



SUDAN UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

SIMULATION OF BLUETOOTH
(ONE_TO_MANY)

August 2014

THESIS SUMMITTED AS A PARTIAL REQUIREMENTS OF B.Sc.
(HONOR) DEGREE IN COMPUTER SCIENCE

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

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& TECHNOLOGY
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PREPARED BY:

IBRAHIM ELAMEEN HAMMED EISSA

MOHAMMED ALSR MOHAMMED ALI

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SUPERVISOR

T.Huda gaml

الآية

قال عز وجل:

(قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ)

صدق الله العظيم

سورة البقرة {32}

الحمد لله

الحمد لله الذي خلق كل شئ وقدره لحمد لله الذي له الأمر جميعا ومدبره، الحمد لله الأول لا شيء قبله، الحمد لله الآخر لا شيء بعده، الحمد لله الظاهر فوق كل شيء وقاهره، الحمد لله الباطن لا يخفى عليه شيء ومُبصره، الحمد لله مالك الملك كله وحاكمه، الحمد لله الحي الذي لا يموت، الحمد لله بعدد ما خلق، الحمد لله ملئ السموات وملئ ما حوت وملئ ما يعرجفها وما يتنزل منها وما خفى، الحمد لله ملئ الأرض وما حوت وما يمشي عليها وما هوساكن فوقها وتحتها، الحمد لله بعدد كلماته التي لا تنفذ، الحمد لله بسعة علمه الذي لا ينفذ، الحمد لله منذ ان كان وحده ولم يكن سواه احد، الحمد لله منذ ان خلق القلم وخلق السموات والأرض، الحمد لله حين أستوى على العرش، الحمد لله حين خلق آدم وسواه وكرمه على كثير مما خلق، الحمد لله الذي علمه الأسماء وخلق له حواء، الحمد لله الذي أمر الملائكة بالسجود له، الحمد لله الذي علمه التوبة فتابعه عليه، الحمد لله الذي جعله خليفة في الأرض.

اللهم لك الحمد على هذا وذاك وانت اهل الحمد والفضل كله اليك والحمد لله الذي خلق من ذرية آدم الصالحين ومنهم النبيين والمرسلين وعباده المخلصين الحمد لله على أحمد الخلق له سيدنا محمد صلى الله عليه وسلم.

DEDICATION

For the person who have always been a source of encouragement, hope, strength and inspiration may Allah forever bless you beloved

My grand Mother

For the angel who have unconditionally loved and supported me may

Mother

To man who supported me in all stages of my life

Father

ACKNOWLEDGEMENT

At the beginning and in the end all thanks belongs to Allah, we thank the almighty for giving us the will power and patience to complete this work; truly without his grace nothing is achievable.

Thanks are also dedicated to the supervision of laboratories for providing us with the equipment and resources that we couldn't have completed this thesis without.

A lot of appreciation and gratitude to the ones who have put their trust on us to complete this research

Our supervisor

T.Huda gamal

Our co-supervisor

T.Mohammed Hassabo.

Thanks to every teacher who have taught us throughout our college years and got us to where we are today.

Abstract

As known Technology of Bluetooth has facilitated the sharing resources among users, especially with the technological evolution in the properties of the smartphones which are currently available. It is designed for wireless communication between a wide variety of different Bluetooth enabled devices; from computers and PDAs (Personal Digital Assistant) to GPS (Global Position System) systems and heart monitoring devices. There are a growing number of companies continually adopting this technology.

In the earlier contact between mobile devices when using Bluetooth technology based on (1= 1), that mean one device send resources to only one device in the communication process.

We try to solve this problem by build Android application support multicast transmitter data rather than transmission to one contact.

المستخلص

كما هو معروف فإن تكنولوجيا البلوتوث سهلت عملية مشاركة المصادر بين المستخدمين وخاصة مع التطور التكنولوجي في خصائص الهواتف الذكية المتوفرة حالياً. وهو مصمم للإتصالات اللاسلكية بين مجموعة واسعة من الأجهزة بتقنية بلوتوث مختلفة؛ من أجهزة الكمبيوتر وأجهزة PDAs إلى أنظمة GPS وأجهزة مراقبة القلب (Heart). هناك عدد متزايد من الشركات التي تعتمد باستمرار هذه التكنولوجيا. في الإتصال السابق بين الأجهزة النقالة عند استخدام تقنية البلوتوث كانت تقوم على أساس (1 = 1)، ذلك يعني جهاز واحد يرسل الموارد لجهاز واحد فقط في عملية الإتصال. ونحن نحاول حل هذه المشكلة عن طريق بناء برنامج بلغة الاندرويد لدعم الإرسال المتعدد بدلا من الإرسال إلى جهة واحدة.

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List of terms

Terms	Description
2D	two-dimensional space
3D	three-dimensional space
OpenGLES	OpenGL for Embedded Systems
OS	Operating System
IDE	Integrated Development Environment
API	Application Programming Interface
ADT	Android Development Tools
VM	Virtual Machine
SIG	Special Interest Group
PAN	Personal Area Network
AFH	Frequency Hopping
ISM	Industrial scientific and medical
GSM	Global System for Mobile Communications
EDGE	Enhanced Data rates for GSM Evolution
WI-FI	Wireless Fidelity
GPS	Global Positioning System
SMS	Short Message Service
IT	Information Technology
SDK	Software Development Kit

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The project falls under the application of share resources via mobile Smartphone's and depend into mobile which use a Bluetooth as a gateway for sharing data.

Technology of Bluetooth has facilitated the sharing resources among users, especially with the technological evolution in the properties of the smartphones which are currently available.

The main idea of the project support the concept of sharing data via mobile phone in an attempt to create mobile application in Android system to support multicast transmitter data rather than transmission to one contact, which contributes to the solution of the delay caused by individual contact. And this application display window containing the names of existing devices in the Bluetooth range to choose the file which we want to share it with them.

1.2 Research Problem

In the earlier contact between mobile devices when using Bluetooth technology based on (1= 1), that mean one device send resources to only one device in the communication process. If we want to send to set of portable devices must repeat the process transmitter with all available devices, which would takes a long period of time.

Also, the window which display the devices in the specified range it offers opportunity to choose only one device to hold communication with it.

1.3 Research Objectives

The main idea of this project is the development of sharing resources between portable devices by building android application support multicast transmitter.

To add these features to mobile devices to provide (1 = m) in the communication process, that means only one device is sharing a variety of resources with a set of mobile devices, which contributes to the solution of the delay caused by individual contact.

