A Survey Paper based on Bluetooth Data Transmission

Ms. Kanchan K. Masade[#1], Prof. Dr. D. M. Bhalerao[*2]
#Student, Department of E&TC, Sinhgad college of engineering, Pune -41, Maharashtra, India
**Professor, Department of E&TC, Sinhgad college of engineering, Pune -41, Maharashtra, India*

***Abstract*—** *One of the growing technologies called Bluetooth wireless network. The communications from Bluetooth devices in order to form the master-slave based network, networks formed are called as scatternet. The important feature of Bluetooth networks is use of routing protocols and their performance. Efficient routing in such networks has positive impacts on the performance of a network but the routing for inter-piconet communication has not been standardized yet. Many protocols have been proposed for route optimization but they still need more development. In a previous work, the route request packet was flooded throughout the network in order to find the main route.*

I. Introduction

a) No need to equip with any extra component in vehicles.

b) Special-purpose sensors are not required at roadside.

c) very easy and fast deployment and maintenance of bluetooth receivers at roadside since there is no need to tear up any piece of the road.

d) The cost of integrating Bluetooth receivers with traffic road-side infrastructure (e.g., traffic controllers) is minimized. This platform will enable the development of new interesting applications and services for transportation field.

II. Survey on bluetooth

A. Bluetooth Background:

Bluetooth is a wireless communication standard using the 2.4 GHz radio spectrum that has been accepted globally. Existence of Bluetooth technology found in many devices such as cell phones, game consoles, headsets, in-vehicle Bluetooth hub, and recently in high-tech watches like fitbit. Bluetooth standards specify an inquiry process**,** which a Bluetooth enabled device known as master device used to discover all the other Bluetooth enabled devices known as slave devices within the proximity. In this data transmission process, the master device broadcasts a message in which any slave device receive this message and replies with an response message that contains, at least, the unique 48 bit identifier of the slave device. This transmission process allows detecting and tracking of the individual devices in the region.

As bluetooth having interesting built-in feature, most of the industries and researchers are using bluetooth technology for different applications and services. Bluetooth now as a built-in capability in vehicles exists for hands-free calls as well as for transmitting of digital music files to a vehicle's stereo system. We envision by using bluetooth technology in building sensing platform to collect traffic data such as the actual number of vehicles, speed of vehicles, and position of vehicles, queue length and blockages in lane through tracking vehicles at urban signalized intersections and streets.

This Bluetooth sensing platform has many advantages including:

The Bluetooth technology was designed in 1994 by Sven Mattisson and Jaap Haartsen, They are the employees of Ericsson Telephone Company. Name of this technology was based on Harald II Viking king of Denmark. The king was nicknamed as blue azure tooth (Bluetooth) due to an illness that produced him coloration in his set of teeth. He united the kingdoms of Scandinavia. Bluetooth unifies the different technologies by means of an universal device for the interconnection of all kind of peripherals. The devices that incorporate bluetooth recognize and it is communicated in such a way that the canal remains open and does not requires direct intervention and constant user attention. The specification sprang up at the beginning of 1998 through the collaboration of several leading undertakings of the industry of the wireless technologies: Ericsson, Nokia, Intel, IBM, Toshiba, Motorola and, more late, 3Com (Palm), which formed the SIG (Special Interest Group). These undertakings have adopted this technology to develop it with their own products, which began to work out to the market at the end of the year 2000. Each new member company of the SIG grants other companies, a license to implement the specification 1.0.

Ericsson is the main Bluetooth promoter as an open specification for the industry of the computer science and of the telecommunications. Use of bluetooth module may reduce the cost of device, which would beneficial to user as well as manufacture. Some esteem speaks of a superior

number 1000 millions of Bluetooth units for the year 2005.

B. Basic Functioning of Bluetooth:

Each Bluetooth has a microchip (transceiver) that transmits and receives the frequency of 2.4 GHz. Besides of the canals of data, are available in three canals of voice to 64 Kbit/s. Each device has a unique direction of 48 bits, based on the standard IEEE 802.11 for wireless LAN. The connections are made one by one with a maximum range of 10 meters, although by using amplifiers it can arrive until the 100 meters, it introduces distortion. Bluetooth has been designed to operate in an environment of multi-user. The devices can be qualified to communicate among themselves and interchange the data of a transparent form to the user. Each link is code and protected against interferences and loss of link. Bluetooth cannot be considered as a secure wireless network. To increase security of bluetooth techniques are introduced. The topology used in a network can be a point to point or multipoint. As devices forms a network, one them is master and others are slaves. The speed for an asymmetric canal of data can reach to 721 Kbit/s in a sense and 57.6 Kbit/s in the other, or 432.6 Kbit/s in both senses if the link is symmetrical. This is all for Bluetooth version 1.2, we are using 2.0+EDR that implies transmission speed is up to 3Mbit/s.

III. ARCHITECTURE OF BLUETOOTH

A. Specter of frequencies:

Two major consideration is, it should provide public access, without any license. Then, it must be valid universally. Therefore, Bluetooth operates on a frequency ISM 2.4 GHz.

