BLUETOOTH- A HISTORICAL PERSPECTIVE TO THE MODERN DEVELOPMENT

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Abstract: The paper consists of the evolution of Bluetooth to the recent technological development taking place in the field of bluetooth. It deals with the present areas of application, various technologies supported, process of communication, connectivity path, its various classes, ranges &uses, the key protocols supported and being used by it.

I. INTRODUCTION

Bluetooth is basically a wireless technology standard used for exchanging data over short distances from mobile devices & personal area networks(PAN).Earlier it was invented as an alternative to RS-232 data cables. It is managed by the Bluetooth special interest group(SIG).It was made familiar by a telephone network company named "ERISCON" in 1994.In its earlier days it was called "Short link radio technology" later on it was named as "BLUETOOTH". It can easily connect with several devices and easily overcome problems of synchronization.

Fig1-Bluetooth signals

II. IMPLEMENTATION

Bluetooth basically works between two frequency ranges. It works on a frequency range of 2402 to 2480MHZ.The other frequency range on which it works is in between 2400 to 2483.5MHZ.It includes to guard bands which is 2 MHZ wide at bottom and 3.5 MHZ wide at the top.
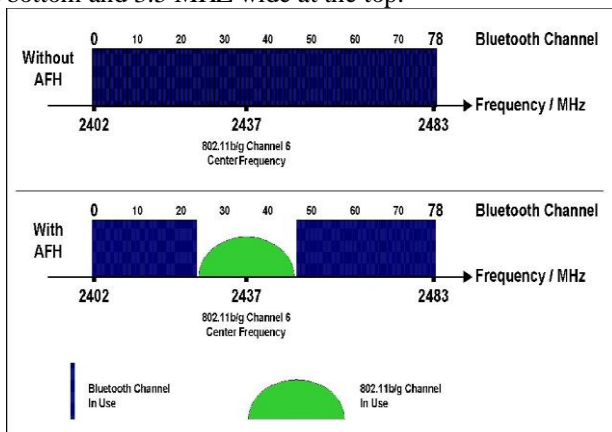

Fig 2- Operating frequency ranges.

III. TECHNOLOGY USED &WORKING

It uses radio technology called "Frequency hoping spread spectrum". It basically reduces the interference produced. Firstly, it divides transmitted data into packets and transmits each packet on one of 79designated Bluetoothchannels. Each channel bandwidth is-1MHZ.It produces 800 hops/second. In the concept of frequency hoping multiple frequencies are used for transmission of data. In the given fig- Let a sender is sending data by frequency f1 for 625 microseconds.
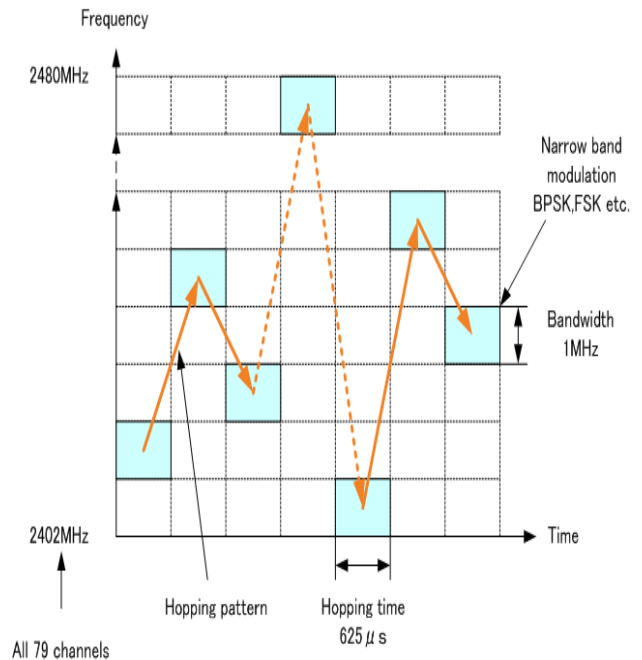

Fig 3- Frequency hoping spread spectrum

IV. BLUETOOTH PROTOCOLS

The various protocols of Bluetooth are as follows-

- LMP (Link management protocol)-It is used for set up and control of the radio link between two devices.
- L2CAP (Logical link control and adaption protocol)-It is used to multiplex multiple logical connections between two devices using different higher level protocols.
- SDP (Service discovery protocol) - It allows a device to discover services offered by other devices.
- RECOMM (Radio frequency communications) - It is a cable replacement protocol used to generate a virtual serial data stream.
- BNEP(Bluetooth Network Encapsulation)-It is used for transferring another protocol stack's data via

