International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 02 | Feb-2018 www.irjet.net p-ISSN: 2395-0072

Simultaneous Wi-Fi and Bluetooth Connections

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Abstract - *Connection for data transfer between mobile or desktop devices is conventionally done using Wi-Fi(Wireless Fidelity – IEEE 802.11 connections) or Bluetooth technology. In this paper we attempt to present a scheme to provide data transfer using Wi-Fi and Bluetooth technologies simultaneously. The main purpose of this paper is to propose a model for use of both the technologies simultaneously that will bring out noticeable differences in data transfer rates, especially in the case of heavy payload.*

Key Words: Wi-Fi, Bluetooth, Connection, Data transfer.

1. INTRODUCTION

The existing data transfer methods use an ad-hoc Wi-Fi connection between two devices. During the entire transfer process, Bluetooth is kept idle, thus wasting that resource. On the other hand, the Wi-Fi module is kept idle when devices use a Bluetooth RFCOMM channel for connection. Simultaneously using Bluetooth with the existing Wi-Fi modules solves this problem. The problems faced by differences in the ranges of Bluetooth and Wi-Fi streams can be handled by using the 'seamless connection[1]' technique. The overall idea is to setup the connections one by one, manage these connections at the same time and then terminate both the connections after the said purpose of file or data transfer is successfully complete.

2. SCOPE

Wireless connections for data transfer have highly varied applications ranging from handheld mobile devices to complete desktop computers. All the areas that use P2P file sharing using the said wireless mediums can benefit from implementing the simultaneous transfer methodology.

3. EXISTING DATA TRANSFER SYSTEMS

The currently existing systems used by devices for data transfer are Wi-Fi or Bluetooth. Both these technologies have similar working strategy.

3.1 Bluetooth

Bluetooth was the first wireless technology that replaced the wired data transfer mediums. Bluetooth works as a Wireless Personal Area Network (WPAN). It works by creating an ad-hoc RFCOMM (Radio Frequency Communication) tunnel between two devices which is then used for communication or data transfer. The range of Bluetooth is around 10 meters and the speeds range from 1mbps-2mbps. Bluetooth works on 2.5GHz frequency ISM band.

3.2 Wi-Fi (Wireless Fidelity)

Wi-Fi (Wireless Fidelity) is the Wireless Local Area Network (WLAN) technology. More and more people are connecting to this technology due to rapid development as it has high performance and security. A Wi-Fi data transfer works by creating an ad-hoc server to which different receivers can connect and download the available data. Wi-Fi is based on IEEE 802.11 standard which uses 2.4 GHz or 5GHz frequency bandwidth based on the hardware available. The range of Wi-Fi is about 100 meters and the speed is about 100mbps.

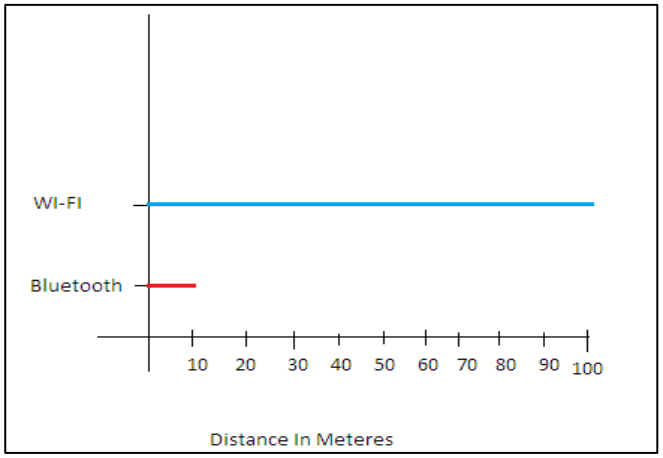

Chart -1: Range comparison of Bluetooth and Wi-Fi

4. PROPOSED SYSTEM

The proposed system is divided into two main parts:

1. Sender (Initiates Server functionality)
2. Receiver (Connects to the available server for downloading files)

The proposed system for using Bluetooth and Wi-Fi simultaneously for data transfer has these main steps:

1. Checking availability of resources.
2. Setting up an open Wi-Fi hotspot.
3. Connecting to the available hotspot.

4. Setting up the Bluetooth connection.
5. Managing the connections.
6. Termination.

Most of these steps like checking availability and managing are performed by both the sender and receiver while others are sender or receiver specific.

