WIRELESS TRANSMISSION OF AUDIO VIA BLUETOOTH

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ABSTRACT

WIRELESS TRANSMISSION OF AUDIO VIA BLUETOOTH

Aim of the project is transmission of high quality audio using Bluetooth. The current wireless systems employ microwave system for transmission of audio. In these systems the voice quality suffers a great deal. We experience glitches and loss of data due to problems like interference and limited availability of spectrum. Interference can be caused by nearby electronic devices or someone else using the same frequency. Another drawback of the current systems is the absence of adequate security measures for transmission and reception of audio signals. Employing a security system is a difficult and costly measure.

This project is based upon the transmission of high quality stereo audio which is achieved using Bluetooth technology. We can transfer simplex high quality stereo audio as well as duplex audio. The advantages of using Bluetooth instead of microwave systems are quite evident. Bluetooth operates in a dedicated frequency spectrum which eliminates the problems due to interference. It uses frequency hopping for security purposes and also for limiting the interference.

High quality stereo audio is transferred from any device capable of Bluetooth to our Bluetooth module via the A2DP (Advanced Audio Distribution Profile) profile. It can also be used as a Bluetooth headset by using the HFP (Hands Free Profile) for two way communication. A mobile phone was used to pair with this device, the device switches between profiles depending upon the need of the mobile phone. If music was played on the phone, the device switched to A2DP but if a call was being received, it automatically switched to HFP.

DECLARATION

No portion of the work presented in this dissertation has been submitted in support of another award or qualification either at this institution or elsewhere.

DEDICATION

To Almighty Allah, for Whose greatness we do not have enough words,

To our parents and friends, without whose unflinching support and unstinting cooperation, a work of this magnitude would not have been possible

ACKNOWLEDGEMENTS

There is no success without the will of Allah. We are grateful to Allah, Who has given us guidance, strength and enabled us to accomplish this task. Whatever we have achieved, we owe it to Him, in totality.

We would like to thank our supervisor Maj. Dr. Asif Masood, for his help and motivation throughout the course of our project. He provided us guidance and lent valuable suggestions for making our project better.

We are grateful to Maj. Dr. Adnan Rashdi for providing his unconditional support and guidance. He provided valuable supervision in the initial testing phase of the project and helped us out with the choice of equipment to be used. We are truly thankful to him, for without his support this project would not have been possible.

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CHAPTER 1

INTRODUCTION

This chapter gives a brief overview of our project design and implementation. It gives a brief overview, limitations of the currently implemented systems and qualities of this project. The project timeline is given at the end.

1.1 Project Definition

The aim of the project is transmission of high quality stereo audio using Bluetooth technology. This can be accomplished by digitizing the audio signal from an audio source and then interfacing it with a suitable Bluetooth module.

1.1.1 Project Objectives

1.1.1.1 Industrial Objectives

To provide a dynamic Bluetooth device capable of performing different functionalities as compared to the freely available monotonic Bluetooth devices; to provide a user friendly multipurpose Bluetooth device able to pair with all types of Bluetooth devices; to provide a low cost and single point solution for Bluetooth connectivity.

1.1.1.2 Academic Objectives

To cover all the aspects from hardware designing and development to software designing; acquisition of Bluetooth technology and its functionality; to gain knowledge of micro controllers and hardware interfacing with the Bluetooth module.

1.2 Limitations of the current system

The current wireless systems employ microwave system for transmission of audio. In these systems the voice quality suffers a great deal. Glitches and loss of data is experienced due to problems like interference and limited availability of spectrum. Interference can be caused by nearby electronic devices or someone else using the same frequency.

Another drawback of the current systems is the absence of adequate security measures for transmission and reception of audio signals. Employing a security system is a difficult and costly measure.

1.3 Project scope

This project is based upon the transmission of high quality stereo audio which is achieved using Bluetooth technology. It can transfer simplex high quality stereo audio as well as duplex audio.

The advantages of using Bluetooth instead of microwave systems are quite evident. Bluetooth operates in a dedicated frequency spectrum which eliminates the problems due to interference.

Bluetooth makes use of the frequency hopping technique which provides adequate security to the audio signal being transmitted. The signal is divided into small packets which are transmitted on different frequencies in a pseudorandom manner thus making it very difficult to sniff. Bluetooth technology is a better option as it consumes far less energy and thus feasible for large scale deployment.

1.4 Project Life Cycle

The life cycle of the project was divided into three parts. Detail of implementation is explained here. Before the first interim presentation implementation of the serial interfacing of the Bluetooth module with host computer was done. This interface was used to program the module. The modules were able to detect any Bluetooth device in its vicinity and data was able to transmit between two Bluetooth modules.

In the next part, before the second interim presentation, implementation of the hardware circuitry for audio transmission purposes took place. Transmission of high quality stereo audio via Bluetooth from a mobile phone or any other Bluetooth transmitter to the Bluetooth module via A2DP (Advanced audio distribution profile) was done.

Also implementation of the duplex communication between a mobile phone and the Bluetooth module via Headset profile was also tested successfully.

The final round was the integration and debugging round. The voice signal needed to be amplified for satisfactory results, which was carried out by implementing an amplification circuitry. Then all the hardware was integrated into one piece and was given the shape of a product. The final product was in the shape of headphones capable of receiving and transmitting high quality audio.

CHAPTER 2

LITERATURE REVIEW

2.1 Bluetooth

It is a wireless technology for exchange of data from stationary and mobile devices over short distances; it also creates PANs known as personal area networks that have very high level of the security. At first it was thought to be an wireless substitute for the RS-232 data cables. It easily synchronizes with many devices thus overcoming the problem of synchronization.

Frequency-hopping is a radio hopping technology used by Bluetooth which divides the data to be sent and then transmits parts of it on 79 different channels of range 2402-2480 MHz with spacing 1 MHz. This band is used for short-range transmissions.

In regular Bluetooth, also known as the basic rate set up, the modulation scheme is Gaussian frequency-shift keying (GFSK). It achieves a total speed of 1 Mbit/s. In EDR (extended speed) π/4-DQPSK & 8DPSK are employed, which give two, and three Mbit/s respectively.

2.1.1 Frequency Hopping

Frequency-hopping is a radio technology used by Bluetooth which divides the data to be transmitted and then sends parts of it on 79 different channels of range 2402-2480 MHz with spacing 1 MHz. This band is called the globally unlicensed ISM band used for short-range radio frequency transmissions. Frequency hopping ensures security and reduces interference, which is common problem in all other wireless technologies.

2.1.2 Communication

Bluetooth is a packet protocol with master-slave architecture. Packet-Switching is a method of digital networking communications that groups all data to be transmitted– regardless of type, content, or structure – into suitable sizes, called packets. It can deliver variable speed data streams over a shared network. When passing through network adapters, routers, switches and the other nodes, the packets are added in a queue and buffered, which result in different throughput and delay depending on the traffic in the network.