In addition to create window that containing the names of mobile devices within a range of Bluetooth, rather than select individual device, by determined a set of mobile devices to share resources with them.

1.4 Research Methodology

To add these features, we create application simulate the Bluetooth program's but it support characteristic (1=m), and also support the old characteristic which was followed (1= 1).

1.5 Research Scope

The basic idea underlying the project is characteristic (1 =m) only, and didn't include characteristic (m=m).

And also we use the same range of Bluetooth (10-meter), and the frequency of the transmitter signal is 2.45GHz which was agreed by ISM.

Also, all the devices that we want to share the sources with them must be containing the Bluetooth, and this devices is Smartphone because it's based on android OS, and these devices are Smartphone's only, and the type of the data is text file only.

1.6 Research Structure

We have five chapters, chapter2 talking about the general concept about Android system and Bluetooth, and Rooting in kernel OS, Chapter 3 describe tools and literature review, Chapter 4 Talking about system analysis, chapter 5 display system design, chapter6 Talking about conclusion and recommendation.

CHAPTER 2

BLUETOOTH AND ANDROID

2.1 Introduction

This section introduces general background about the project and it's include some information of android OS and Bluetooth technology.

2.2 Android OS

Android has become most famous in mobile systems .It's a mobile operating system initially developed by INC, A firm acquired by Google in 2005.

Android-software is a stack for mobile devices that includes an operating system, middle-ware and key applications. It's based on the Linux kernel.

The version history of the Android mobile operating system began with the release of the Android beta in November 2007. The first commercial version, Android 1.0, was released in September 2008. Android is under ongoing development by Google and the Open Handset Alliance, and has seen a number of updates to its base operating system since its original release. These updates typically fix bugs and add new features.

Since April 2009, Android versions have been developed under a codename and released in alphabetical order: Cupcake, Donut, Éclair, Froyo, Gingerbread, Honeycomb, Ice Cream Sandwich, and Jelly Bean. As of 2013, over 500 million active devices use the Android OS worldwide. The most recent major Android update was Jelly Bean 4.2, which was released on commercial devices in November 2012.

First device working on android OS was HTC G1 (Dream) which was launched on October 22-2008. After that android became most popular and it's been used in many devices and used to solve many problems that other OS couldn't solve it.

2.2.1 Android rooting

Is the process of allowing users of smartphones, tablets, and other devices running the Android mobile operating system to attain privileged control (known as "root access") within Android's subsystems.

Rooting is often performed with the goal of overcoming limitations that carriers and hardware manufacturers put on some devices, resulting in the ability to alter or replace system applications and settings, run specialized apps that require administrator-level permissions, or perform other operations that are otherwise inaccessible to a normal Android user. On Android, rooting can also facilitate the complete removal and replacement of the device's operating system, usually with a more recent release of its current operating system, And also we use the Bootloader to release the modified Kernel.

2.3 Bluetooth

2.3.1 General information about Bluetooth

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices, building personal area networks (PANs). Invented by telecom vendor Ericsson in 1994, it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization.

Bluetooth is managed by the Bluetooth Special Interest Group (SIG), which has more than 19,000 member companies in the areas of telecommunication, computing, networking, and consumer electronics. Bluetooth was standardized as IEEE 802.15.1, but the standard is no longer maintained. The SIG oversees the development of the specification, manages the qualification program, and protects the trademarks. To be marketed as a Bluetooth device, it must be qualified to standards defined by the SIG.

A network of patents is required to implement the technology, which is licensed only for that qualifying device.

Bluetooth exists in many products, such as telephones, tablets, media players, robotics systems, handheld and console gaming equipment, and some high definition headsets, modems, and watches. The technology is useful when transferring information between two or more devices that are near each other in low-bandwidth situations. Bluetooth is commonly used to transfer sound data with telephones (i.e., with a Bluetooth headset) or byte data with hand-held computers (transferring files).

Bluetooth protocols simplify the discovery and setup of services between devices. Bluetooth devices can advertise all of the services they provide. This makes using services easier, because more of the security, network address and permission configuration can be automated than with many other network types.

Bluetooth operates in the range of 2400–2483.5 MHz (including guard bands). This is in the globally unlicensed (but not unregulated) Industrial, Scientific and Medical (ISM) 2.4 GHz short-range radio frequency band. Bluetooth uses a radio technology called frequency-hopping spread spectrum. The transmitted data are divided into packets and each packet is transmitted on one of the 79 designated Bluetooth channels. Each channel has a bandwidth of 1 MHz. Bluetooth 4.0 uses 2MHz spacing which allows for 40 channels. The first channel starts at 2402 MHz and continues up to 2480 MHz in 1 MHz steps. It usually performs 1600 hops per second, with Adaptive Frequency-Hopping (AFH) enabled.

2.3.2 Piconets and Scatternets

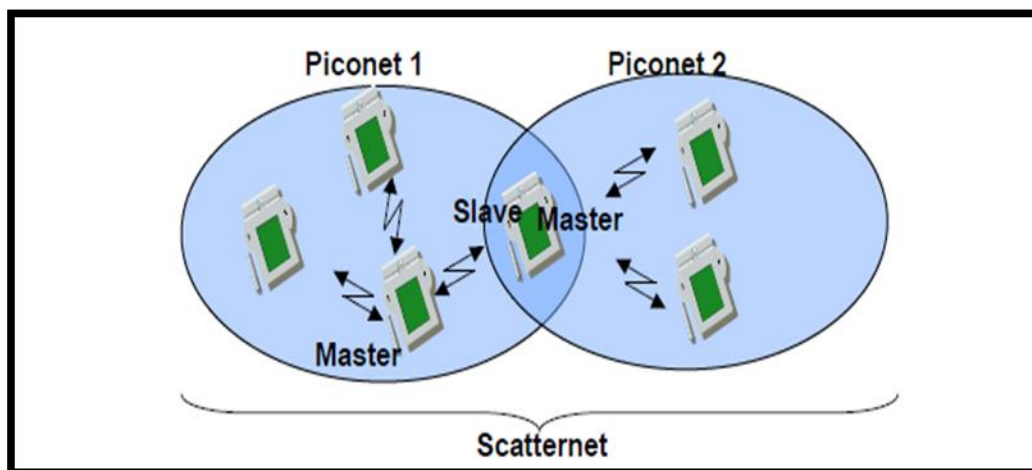


Figure2.1: Scatternet

Bluetooth is a packet-based protocol with a master-slave structure. One master may communicate with up to seven slaves in a piconet, all devices share the master's clock. Packet exchange is based on the basic clock, defined by the master.