L2CAP
- ADVTP (Audio/video distribution transport protocol)-It is used by advanced audio distribution profile to stream music to stereo headsets.
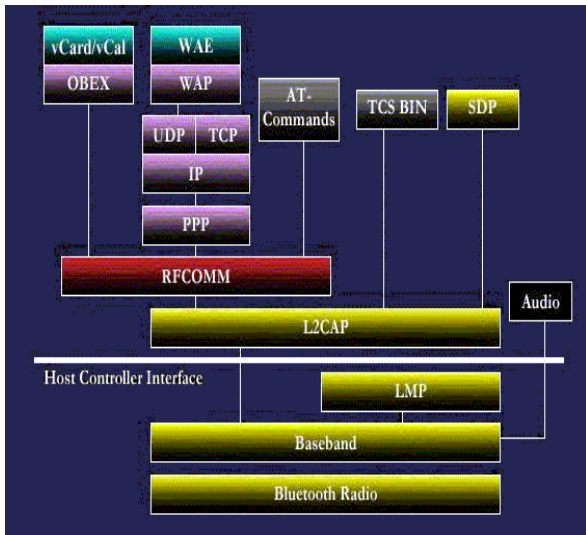- TCP (Telephony control protocol)-It is used for establishment of voice & data calls between Bluetooth devices.

Fig 4- Bluetooth Protocol stacks

V. CONNECTIVITY

At any instant data can be transferred between the master & one other device.It is the master& one other device.It is the master which chooses which slave device to address.The switching process from one device to another takes place in a round –robbin fashion.

Fig 5- Connectivity of Bluetooth   with other devices.

VI. BLUETOOTH CLASSES, RANGES USES

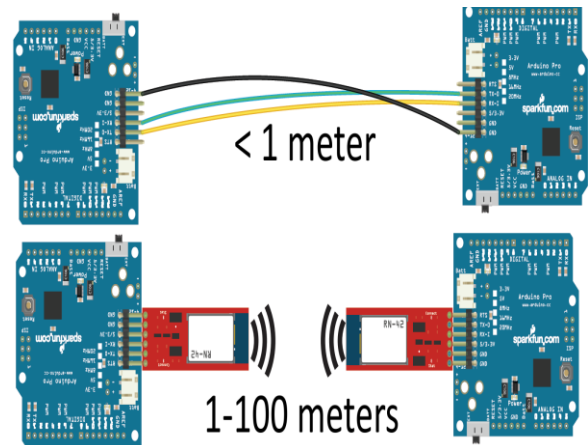| CLASSES	RANGES(in m)	USES
1	100m	Industrial application
2	10m	For mobile applications
3	1m	In radios

Fig 6- Bluetooth ranges

VII. BLUETOOTH DEVELOPMENTS

a) Bluetooth V1.0&V1.0B- It includes mandatory Bluetooth hardware device address, which was a major setback for certain services planned for use in Bluetooth environments.
It had many problems, manufacturers had difficulty making it interoperable.

Fig 7- Bluetooth V1.0

b).Bluetooth v1.1-
Many errors found in the v1.0B were fixed.
It is the indicator of received signal.

c). Bluetooth v1.2-
Enables Faster connection.
Higher transmission speeds up to 721kbits/seconds than in v1.1
Host controller Interface (HCI) with three wires UART.

Fig 8- Bluetooth V1.2

d).Bluetooth v2.0 +EDR-
This version released in 2004.It consists of EDR (Enhanced Data Rate) for faster data transfer. Its nominal rate is-3Mbits/seconds.

e). Bluetooth v2.1 + EDR-
This version was adopted on 26thJuly 2007.It has the feature for improving the pairing experience for Bluetooth device, while increasing the use and strength of security.

Fig 9- Bluetooth V2.0

f). Bluetooth v3.0+HS-
Version 3.0 +HS was adopted by Bluetooth SIG on 21April 2009.It provides data transfer speeds of up to 24 Mbits/seconds.

Fig 10- Bluetooth V3.0

g). Bluetooth v4.0-
This version has been adopted on 30th of June 2010.It includes classic Bluetooth, Bluetooth high speed& Bluetooth low energy protocols.
High speed based on-Wi-Fi.
Classic Bluetooth consists of- legacy Bluetooth protocols.
Bluetooth low energy- is an alternative to V1.0 to V3.0 & it aims at very low power applications running of a coin cell.

Fig 11- Bluetooth V4.0

h). Bluetooth v4.1-
This version has been adopted on 4 December2013.Basically; it is an incremental software update to v4.0 & not a hardware update.
The features of this specification includes-
a).Mobile wireless service signalling.
b).Dual mode & topology.

i). Bluetooth V4.2-
It was released on december 2,2014.It focused on features such as- Data length extension which requires a hardware update.

The areas of improvements where it focused are-
a). LE secure connections.
b). LE data packet length extension.
c). Link layer privacy.

VIII. APPLICATIONS

a). Wireless control of and communication between a mobile phone & a handsfree headset.
b). Wireless streaming of audio to headphones with or without communication capabilities.
c). wireless communication with PC input & output devices. For ex-Mouse, keyboard, Printer.
d). wireless bridge b/w two ethernet networks.
e). Dial- up internet access on personal computers or PDAS using a data capable mobile phone as a wireless modem.

IX. CONCLUSION

This paper consists of the developments taking place in the field of Bluetooth technology that how all started and spread up to this extent. Developments are still going on. Whatever problems were coming are handled of in its next versions of developed models. Many new features are added day by day in it to make it more advanced user friendly.

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