In a Pico net 1 master can connect with 7 slaves; all the slaves share the master clock. Packet swap is defined by the master, which ticks at intervals of 312.5 µs. Two clock cycles constitute a 625 µs duration slot; two slots makeup to 1250 µs. In odd slots master receives and in even slots it transmits. For one-slot packets, the slave, oppositely, transmits in odd slots & receives in even slots. The packets can be one, three or five slots long however transmission by the master will always begin in even slots and that by the slave will begin in odd slots.

2.1.3 Bluetooth 2.1+EDR

To make use of Bluetooth technology, every device should be capable to understand specific profiles of Bluetooth. Bluetooth profiles are the definitions of applications and give general behaviors that Bluetooth enabled devices can use to communicate with each other. There is an extensive array of profiles which illustrate various types of apps or uses for devices. By following direction provided by the Bluetooth specification, developers can make applications to work with additional Bluetooth devices.

At least, every Bluetooth profile should contain information on the subsequent topics: Dependencies on other Bluetooth profiles; interaction formats of User; protocol stack sections that are used by that specific profile.

To carry out its function, every profile makes use of specific parameters & options at every level of stack and that might comprise an outline of the essential service record. Bluetooth specification is compatible with 1.2. The best trait of 2.1 is its Secure Simple Pairing Profile. The pairing for Bluetooth devices is improved by this, while escalating the strength & use of protection. It also allows different improvements that include "Extended inquiry response" (EIR), which gives extra information throughout the inquiry process that allows enhanced sorting of devices before pairing. Another feature is sniff-sub-rating, that can reduce power usage when operating in low-power form.

2.1.4 EDR

For the quick data transfer Enhanced Data Rate (EDR) is used. Normal speed of EDR is around three MB/s, even though actual bit rate is 2.1 MB/s. It makes use of a grouping of Phase Shift Keying modulation (PSK) and GFSK by means of two variations, 8DPSK and $\pi/4$ Differential QPSK. It may offer low power usage by using a condensed duty cycle.

2.2 Bluetooth Profiles

To employ Bluetooth technology, every device should be capable to understand specific profiles of Bluetooth. Bluetooth profiles are the definitions of applications and give general behaviors that Bluetooth enabled devices can use to communicate with each other. There is an extensive array of profiles which illustrate various types of apps or uses for devices. By following direction provided by the Bluetooth specification, developers can make applications to work with additional Bluetooth devices.

At least, every Bluetooth profile should contain information on the subsequent topics: Dependencies on other Bluetooth profiles; interaction formats of User; protocol stack sections that are used by that specific profile.

The profile we have selected for our transmission is advanced audio distribution profile (A2DP), it further depends on following profiles:

2.2.1 Generic Access Profile (GAP)

GAP provides the basis for all other profiles and defines a consistent means to establish a baseband link between Bluetooth enabled devices. The profile defines operations that are generic and can be used by profiles referring to GAP and by devices implementing multiple profiles. GAP ensures that any two Bluetooth enabled devices, regardless of manufacturer and application, can exchange information via Bluetooth in order to discover what type of applications the devices support. Bluetooth enabled devices not conforming to any other Bluetooth profile must conform to GAP to ensure basic interoperability and co-existence.

2.2.2 Generic Audio/Video Distribution Profile (GAVDP)

The Generic Audio/Video Distribution Profile (GAVDP) defines a generic part of the protocols and procedures that realize distribution of audio content and/or video content using ACL channels. The profile specifies signaling transaction procedures between two devices to setup terminate and reconfigure streaming channels. Streaming parameters and encode/decode features are included in Advanced Audio Distribution Profile (A2DP) and Video Distribution Profile that depend on this profile.

2.2.3 Advanced Audio Distribution Profile (A2DP)

A2DP describes how stereo-quality audio can be streamed from a media source to a sink. The profile defines two roles of an audio device:

Source (SRC) – A device is the SRC when it acts as a source of a digital audio stream that is delivered to the SNK of the Pico net.

Sink (SNK) – A device is the SNK when it acts as a sink of a digital audio stream delivered from the SRC on the same Pico net.

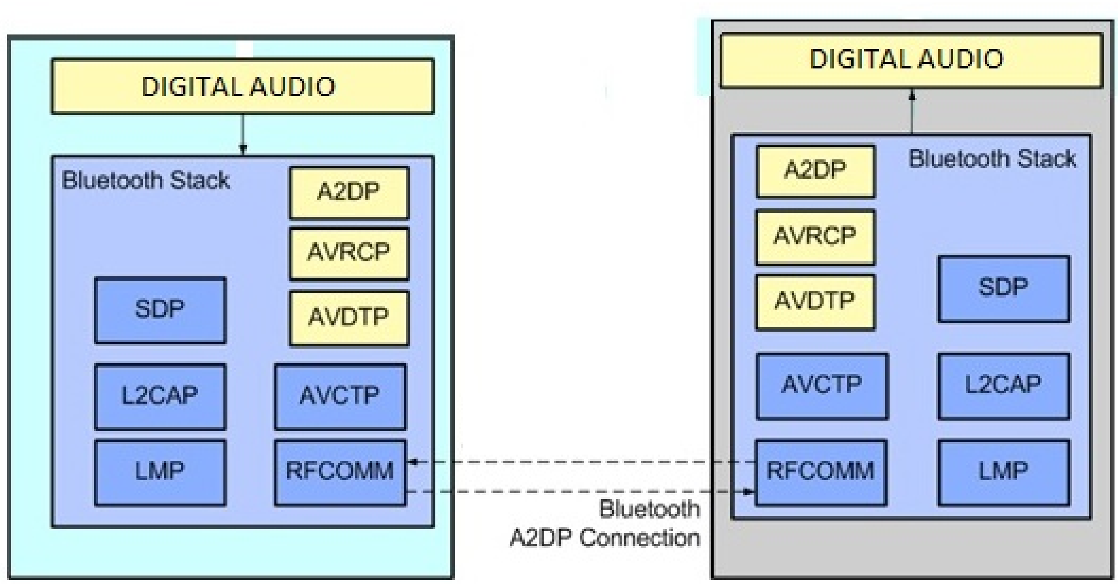
A2DP defines the procedures and protocols that realize distribution of audio content of high-quality in stereo or mono on ACL channels. Therefore the term "advanced audio" should be distinguished from "Bluetooth audio" which indicates distribution of narrow band voice on SCO channels, as used by mobile Bluetooth headsets.

A2DP is designed to transfer a uni-directional 2 channel stereo audio stream, like music from an MP3 player, to a headset or car radio. It includes mandatory support for the low-complexity SBC codec and supports optionally: MPEG.1, MPEG.2, MPEG.4, AAC, and ATRAC, and is extensible to support manufacturer defined codices, such as apt-X. Surround sound distribution is not included in the scope of this profile.