Scatternet is Allows many devices to share same area and Makes efficient use of bandwidth.

piconet is a network that is created using a wireless Bluetooth connection. Some examples of piconets include a cell phone connected to a computer, a laptop and connected to Bluetooth-enabled digital camera, or several PDAs that are connected to each other.

2.3.3 Development

Since its creation 20 years ago Bluetooth has seen a number of improvements. Over the years the speed of connection and discovery of Bluetooth devices has been increased, the data transfer rate has got faster and support for low energy use (known as Bluetooth Smart or BLE) has been added.

The latest version of Bluetooth currently available is 4.1, "enhanced usability and increased developer flexibility." One of those enhancements took the form of removing the need for a host when transferring information or data.

With earlier versions of Bluetooth everything would need to communicate directly with a host device, but now devices can communicate independently and then feed that data back to the host all at once.

2.3.4 Bluetooth Application Areas

The applications area Includes:

- Data and voice access points
- Real-time voice and data transmissions.
- Cable replacement Eliminates need for numerous cable attachments for connection.
- Adhoc networking Device with Bluetooth radio can establish connection with another when in range.

2.3.5 Protocol Architecture

Bluetooth is layered protocol architecture

- Core protocols
- Cable replacement and telephony control protocols
- Adopted protocols

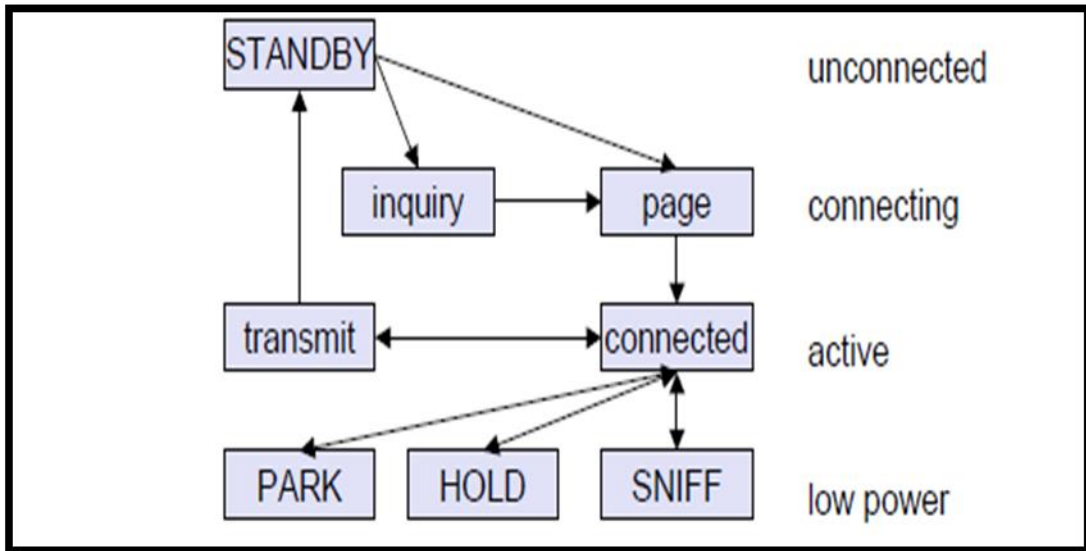


Figure2.2: State of Bluetooth Connection

2.3.5 Slave Connection State Modes

Active: participates in piconet Listens, transmits and receives packets

Sniff: only listens on specified slots

Hold: does not support ACL packets Reduced power status, May still participate in SCO exchanges.

Park: does not participate on piconet, still retained as part of piconet.

CHAPTER 3
TOOLS AND LITERATURE REVIEW

3.1 Introduction

This section introduces tools are used to complete the implementation of this project.

3.2 Android

Android is a software stack for mobile devices that includes an operating system, middleware and key applications. Android is an operating system based on Linux with a Java programming interface.

The Android Software Development Kit (Android SDK) provides all necessary tools to develop Android applications. This includes a compiler, debugger and a device emulator, as well as its own virtual machine to run Android programs.

Android allows background processing, provides a rich user interface library, supports 2-D and 3-D graphics using the OpenGL libraries, access to the file system and provides an embedded SQLite database.

An android application consists out of different components and can re-use components of other applications if these applications declare their components as available.

3.2.1 The reasons for using Android

The main reason for using android in the development of the application in this proposed project is its open source nature, using the right tools anything can be done with the OS.

Since its an open source it's source code could be available for further development and modification in the application.

Another reason is that android applications are easy to handle and easy to implement using the SDK facilitated by android, also performance stability and

security is boosted since android is based on Linux kernel, finally the time for developing the application is considerably less.

3.2.2 Android Problems

Android developers face some hardships due to some problems related to android and here are examples of them:

3.2.3 Software fragmentation

There are too many versions of the android OS in circulation and that resembles a major issue for software developers who have to support all these versions.

3.2.4 Hardware fragmentation

There are more than 170 running android with varying features which also cause a difficulty for application developers.

3.2.5 The update process

getting the update to the latest version may be an issue and some users may have to wait for some time to get it.

3.2.6 Android Architecture

The following diagram shows the major components of the Android operating system. Each section is described in more detail below.