B. Outline of multiple access:

In the band ISM of 2.4 GHz are defined a whole of 79 leaps of bearing with 1 MHz of separation. The time between leaps is of 625 microseconds. The sequence of specific leap is determinate for the unit that controls the FH canal, called master. The clock of this unit defines also the phase in the sequence of leap. The other units, called slaves, use the identity of the master to select the same sequence of leap and add times of stopped to its clocks to synchronize the frequency of leap.

In the dominion of the time, the canal is divided into time slots.The minimum time between leaps of 625 microseconds corresponds with a time slots. To simplify the implementation, the communications of full-duplex held by applying double division in the time (TDD). This unit should transmits and receives data alternately. The separation between the transmission and the reception prevents effectively the crosstalk between the operations of transmission and reception of the transmitter of radius. Since the transmission and the reception carry out in different slot times, also use bearing different.

C. Communication based on packet transmission:

Bluetooth uses a communication system based on packet transmission. The flux of information is fragmented in packages. In each slot, only one message can be send as an unique package. All packages have the same format, beginning with a code of access, followed for the head of the package and finally the field of data of user. The package only is accepted in the case of the access code coincides with the identification code of the master of the piconet. This prevents that packages are accepted by a false piconet that uses the same canal for the transmission.

1. In a canal with slot, has been defined so much link synchronous as asynchronous, as you can see in the following section. The performance of the type of package is different to link synchronous already asynchronous:
2. In asynchronous links, the packages can be slotted as, three slots or five slots. The rate of maximum transmission that is obtained in link asynchronous is of 3 Mbps. The fields of data user is variable.
3. In synchronous links, there is one package slot and the field of data user is fixed. The synchronous links supports full-duplex with rates of transmission of 64 kbps in both senses. Fig. 1 shows diagram of Bluetooth scatternet.

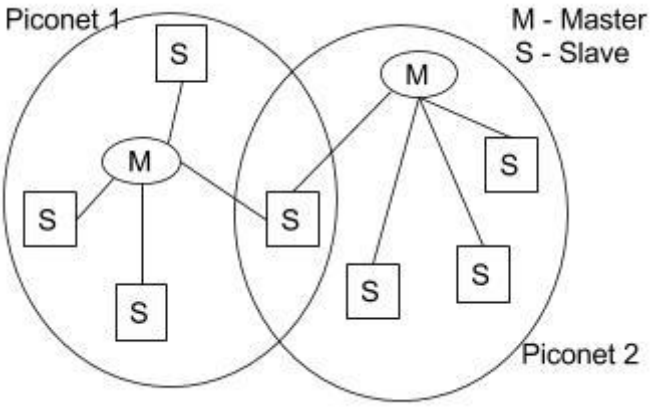

Fig 1. Bluetooth Scatternet ***D. Physical connections:***

There are two types of physical links:

- Link synchronous oriented to the connection (SCO). It is a link point to point between a master and a unique slave. The link settles by reserving duplex slots at regular intervals.
- Link asynchronous without connection (ACL). The

ACL link is a link point to multipoint between the master and all slaves of the piconet. This link uses all the slots of the canal that are not used for links SCO. The traffic for this type of links is promoted by the master. The structure in the slots of the canal of a piconet permits to mix synchronous links and asynchronous.

E. Establishment of the Connection:

The stations can be in different manners of functioning, for the establishment of connection and for the economy of energy. Establishment of connections are defined as three states: scan, it pays and inquiry. Keeps the maximum energy, when station is in idle mode, as asleep. However, this station will have to be awaked and see every certain time if there is some station that wants to communicate with it.

To establish a connection is necessary to know the identity of unit with whom we want to connect. If this information is not known then, a broadcast message will have to be send and the receivers will have to answer with its identity and information of clock. The units in idle mode also have to listen the broadcast messages.

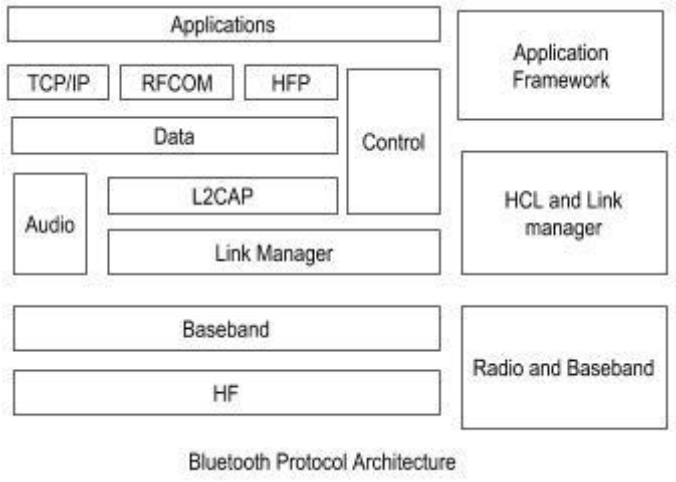

Fig. 2. Bluetooth layer and protocol architecture

F. Administration of the energy

This is an important point in the design of all system that is fed by a battery; because of the consumption of this is possible manner. For the economy of energy, Bluetooth defines a series of states where the stations go in and go out. In the idle mode, the single station scans the net during 10 MS each 't' seconds, where 't' can be between [1.28 - 3.84] seconds.