2.2.4 A2DP Architecture

The block diagram for A2DP architecture is given in figure 2.1.

Figure 2.1 Block diagram of A2DP architecture



To start streaming data from a source to sink device the steps that take place are:

The transmitting Bluetooth device pairs to another Bluetooth device. It then searches the service discovery profile (SDP) on the receiving device to determine if the device supports A2DP. If A2DP is supported the transmitting device assumes the role of source (SRC) and denotes the other device as sink (SNK). Audio data is then converted to a suitable format and is sent over the Bluetooth link

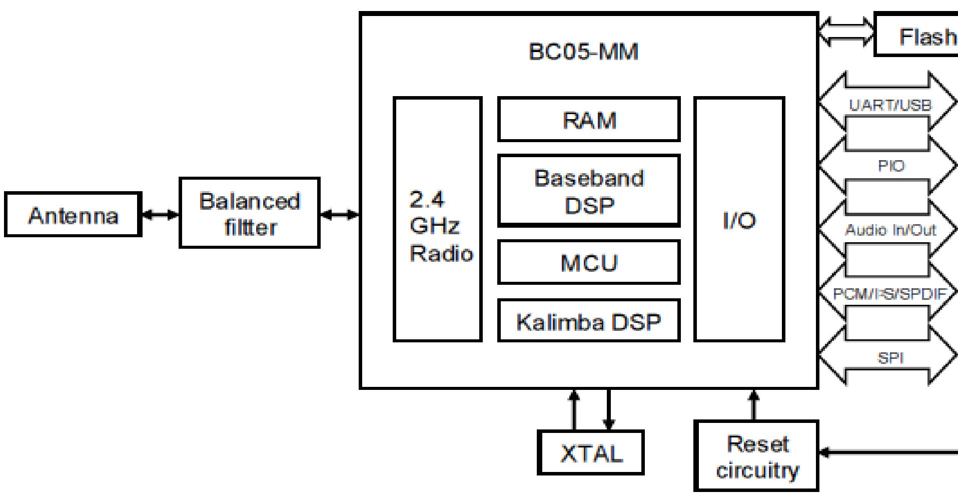
2.3 WT.32 Module

Manufactured by Bluegiga this module has the following specifications:

Support of the critical Advanced Audio Distribution Profile (A2DP); Integrated antenna; Bluetooth 2.1+ EDR compliant; Class 2, range up to 10 meters; Integrated DSP processor; stereo codec and battery charger; Transmit power 7dBm; receiver sensitivity .87dBm; Extended temperature range from .30C to +85C; Low power consumption; iWRAP firmware for controlling connections and configuring settings; Up to 14 supported Bluetooth profiles in iWRAP firmware

2.3.1 Block Diagram

Figure 2.2 Block Diagram



2.3.2 BC05.MM

The BlueCore05.MM is a single-chip radio and baseband IC for Bluetooth 2.4GHz systems. It provides a fully compliant Bluetooth system to v2.0+EDR of the specification for data and voice. BlueCore05.MM contains the Kalimba DSP co-processor with double the MIPS of BlueCore03.MM, supporting enhanced audio applications. BlueCore05.MM integrates a 16.bit stereo codec and it has a fully differential audio interface with a low noise microphone bias.

2.3.3 Crystal

The crystal oscillates at 26MHz.

2.3.4 Flash

Flash memory is used for storing the Bluetooth protocol stack and Virtual Machine applications. It can also be used as an optional external RAM for memory-intensive applications.

2.3.5 Antenna

WT32 uses ceramic chip antenna with high dielectric constant, which makes the antenna very insensitive to surrounding environment and thus gives high design freedom around the antenna.

2.3.6 Synchronous Serial Interface

This interface is for connecting with other digital devices. for system debugging the SPI port may be used. For programming the flash memory this interface may be used.

2.3.7 UART

UART interface is a typical Universal Async Receiver Trx (UART) setup for establishing link between serial enabled devices.

2.3.8 Audio Interface

The audio input/output for WT-32 has complete functional inputs and outputs and a mic biased o/p. A high class stereo acoustic Bluetooth function can be performed by low quantity of peripheral components.

2.3.9 Programmable I/O

Ten digital programmable terminals for input as well as output are there in WT-32. The firmware operating on the device controls these terminals.

2.3.10 Reset

A reset circuit for WT-32 is available that can be employed to reset the device in the set up to make sure correct function of the memory (flash). WT-32 reset pin can be externally operated to reset the module externally.

Chapter 3

DESIGN AND DEVELOPMENT

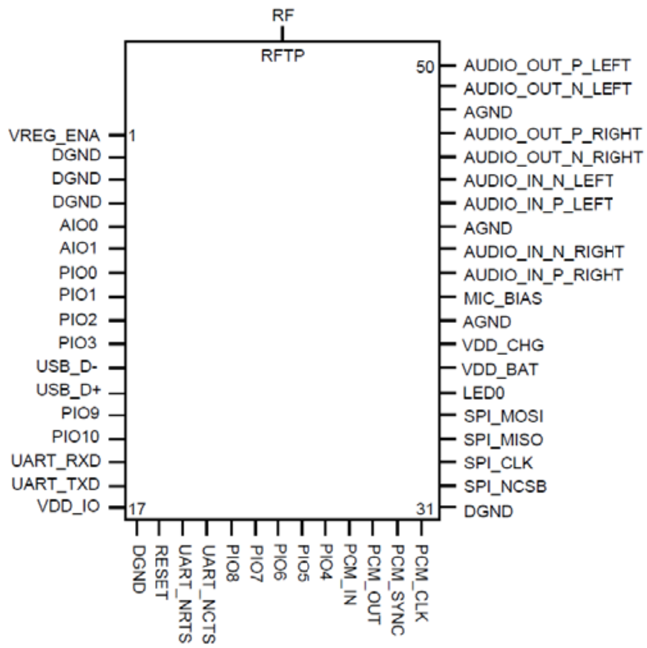
3.1 WT 32 MODULE

WT32 specifications are class 2, Bluetooth 2.1 + EDR module. It has an incorporated Bluetooth module, having required basics from the Bluetooth radio to Bluetooth aerial, & a completely developed protocol stack of iWRAP. WT32 is next generation, class two, module Bluetooth 2.0+ EDR which introduces 3 x quicker bit rates in contrast to available Bluetooth 1.2 modules with lesser power usage.

WT32 is a completely incorporated and complicated unit, having required basics from Bluetooth radio to Bluetooth aerial and a fully implemented stack of protocols. So WT32 gives a perfect key for the programmers who wish to implement wireless system of Bluetooth in their device.

By default it is prepared with a potent and user-friendly firmware of iWRAP. It facilitates user to use Bluetooth functionality using basic ASCII codes given to device by a serial connection – it behaves similar to a Bluetooth modem. WT32 pin description diagram is given in figure 3.1.