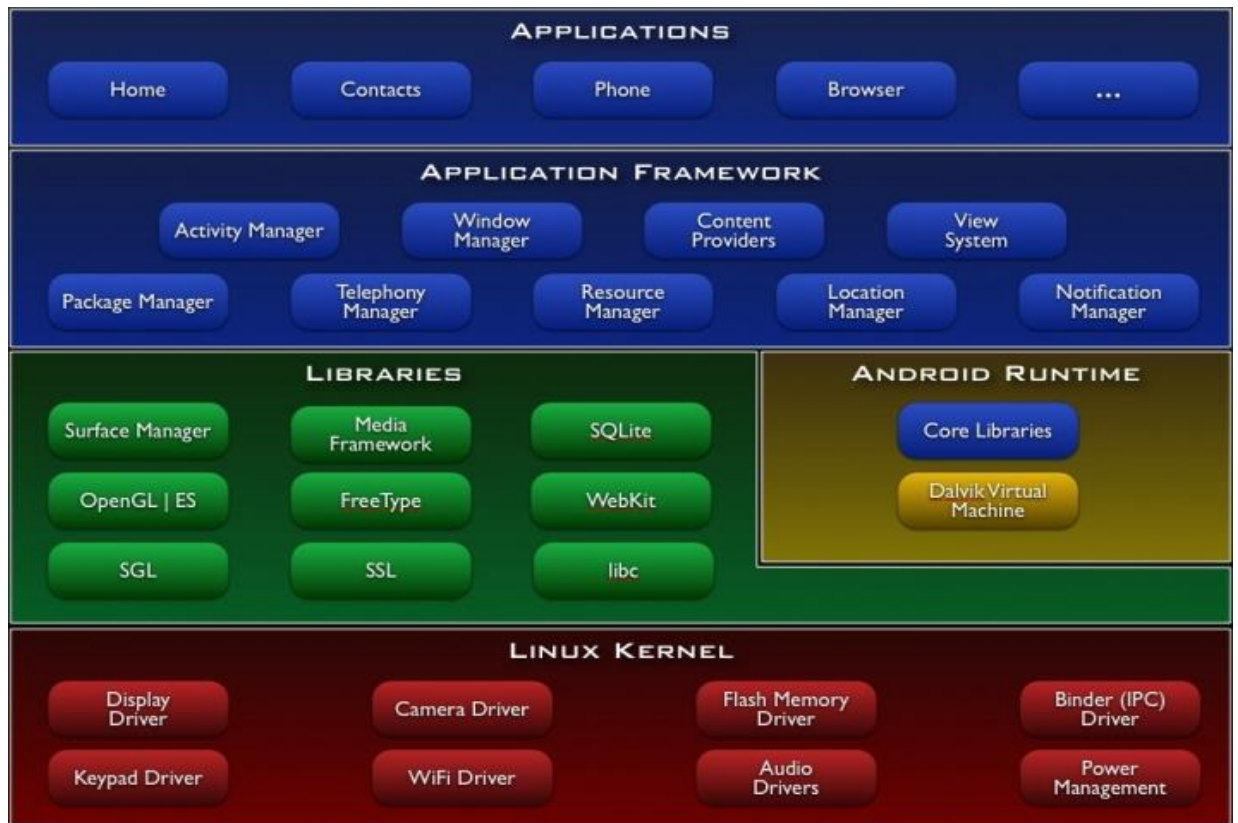


Figure3.1: Android architecture

3.2.7 Applications

Android has a set of core applications including an email client, SMS program, calendar, maps, browser, contacts, and others. All applications are written using the Java programming language.

3.2.8 Application Framework

Developers are free to take advantages of the device hardware and its applications, they have full access to the same framework APIs (Application Providers Interfaces) used by the core applications. The application architecture is designed to simplify the reuse of components.

3.2.9 Android Runtime

Android includes a set of core libraries that provides most of the functionality available in the core libraries of the Java programming language.

Classes are compiled by Java language compiler and Dalvik Executable (.dex) is produced and the .dex is executed by the Dalvik virtual machine.

The Dalvik VM relies on the Linux kernel for underlying functionality such as threading and low-level memory management.

3.2.10 Libraries

Android includes a set of C/C++ libraries used by various components of the Android system. These capabilities are exposed to developers through the Android application framework.

3.2.11 Linux Kernel

Android relies on Linux version 2.6 for core system services such as security, memory management, process management, network stack, and driver model. The kernel also acts as an abstraction layer between the hardware and the rest of the software stack.

3.2.12 Application Components

Application components are the essential building blocks of an Android application. Each component is a different point through which the system can enter your application and each one exists as its own entity and plays a specific role.

There are four different types of application components. Each type serves a distinct purpose and has a distinct lifecycle that defines how the component is created and destroyed. These components are:

3.2.13 Activities

An activity represents a single screen with a user interface.

3.2.14 Services

It is a component that runs in the background to perform long-running operations or to perform work for remote processes. A service does not provide a user interface.

3.2.15 Content providers

Manages a shared set of application data. You can store the data in the file system, An SQLite database, or any other persistent storage location your application can access. Through the content provider, other applications can query or even modify the data.

Content providers are also, useful for reading and writing data that is private to your application and not shared.

3.2.16 Broadcast receivers

Is a component that responds to system-wide broadcast announcements. Applications can also initiate broadcasts. They may create a status bar notification to alert the user when a broadcast event occurs.

3.2.17 Activating Components

Three of the four component types—activities, services, and broadcast receivers—are activated by an asynchronous message called an intent. Intents bind individual components to each other at runtime, whether the component belongs to your application or another.

Content provider, is not activated by intents. Rather, it is activated when targeted by a request from `ContentResolver`. The content resolver handles all direct transactions with the content provider so that the component that's performing transactions with the provider doesn't need to and instead calls methods `ContentResolver.query()`. This leaves a layer of abstraction between the content provider and the component requesting information (for security).

There are separate methods for activating each type of component:

- You can start an activity by passing, (when you want the activity to return a result).
- You can start a service or you can bind to.
- You can initiate a broadcast by passing.
- You can perform a query to a content provider.

3.2.18 Android Development Tools

Tools used in android development are:

- Google provides the Android Development Tools (ADT) to develop Android applications with Eclipse. ADT is a set of plug-in which extended the Eclipse IDE with Android development capabilities.
- ADT contains all required functionality to create, compile, debug and deploy Android applications from the Eclipse IDE and from the command line. Other IDE's, e.g. IntelliJ, are also reusing components of ADT.
- ADT also provides an Android device emulator, so that Android applications can be tested without a real Android phone.

3.2.19 Android Emulator

The Android Development Tools (ADT) includes an emulator to run an Android system. The emulator behaves like a real Android device (in most cases) and allows you to test your application without having a real device.

You can configure the version of the Android system you would like to run, the size of the SD card, the screen resolution and other relevant settings. You can define several devices with different configurations.

Via the emulator you select which device should be started, you can also start several in parallel. These devices are called "Android Virtual Device" (AVD).

The ADT allow deploying and running your Android program on the AVD.

3.3 Eclipse

The eclipse is a project created to be used as an open source framework to provide many of the underlying services software developers need. It consists of a set of APIs and of real code designed to do real work, the Eclipse Platform is the foundation for constructing and running integrated end-to-end software development tools.

As an open source effort, Eclipse is vendor-neutral. This eliminates vendor lock-in and makes it easier to drive changes in your IT.

