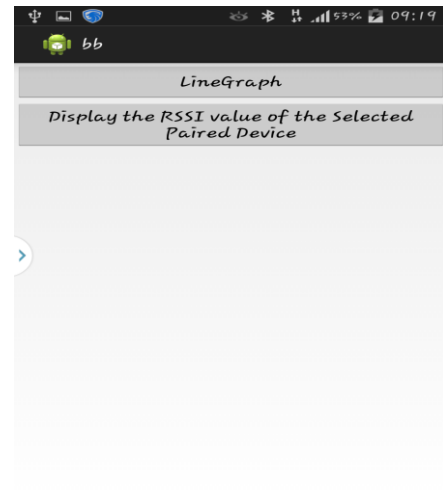

Figure 6. Displays RSSI value and Line Graph

Display the RSSI value of the selected paired device will generate the RSSI value and Distance between two devices paired as shown in **figure 7**.
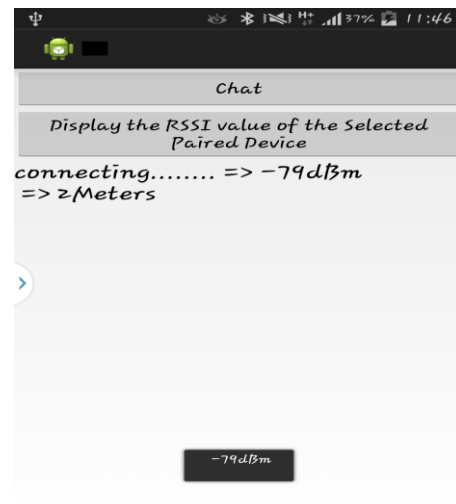

Figure 7. Displaying RSSI value and Distance

C. WI-FI CONTROL PANEL

Clicking the Wi-Fi button in the Phone Monitor Control Panel will take us to Wi-Fi Control Panel as shown in **figure 8** consists of Enable, Disable and Scanning Wi-Fi.
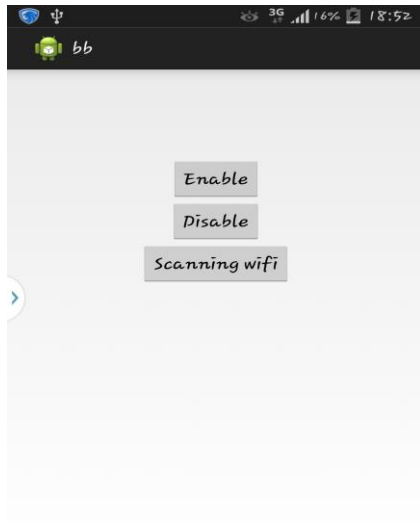
Figure 8. Wi-Fi Control Panel

V. CONCLUSION AND FUTURE WORK

The presented work validates the usage of the Phone monitor application to accurately estimate and display the Bluetooth RSSI values and distance.

The application was designed using Eclipse and Java code. This application can only be installed and run in smartphones with Android as their operating system (OS). Once the application is installed, we can control the Bluetooth and Wi-Fi of the phone through this application. For future work, we can use Bluetooth discovery method instead of paired devices to estimate the RSSI values and Distance.

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