Figure 3.1 WT32 Pin Description

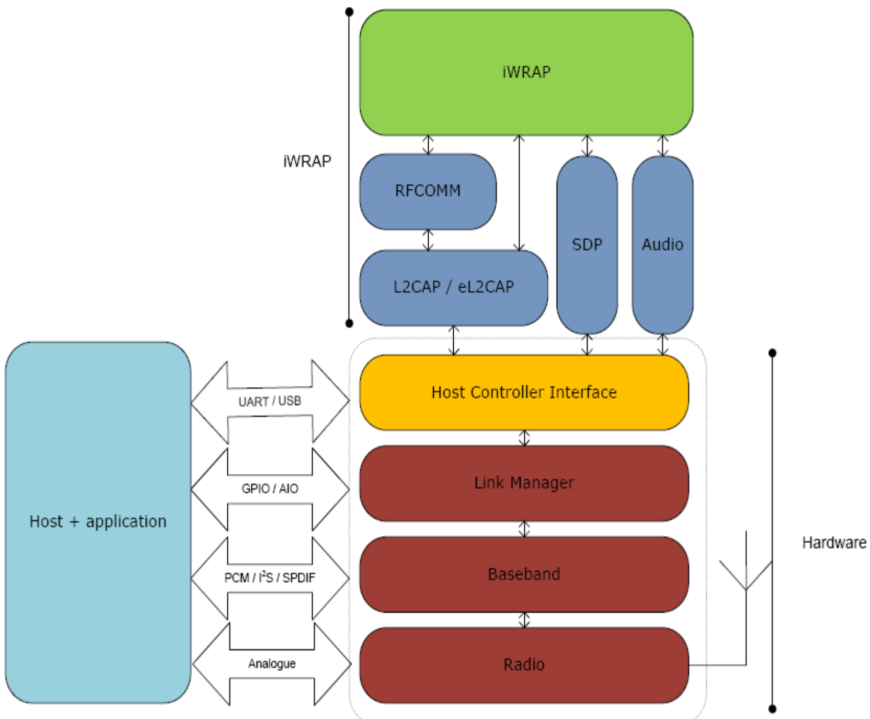


3.1.2 IWRAP

IWRAP is software embedded running totally on the RISC CPU of WRAP THOR units. Complete protocol stack and a lot of Bluetooth profiles are implemented in it. Application software layer and all the other layers operate on inbuilt RISC CPU in a VM environment called a Virtual Machine (VM). iWRAP firmware can link with the host system through a variety of interfaces, shown in figure 4. UART interface is the most common interfacing technique where we use the ASCII codes that the iWRAP firmware supports. Using the proper ASCII commands, the user can control Bluetooth functionality without taking into consideration the complexity of the protocol stack of Bluetooth. Interface of GPIO is another interfacing technique which can be used for command execution and event monitoring. For audio PCM, as well as SPDIF and I2S analog interfaces are available. The hardware used dictates which interface is to be used.

The application code is written by the user to the host system in order to command iWRAP firmware using ASCII codes. As a result it becomes easier to develop Bluetooth enabled applications.

Figure 3.2 Bluetooth Module with iWRAP Firmware



The UART interface interfaces Bluetooth module with iWRAP firmware to a host system. The options available are:

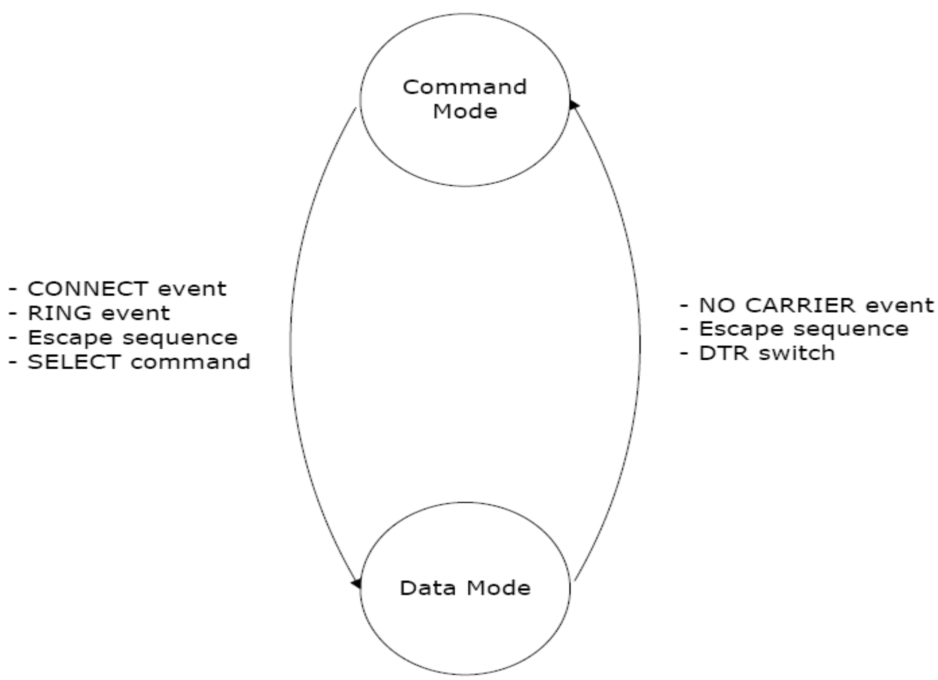
We can employ software to manage iWRAP by using ASCII instructions if the host system has a processor. If iWRAP needs not to be controlled, or if the host does not have a CPU, iWRAP may be programmed to be autonomous and invisible. Using this option iWRAP can automatically accepts connections or can open them. Audio can be transmitted over a Bluetooth link using audio interfaces.

3.1.3 IWRAP modes

Two main operational modes exist for iWRAP namely the command mode and the data mode, as shown in figure 5. While the iWRAP is in the command mode, ASCII codes are sent to iWRAP and it performs different tasks or to alter design setting.

If there are no connections command mode is the default mode. In order to receive and transmit information over a linkage data mode is used. Data mode becomes available only if a Bluetooth connection is available. Transition between modes can take place at all times given the circumstances for the data mode meet.

Figure 3.3 Mode transition in Bluetooth



3.1.4 Command mode

When the module is turned on it is in command mode (by default). ASCII codes are sent to the firmware to carry out a variety of tasks.

In case the Bluetooth connections are active and available, the data from far away devices is stored into buffers of iWRAP.

Because iWRAP is an embedded firmware, only small amount of data can be buffered as buffering capacity is low. Usually, around 1000 bytes can be buffered, but the amount of data can vary depending upon the firmware and the state of iWRAP.

The command 'LIST' is used to display the amount of data that is buffered, and active connections.

3.1.5 Data mode

When one or more Bluetooth connections are available data mode is the default mode. In this mode data is transmitted transparently between the UART interface and Bluetooth link.