In this project eclipse will be used as a platform for developing the android application.

3.4 LITERATURE REVIEW

In this section we talk about the pervious study in the Bluetooth technology.

The wibree technology

Nokia Company has conducted a study in Bluetooth on his way to make it connects more than one device and that was in 2007, researches findings to produce the wibree.

Wibree is a way to connect to the wireless short-range (on the radio wave) at 2.4 GHz complementary to Bluetooth, and by which a strong performance of applications between MB 10-0 and quickly exchange data 1 MB per second to not exceed the distance of 10 meters., And is characterized by the decline in the total energy consumption of the device is between 80-75% of the power of a fully charged battery.

The main objective of in presenting this technology is connected the possibility of more than one device at the same time dependent on the small size and low power consumption can also be connected with any device based on Bluetooth.

The similarities

An attempt to improve the performance of Bluetooth and try to enable it to communicate with more than one device at the same time.

The difference

The result of these research findings to produce a new device "wibree" where is complementary to the Bluetooth device.

CHAPTER4

SYSTEM ANALYSIS

4.1 Introduction

After discussing the tools and techniques used in the development of the application, the research will go on describing briefly the current multilingual conference system and the proposed system in more details.

4.2 System analysis using UML diagrams

The analysis of the proposed system will be demonstrated through UML diagrams; the use case model, the sequence diagram and the activity diagram will be shown next.

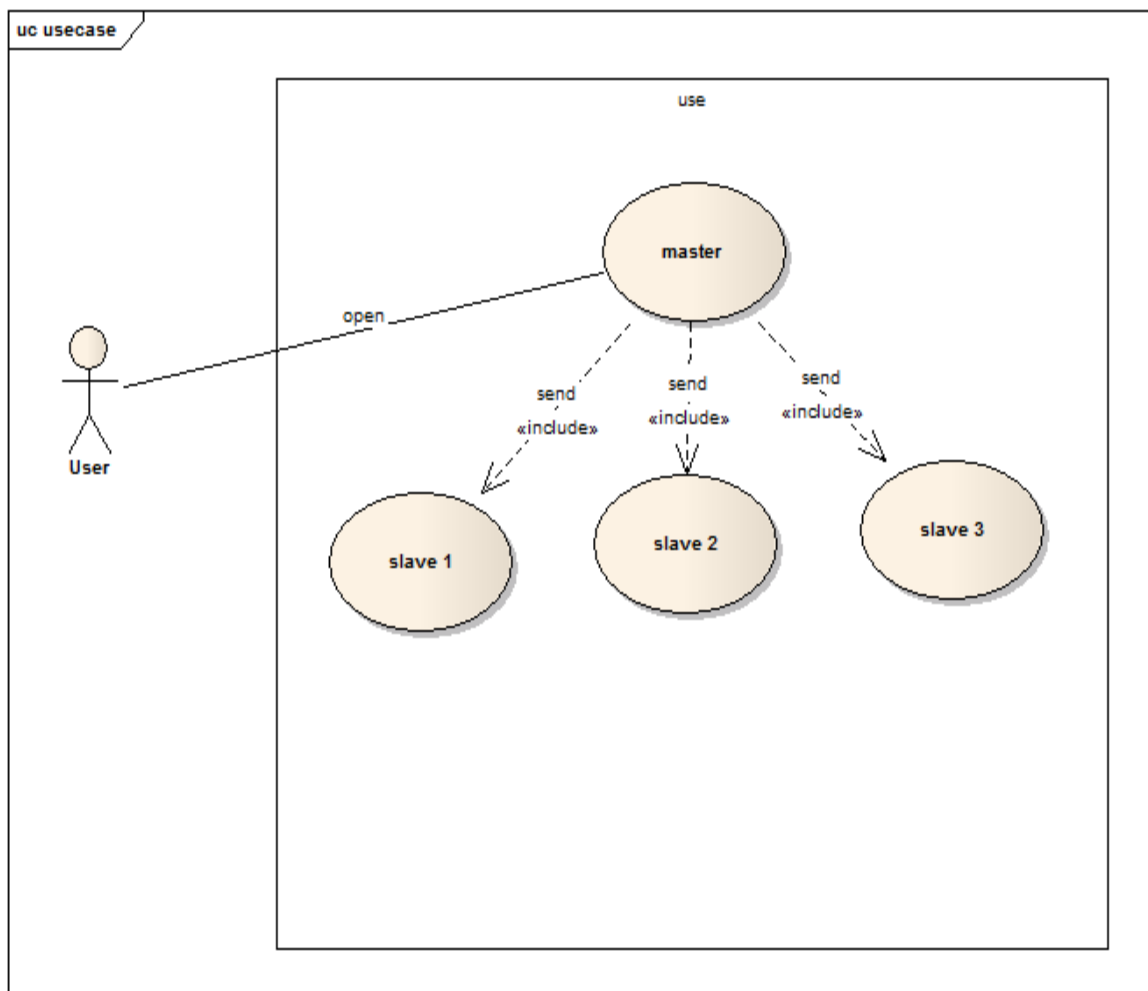


Figure 4.1 usecase diagram

The above figure illustrates the process of searching for devices and send to its.
“Maximum three devices”