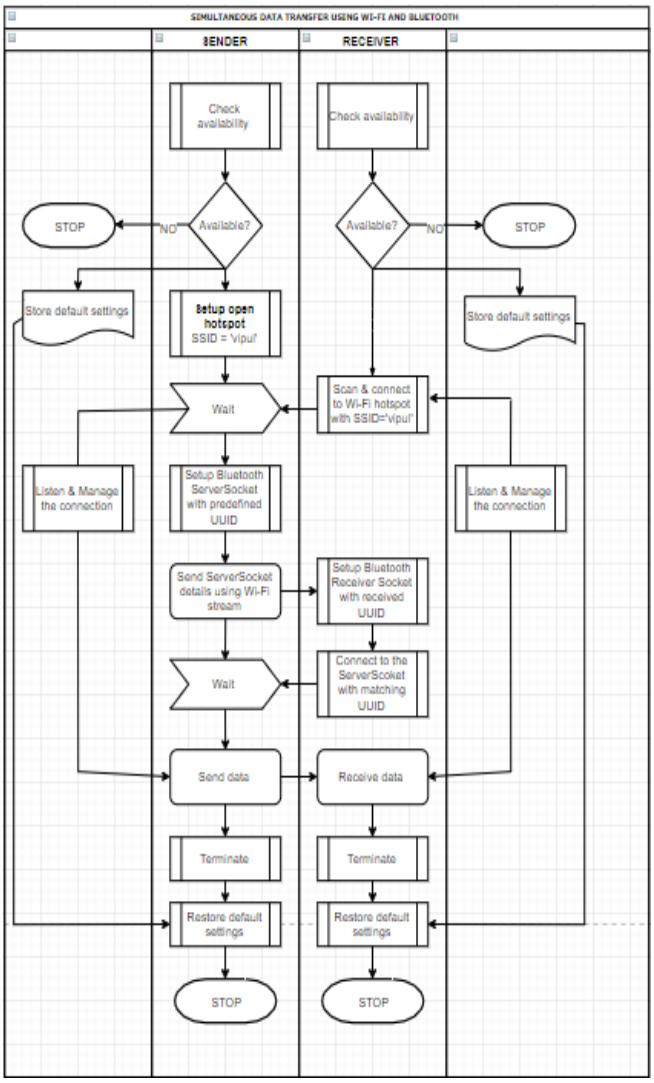

Fig -1: Proposed simultaneous system workflow

4.1 Checking availability of resources

Before beginning the transfer, it is important to check whether the device being used has both Wi-Fi and Bluetooth chips built in it. This can be done by querying the system Bluetooth and Wi-Fi managers. These managers generally return the current system settings and preferences if the queried resource is available.

4.2 Setting up an open Wi-Fi hotspot

To begin setting up the connection, the sender will have to first setup an open hotspot for Wi-Fi devices. The hotspot connection is to be kept open so that the client device can connect without any need for authentication. However, it is strongly advised to create an encrypted connection for security purpose. The server hotspot is setup by selecting a unique SSID(Service Set Identifier) which is a case sensitive text string that is used to identify a wireless device. The proposed system makes the setup by setting up a unique SSID string as 'vipul' which will then be used by client to scan and connect automatically without the need for user intervention.

4.3 Connecting to the available hotspot

This step is performed by the receiver/client to complete the Wi-Fi connection. Once the system goes into receiving mode, the receiver starts scanning for available Wi-Fi hotspots with the predefined unique SSID (for example: 'vipul'). If such device is available the receiver will automatically connect to the device thus completing the Wi-Fi connection.

4.4 Setting up the Bluetooth connection

Once the devices are connected using Wi-Fi, the system implements bluetooth sockets for setting up the Bluetooth connection. The server now sets up a Bluetooth Server-Socket which uses custom generated UUID(Universally Unique Identifier) which is a 128 bit string that uniquely identifies our system. These settings are then sent to the already connected receiver using the existing Wi-Fi connection. The receiver then used these received settings to set its own Socket for Bluetooth connection. Now as both Server-Socket and receiver's Socket contain the same UUIDs, the system connects these two sockets thus forming an RFCOMM channel which will be used for transmission and receiving of the data.

4.5 Managing the connections

After setting up the connections, files are selected to be transferred using Wi-Fi and Bluetooth channels. During the transfer process, the system listens for all the ongoing transactions to detect any abnormalities. In any case, if one connection breaks then the remaining data is transmitted using the other connection. This is where the seamless connection[1] technique comes into play.

4.6 Termination

Once the system successfully transfers the available data, the Bluetooth and Wi-Fi connections should be terminated so that the user will be access the system for other purposes. The simultaneous system stores the user's default preferences before setting up the custom UUID and SSID. These saved preferences are now applied again to take the system to its previous state. This marks the end of the entire process.

5. ISSUES FACED

The proposed system is highly efficient when throughput and data rates are considered. However, some unavoidable technical issues that might be faced by the system are:

1. Interference
2. Hardware limitations

5.1 Interference

Bluetooth and Wi-Fi use similar bands for data transmission – 2.5 and 5GHz. These bands are very close to each other which introduces minor interference[2]. Also, environmental radiation such as radiation from other devices and other existing noise sources can also introduce newer sources of interference. But, the interference caused by these sources is negligible[3][4] incase of day-to-day file transfers.

5.2 Hardware Limitations

Using two channels and managing them at the same time is a complex task and thus requires a fair amount of memory (RAM) for efficient performance. The available memory at the user device is an important factor in determining the efficient performance of the system.

Also, Bluetooth has short range than Wi-Fi module. This is also a limiting factor as to how far apart the two devices can be from each other. This problem can be solved to some extent by implementing seamless connectivity[1].

6. CONCLUSION

The proposed system uses Bluetooth and Wi-Fi connections to transfer data. It is clear from the above discussion that the simultaneous use of Wi-Fi and Bluetooth theoretically works faster than the conventional methods. The proposed system will be considerably efficient incase of high payloads of data.

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