When iWRAP changes from command mode to data mode, a "READY" event takes place, but we can mask away events by the "SET CONTROL ECHO" command.

To interchange between the two modes the DTR (Data terminal ready) pin can also be used. This method needs no guard time and much faster switching can be achieved. The "SET CONTROL ESCAPE" command is employed to enable the DTR pin.

To point out whichever a Bluetooth connection or data mode the Carrier Detect (CD) pin is used. To enable the CD pin we use the "SET CONTROL CD" command.

3.1.6 INTERFACING

A number of physical interfaces can be used to interface host system to iWRAP firmware, which are shown in the figure 6. UART interface is the most commonly used interfacing method. It uses ASCII codes which iWRAP firmware supports.

Using those instructions, the host can control Bluetooth functionality without any in depth knowledge of Bluetooth technology or giving much thought to the complexity of the protocol stack. For event monitoring, PCM and command execution GPIO interface is to be used. I2S, SPDIF, or analog interfaces are used for audio.

3.1.7 UART Module

The segment of the serial comm system of device is UART (The Universal Asynch Receiver/Transmitter controller). Bytes of data are taken and individual bits are transmitted in a sequential fashion. At the destination, another UART reunites the bits into bytes.

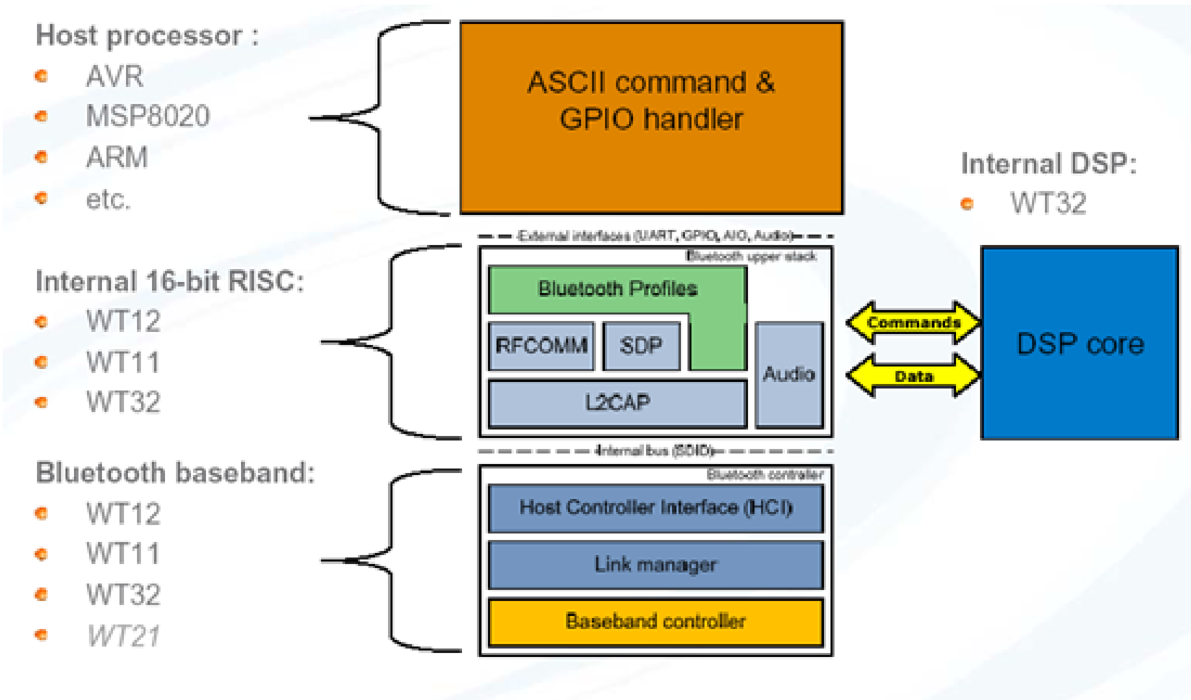
Host system can be connected to a WRAP THOR Bluetooth module having iWRAP firmware using the UART interface.

We can employ software to manage iWRAP by using ASCII codes if the host system has a processor.

If iWRAP needs not to be controlled, or if the host system does not have a processor, iWRAP may be programmed to be autonomous and invisible. Using this option iWRAP can automatically accepts connections or can open them.

Audio can be transmitted over a Bluetooth link using audio interfaces.

Figure 3.4 WRAP THOR Bluetooth module

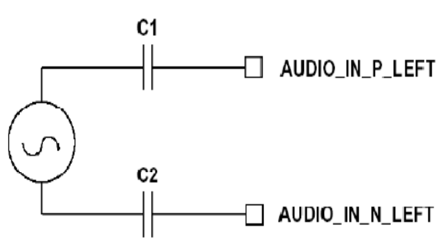


3.2 Audio Interface

3.2.1 Audio input

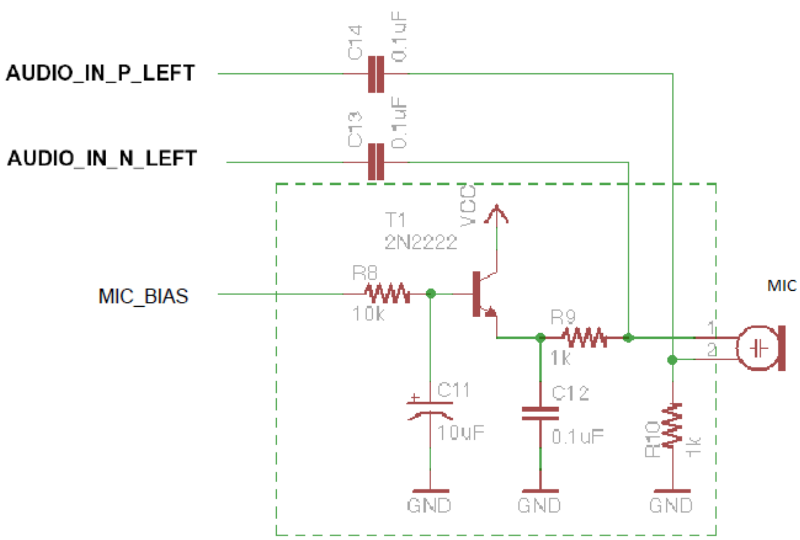
Input can be given in two ways to the module. The first method, as shown in figure 7, is to input voice signal through a regular 3.5mm audio jack. The input comes from an audio transmitter that can be a pc, mobile phone etc.

Figure 3.5 Differential Input



The second method is shown in figure 8, it uses a microphone for taking in the audio signal. The microphone is directly attached to the module and is used when HFP profile is active.