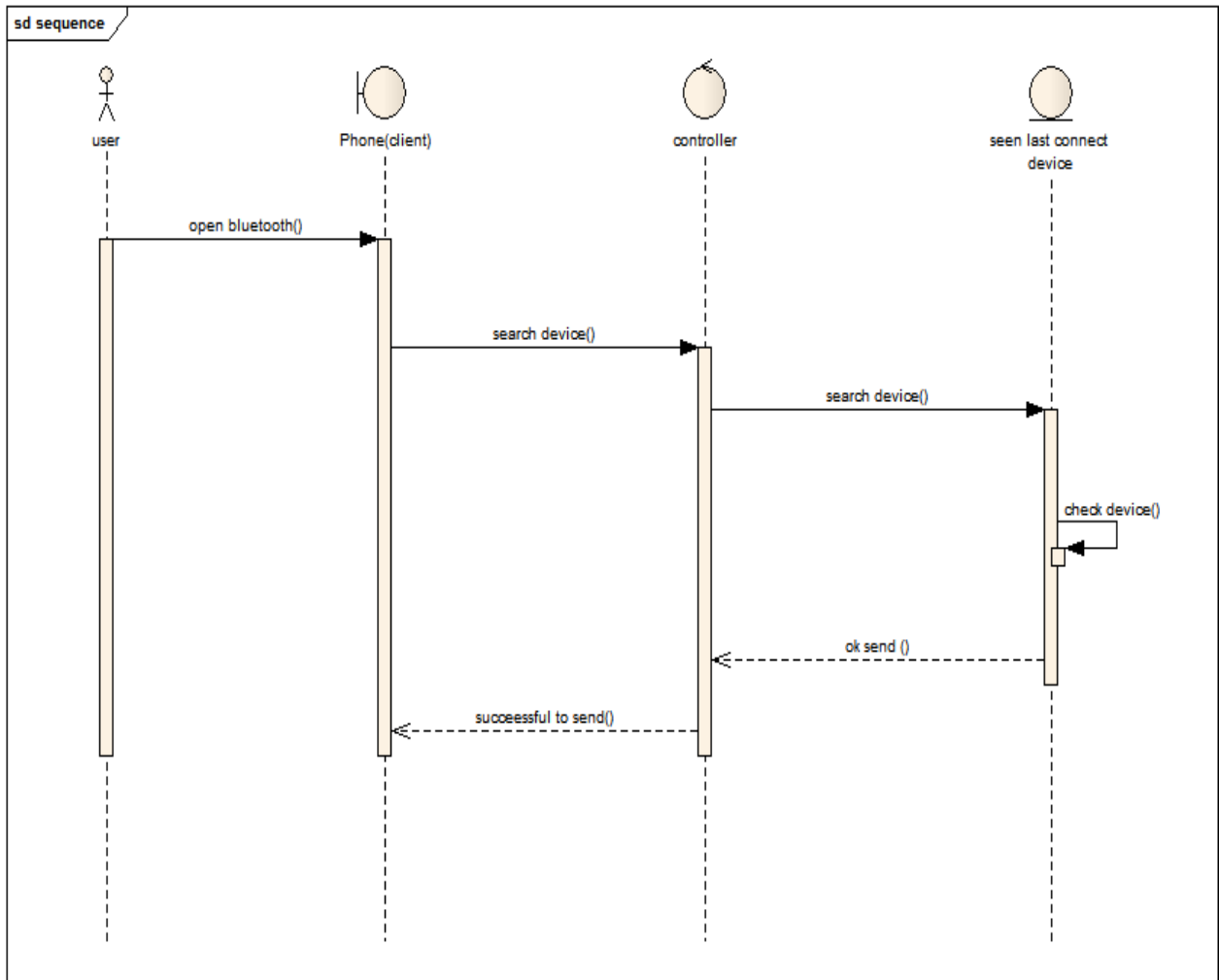


Figure4.2: Sequence diagram

The user open the application, then they are search about devices before the search it check about the list of the least connected devises, if it founded do mark to it and connected with them.

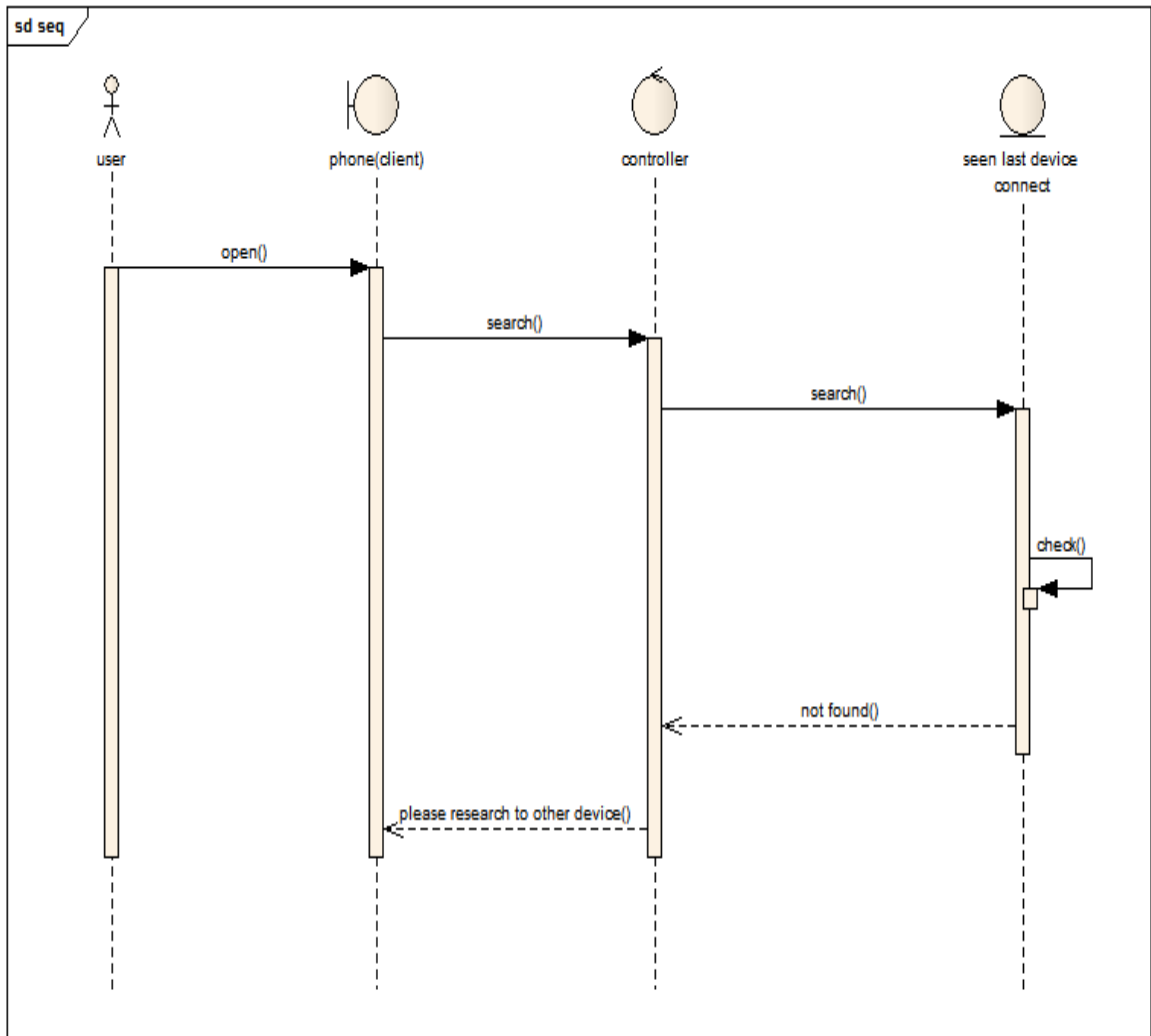


Figure4.3: Sequence diagram

The user open the application, then they are search about devices before the search it check about the list of the last connected devices, if it not founded it search again.

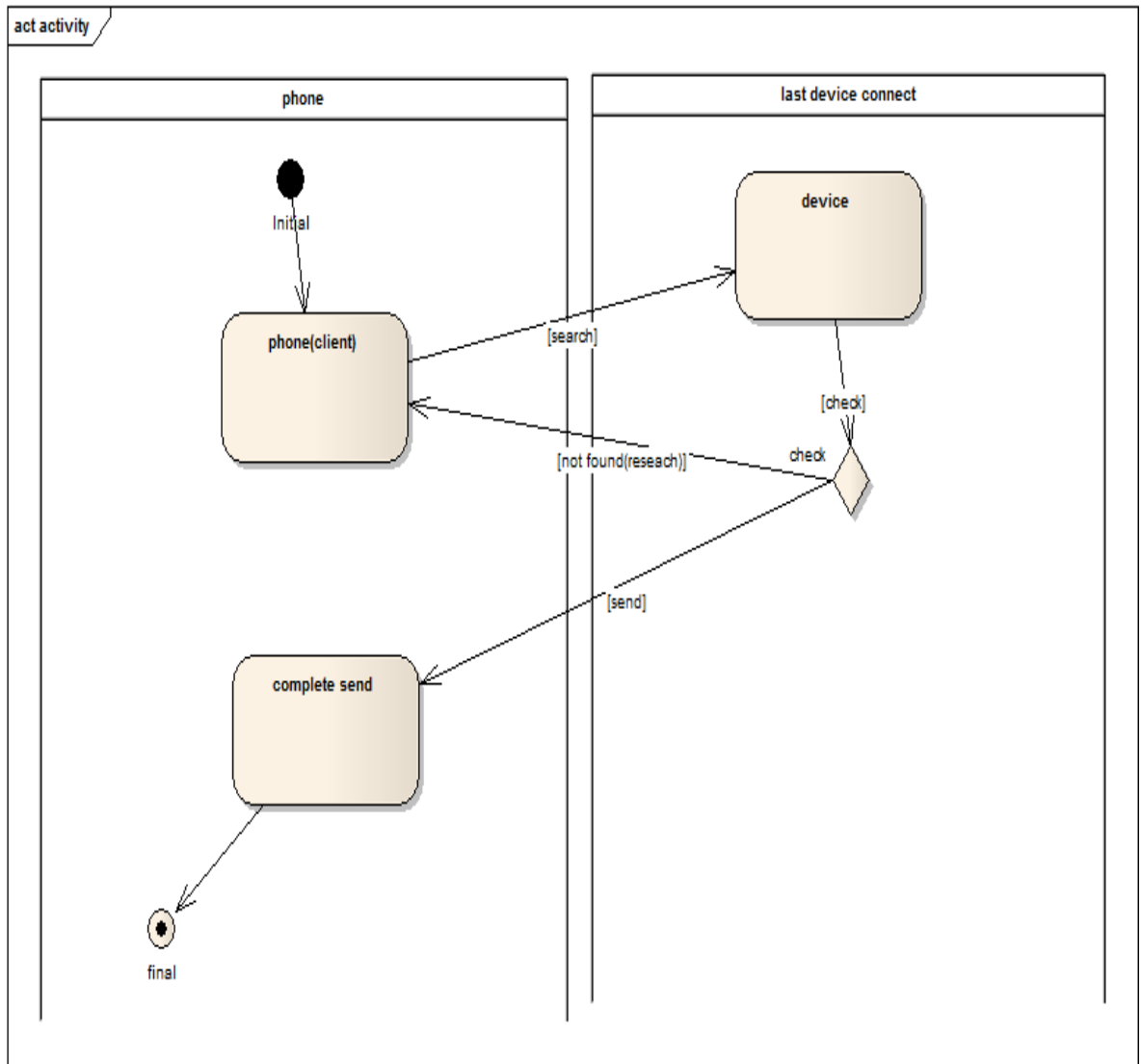


Figure 4.4: Activity diagram

At the first phone (master) search about devices which want to contact with them in the list of the least devices connected, if found it send data to it, else do search again to find the devices. Design

CHAPTER5

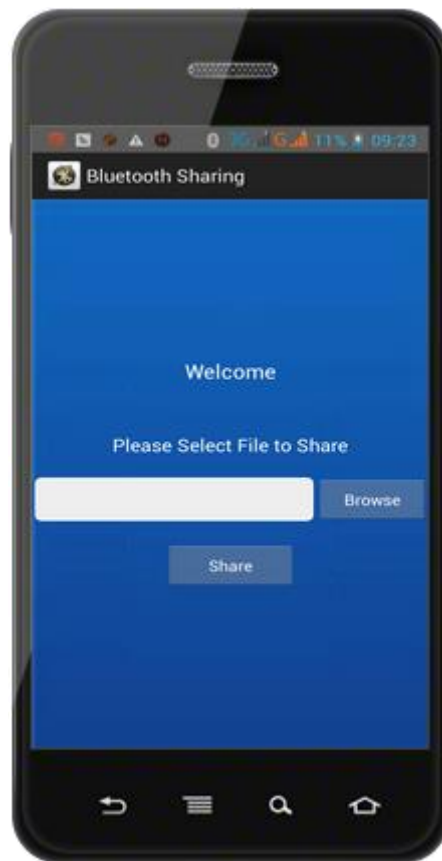
SYSTEM DESIGN

5.1 Introductions

After implementing and analyzing the system, this chapter will be showing the graphical interfaces of the application and a brief description of the interface components and functions.