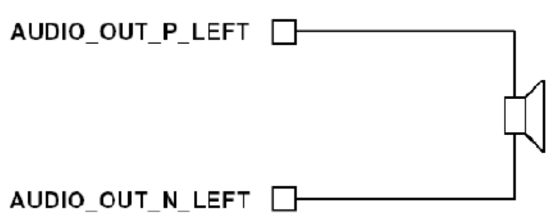
Figure 3.6 Microphone circuitry



3.2.2 Audio Output

Like for the audio input, we have implemented two interfaces for the audio output as well. In the first method audio is given out through the integrated speakers as shown in figure 9.

Figure 3.7 Output speakers



In the second method the audio is given out through a regular 3.5mm jack for external speaker connectivity.

3.3 Bluetooth profiles

Bluetooth profiles specify how the wireless transmission of data should take place between two or more devices. A number profiles are defined for this purpose. Profiles have certain interdependencies between them yet they are separate enough for the manufacturers to implement only the relevant profiles to a particular product.

SPP is RFCOMM protocol we need in for serial connection. RFCOMM is the most common type of Bluetooth socket. RFCOMM is a connection-oriented socket, streaming transport over Bluetooth, also known as the Serial Port Profile (SPP).

Full Bluetooth protocol stack and a set of *Bluetooth* profiles are implemented by iWRAP. Some of those profiles are:

A/V Remotes Controls Profile (AVRCP); Hand Free Profile (HFP); Advanced Audio Distribution Profile (A2DP)

3.3.1 Serial Port Profile

A scenario can be using two devices, such as laptops or PCs, as virtual serial ports and then connecting the two devices via Bluetooth. Figure 10 shows an example.

The SPP defines two roles assigned to device A and device B.

Device A – This is the device that takes initiative to form a connection to another device (initiator).

Device B – This is the device that waits for another device to take initiative to connect (acceptor).

The applications on either side are commonly legacy applications, able and wanting to communicate over a serial cable (which in this case is emulated). But legacy applications are not compatible with Bluetooth protocols for set up of simulated serial lines, because of which they call for some kind of Bluetooth conscious assistant application.

Figure 3.84 SPP Connection Between Two Systems

3.3.2 ASCII COMMANDS TO CONTROL IWRAP

Making a connection to iWRAP, you have to first wait for the READY prompt. No commands can be sent before this. For more information, see SET command.

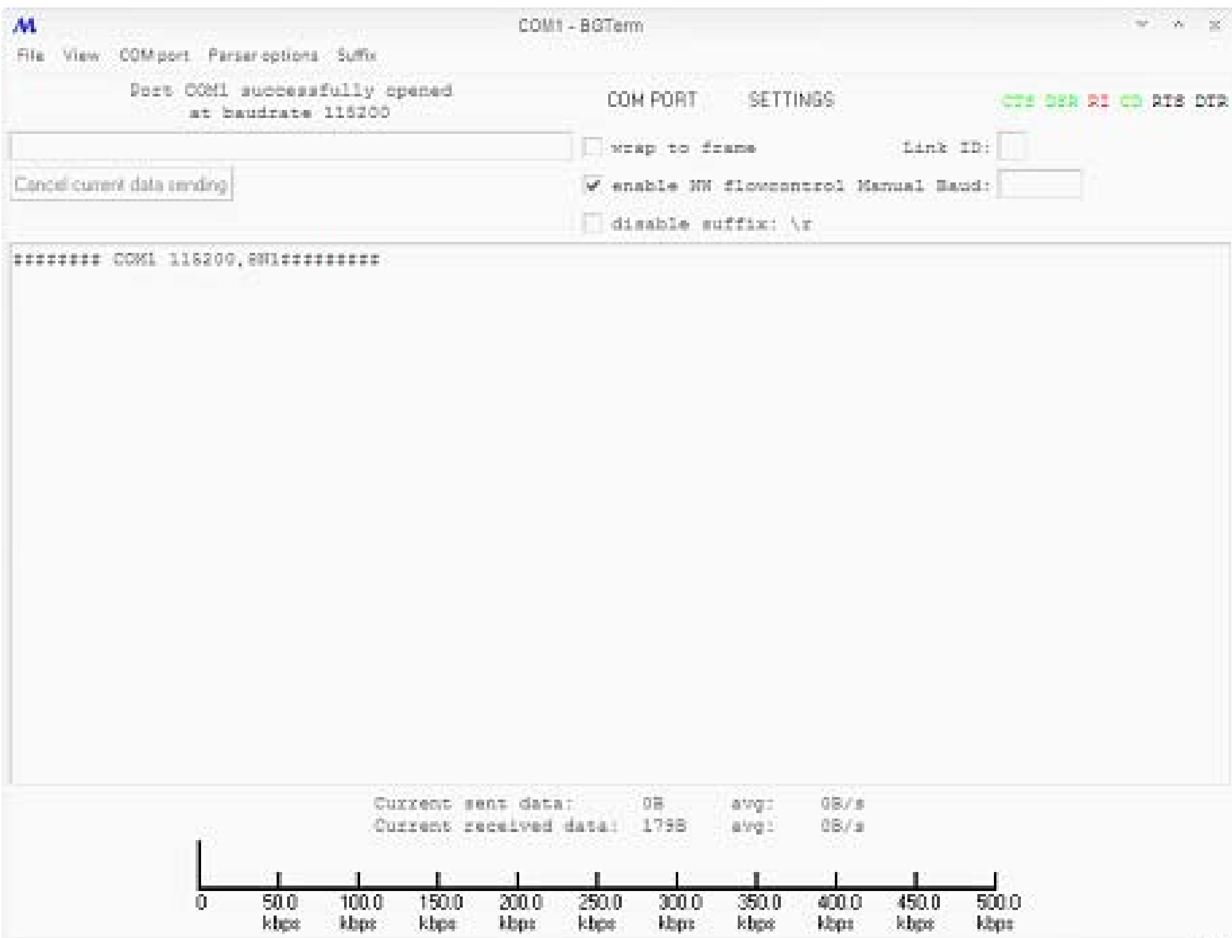
Some answers are broadcasted to all devices by the iWRAP server. Ignore the reply, if you see something that you have not asked for.

In the examples given below, the emboldened are commands given by the device to the iWRAP server and normal lines are answers established from the iWRAP server by the device.

3.3.3 BG Term

In order to give commands to Bluegiga BGTerm, terminal program is used that allows easy use of serial ports. It works just like HyperTerminal. It has many features that make using of iWRAP interface easier. BGTerm has internal MUX and OBEX packet parser and also wrapper for MUX frames. This will be used for giving commands to BT module. The BG term interface is shown in figure 3.9.

Figure 3.9 BG term



CHAPTER 4

PROJECT ANALYSIS AND CONCLUSION

4.1 Compact Design

The Bluetooth transceiver is very small, compact and easy to carry. The final product is in the form of headphones or it can also be reduced to just a small box, capable of all the functionalities that the headphones are. The small size of the device makes it feasible to carry it around with ease. All the circuitry is enclosed in a solid box to avoid any damage in case of mishandling.

4.2 Applications

This device can be used in various daily use applications. Some of these are given as under.

4.2.1 Wireless sound system

Any sound system can be made wireless with the help of this device. The output of the sound system can be used as an input to this device, which can then be transmitted wirelessly via Bluetooth. At the other end a similar device can catch the signals and reproduce the sound via its own speakers or any external speakers as per the requirement.

4.2.2 Television

Any television set can be made to transmit its audio signals via Bluetooth using this device. The audio output of the television can be used as input to the Bluetooth transceiver while the signals transmitted can be received by the device at the other end in the form of headphones. Thus you can enjoy watching television without disturbing anyone else. One such gadget can pair with a highest of 7 other gadgets in case there are more than one listeners.

4.3 User Friendly

The final product is in the shape of a headphone (reducible to a box) with user friendly interface.

4.3.1 Physical Interface

The headphones contain an external button for shutting down the battery power to the circuit which helps in power saving when the device is not in use.

It also contains a switch for selecting between the line inputs i.e. the audio jack and the microphone. As only one input can be processed at a time so the user can easily switch between the modes of input.

A serial connector is also mounted on the device for programming of the device. Programming commands are given from a PC via serial port. So debugging can easily be done in case of a programming error.

4.3.2 Automatic Pairing

This device can easily pair with any other Bluetooth device in its vicinity. Once it pairs with a device, it automatically switches profiles depending upon the use of the paired device. For example if a song is being played on the paired device, our product will automatically switch to A2DP for real time audio streaming. But if the paired device (in case it is a mobile phone) makes a call, the Bluetooth transceiver will switch to HFP profile and two way communications will take place thus eliminating user interaction for switching profiles.

4.4 Conclusion

This project provides a multipurpose Bluetooth transceiver capable of pairing and connecting with all types of Bluetooth devices. A complete working prototype has been developed to demonstrate the effectiveness of a multipurpose Bluetooth device. Unlike the freely available single purpose Bluetooth transmitters, receivers and headsets, this device is capable of both transmitting and receiving with the added feature being the fact that user can decide when to use two way communications and when to use one way transmission.

This device requires little finishing to be able to make the market. Demand for such multipurpose devices is high and launching this device can prove a profitable investment.

CHAPTER 5

APPENDIX

SET PROFILE

to activate/ deavtivate the available *Bluetooth*

"SET …..PROFILE…… {*profile_.....name*} …….[*SDP_...name*]"

Profile_name: This parameter specifies the profile to be set up.

SDP_name : This parameter configures a user friendly description of the service. Neither special characters nor white spaces are allowed. Service name ON sets the profile with the default name.

SET PROFILE SPP ON

RESET - In iWRAP firmware SPP profile is enabled by default.

SET BT NAME - controls the home device's name.

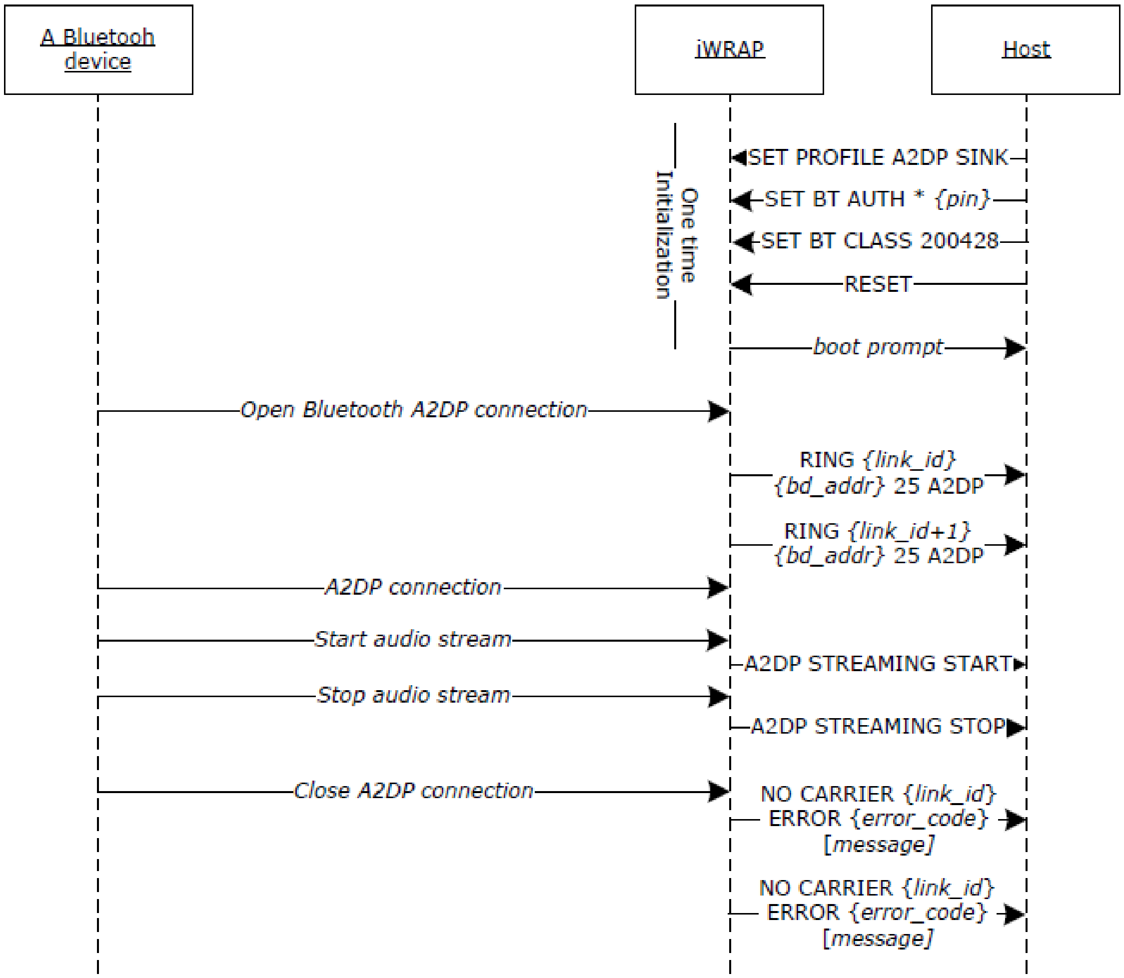
SET BT NAME {friendly_name}

SET PROFILE A2DP SINK

This command displays how to make an iWRAP module to source module i.e. to transmitter.

Figure 5.1 shows the A2DP connection setup.