5.2 System interfaces

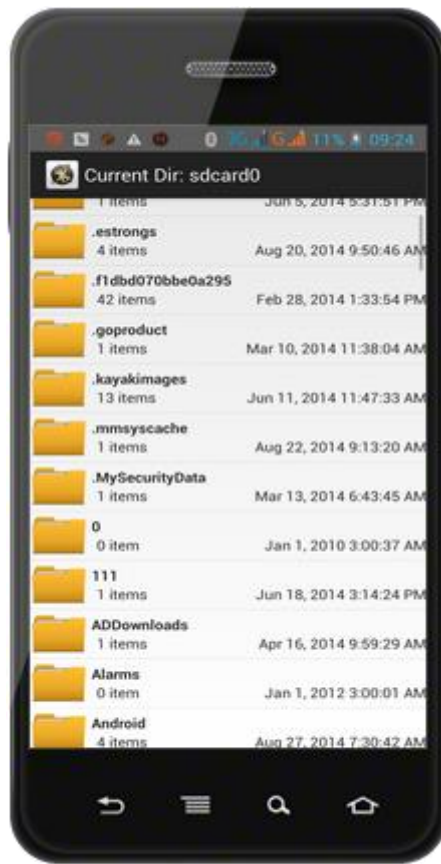
These are the important screens of the system.



Screenshot via SnapPea | snappea.com

Figure 5.1 startup screen

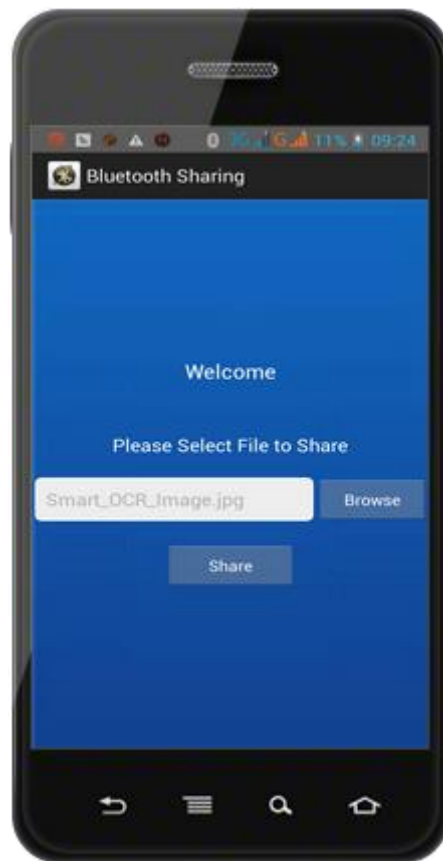
The previous figure shows the first screen for the android application, the screen has a welcome message and “Browse Button” to select the file to be sending and “share Button” to select devices from the list to share with them.



Screenshot via SnapPea | snappea.com

Figure 5.2 interface of Browsing

This screen displayed after choosing the Button “Browse” from the primary interface to choose the file.



Screenshot via SnapPea | snappea.com

Figure 5.3: Selecting the file

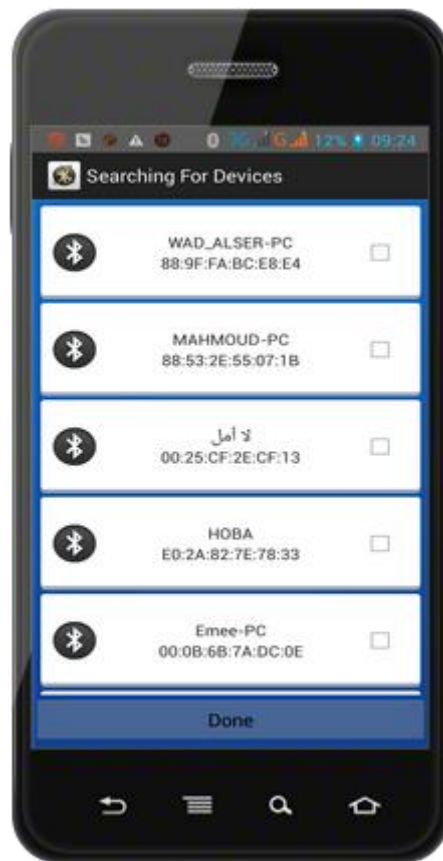
This screen displayed after select the files which want to share it, And display the name of the file.



Screenshot via SnapPea | snappea.com

Figure 5.4: Before Scanning

After choosing the file this screen will be displayed, to choose one of these options “Scan for device” “Done”.



Screenshot via SnapPea | snappea.com

Figure 5.5: Scanning

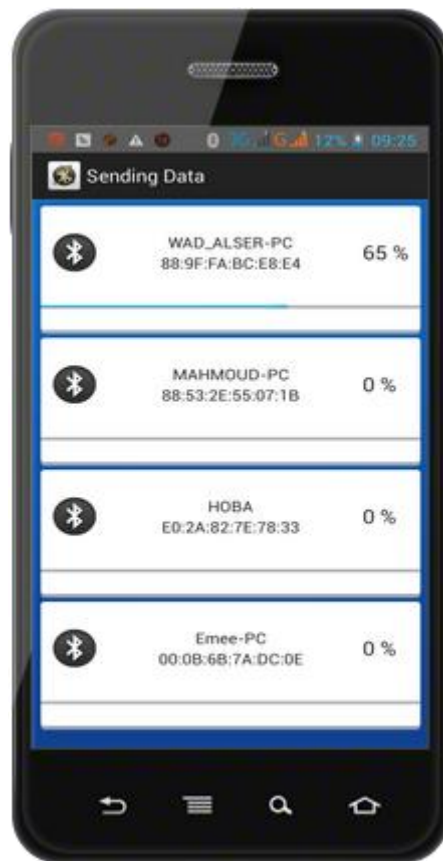
This screen display (scanning process) searching to find the devices which in range of Bluetooth.



Screenshot via SnapPea | snappea.com

Figure 5.6 Mark the devices

This screen to mark the devices which want to share with them, then click “Done” button to send the file.



Screenshot via SnapPea | snappea.com

Figure 5.7 Sending data

After select “Done” This screen will displayed to show the Percentage of sending data.

CHAPTER 6

**RESULTS, CONCOULISON AND
RECOMMENDATIONS**

6.1 Conclusions

An android application was written to simulate the Processes of Bluetooth in attempt to share data with more than one device depending on the Bluetooth technology.

There are two ways to do that:

Put the list of devices which found on array and send the file to the first device after that send the same file to the second device and so on or by Split the file into parts, and send the first part of the file to the first device in the list and then send the same part to the second device, and then send the second part of the file to the first device, and send the same part to the second device in the list and so on.

6.2 Recommendations

- Add new feature to this application to sharing video and images.

To add these features in Bluetooth application of mobile device we must edit:

- The RF module (radio frequency module) is a small electronic device used to transmit and/or receive radio signals between two devices.
- Modify the kernel of mobile Smartphone (because its build on Android OS) to adopted with modification in RF module.

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