Figure 5.1 A2DP sink

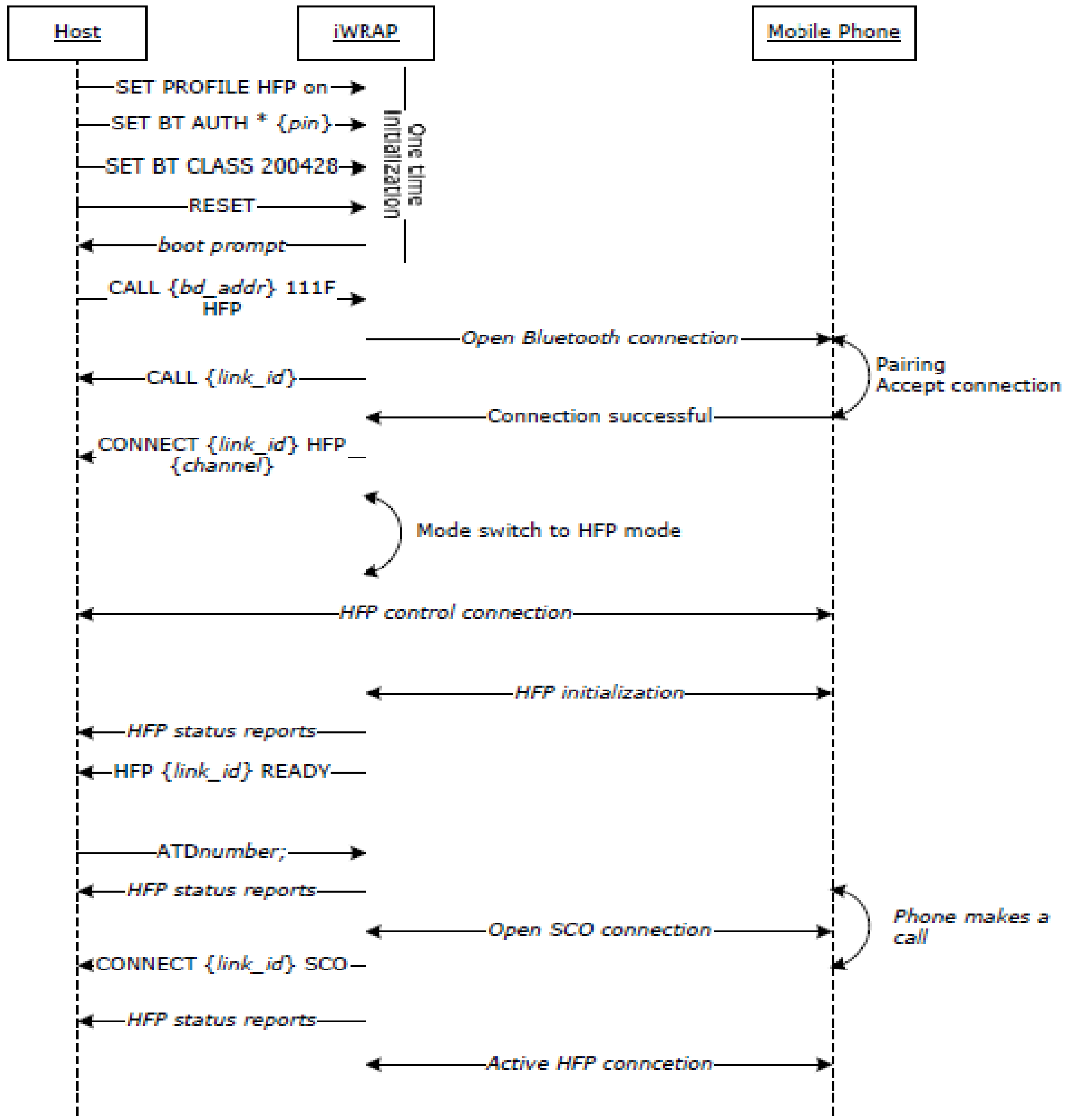


When audio stream is enabled A2DP STREAMING START event is shown and when audio stream is stopped A2DP STREAMING STOPPED event is shown.

SET PROFILE HFP

iWRAP acts the same as a hands free device transmits/receives audio from a cellular handset. The steps that occur during an HFP connection as described in figure 13.

Figure 5.2 HFP connection to a mobile phone



Initially the control link (RFCOMM) is made and as soon as the GSM based call is established then SCO connection is started.

SET CONTROL BAUD

This command changes the local device's UART settings.

SET CONTROL BAUD {baud_rate}, 8{parity}{stop_bits}

baud_rate - UART baud rate in bps.

UART parity setting: n - No parity

UART parity setting: e- Even parity

UART parity setting: o - Odd parity

Number of stop bits in UART communications: 1 - One stop bit

Number of stop bits in UART communications: 2 - Two stop bits

SET CONTROL CD

This command enables or disables the carrier detect signal (CD) in iWRAP. Carrier detect signal can be used to indicate that iWRAP has an active Bluetooth connection. With "SET CONTROL CD" command, one PIO line can be configured to act as a CD signal.

SET CONTROL CD {cd_mask} {datamode}

SET CONTROL ECHO

This command changes the echo mode of iWRAP.

Syntax

SET CONTROL ECHO {echo_mask}.

echo_mask: Bit mask for controlling the display of echo and events

Bit 0 - If this bit is set, the start-up banner is visible.

Bit 1 - If this bit is set, characters are echoed back to client in command mode.

Bit 2 - This bit indicates if set events are displayed in command mode.

Example - set control echo (7).

INQUIRY

INQUIRY {*timeout*}

Timeout: The max quantity of duration (in steps of 1.28s) previous to the inquiry course is stopped. Limits are from 1 to 48. An example is given in table 14.

Figure 5 Basic inquiry command

```
INQUIRY 1
INQUIRY_PARTIAL 00:14:a4:8b:76:9e 72010c
INQUIRY_PARTIAL 00:10:c6:62:bb:9b 1e010c
INQUIRY_PARTIAL 00:10:c6:4d:62:5c 72010c
INQUIRY_PARTIAL 00:10:c6:3a:d8:b7 72010c
INQUIRY_PARTIAL 00:02:ee:d1:80:6d 520204
INQUIRY_PARTIAL 00:10:c6:62:bb:fa 1c010c
INQUIRY 6
INQUIRY 00:14:a4:8b:76:9e 72010c
INQUIRY 00:10:c6:62:bb:9b 1e010c
INQUIRY 00:10:c6:4d:62:5c 72010c
INQUIRY 00:10:c6:3a:d8:b7 72010c
INQUIRY 00:02:ee:d1:80:6d 520204
INQUIRY 00:10:c6:62:bb:fa 1c010c
```

SET CONTROL GAIN

SET CONTROL GAIN controls the interior input and output gain.

SET CONTROL GAIN [{*input*} {*output*} [*DEFAULT*]]

Input: Input gain. limit: 0-17 (hexadecimal)

Output: Output gain. limit: 0-17 (hexadecimal)

If parameters are not set, then it gives the input and output gain limits

CAHPTER 6

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