It is also defined as mode parked (PARK), where the rank of 't' is bit shorter. However, this mode can only be applied when a piconet been established. Only the slaves can participate in this mode. The slave only has to listen to the code of access and head of the packages to be synchronized with the other stations of network. Other mode of below consumption during the connection is the SNIFF mode. In this mode, slaves not able to access network in the whole slot master-to-slave.

In periods of long silence, the master has to send for canal to all slaves, in order that these can resynchronize their clocks. During several operations of transmission and reception, and unit check the access code at the beginning of the slot of reception. If received code of access, the header decoded, since it means that the package can be for it. If the 3 bits of the direction of the slave are not the same that the 3 bits of the receiver, then the slave stops to decode and turns to sleep.

G. Sniff mode

Sniff mode is a low consumption mode of Bluetooth. On sniff mode, the devices have a less participation on traffic of messages and packets. On the sniff mode this occurs only at 'sniff intervals'. On this mode the device also able to listens broadcast messages.

A Bluetooth module in the Sniff mode stays synchronized in the piconet. It listens to the piconet at regular intervals (Tsniff) for a short instant. This enables it to re-synchronize itself with the piconet and to be able to make use of this Sniff window to send or receive data. The consumption is as low as the Tsniff is large (compared to the Sniff window). If Tsniff is in the region of a second and the duration of Sniff (Twin) is in the region of several ms, the consumption will be about 1 to 5% of the maximum transmission consumption (average consumption of 1mA to 5mA approximately).

The Bluetooth Specification, in section 10.8.2 states: "The slave has to listen at Dsniff slot every sniff period, Tsniff for a Nsniff attempt number of times. If the slave receives a packet in one of the Nsniff attempt RX slots, it should continue listening as long as it receives packets to its own AM_ADDR. Once it stops receiving packets, it should continue listening for Nsniff timeout RX slots or remaining of the Nsniff attempt number of RX slots, whichever is greater." Tsniff is programmable and depends on the application. Figure 2.3 is showing the different states of Bluetooth nodes.

H. Interconnection of Piconets

Bluetooth has been designed to give chance to have tenth of piconets operating in the same area, without reducing the performance. To this whole of piconets are known as scatternet. This is possible thanks to that Bluetooth uses a communication based on packet transmission on linking slotted. A station can take part in several piconets, but in an instant of certain time only can communicate in one, however the station can be jumping from piconet by fitting the parameters of the canal (identification of the master and clock of the master). A station can change the role when a piconet passes to another, therefore can be enslaved in a piconet and master in another, but never can be master in two different piconets. The mechanism of selection of the leap in frequencies has been designed to permit the communication between different piconets. In Bluetooth, has be defined a HOLD mode, to permit to a station gives up temporarily a piconet and visit other (HOLD also can be used as an additional mode of below consumption).

IV. Bluetooth Packets

Forward Error Correction (FEC) is used on the data payload to reduce the number of retransmissions. FEC adds unnecessary overhead that reduces the throughput. Therefore, the packet definitions have been kept flexible to use FEC in the payload or not. The packet header is always protected by a 1/3 rate FEC since it contains valuable link information. The general Basic Rate packet format is shown in Figure 3. Each packet consists of three entities: the access code, the header and the payload.

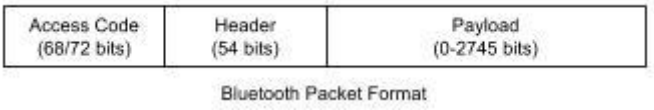

Fig. 3 Bluetooth Packet Format

The general Enhanced Data Rate packet format [4] is shown in Figure 2.5. Each packet consists of six entities: the access code, the header, the guard period, the synchronization sequence, the Enhanced Data Rate payload and the trailer. Different packet fields are then described below.

In the Enhanced Data Rate packet, the access code and header use the GFSK modulation mode as for Basic Rate packets while the synchronization sequence, the Enhanced Data Rate payload and the trailer use the Enhanced Data Rate DPSK modulation mode. The guard time allows for the transition between the two modulations modes.

- Access Code: Access code is used for timing synchronization, offset compensation, paging and inquiry. Access code is divided into three different types : Channel Access Code (CAC), Device Access Code (DAC) and Inquiry Access Code (IAC). The CAC identifies a unique piconet while the DAC is used for paging and its responses. IAC is used for inquiry purpose.
- Header: The header field includes packet acknowledgement information, packet numbering for out-of-order packet reordering, flow control, slave address and error check for header.
- Payload: The packet payload can contain either voice field, data field or both. It has a data field; the payload will also contain a payload header.

IV. Conclusion

Bluetooth is a wireless technology. The technology mobilize you into a new dimension in wireless connectivity. It is important to enclave yourself with right peoples. Bluetooth is a new standard. Which will allow any sort of electronic equipment to make it's own piconet without wires, cables or any direct action from user. In this paper, we have discussed about bluetooth invention, architecture, bluetooth working in piconet and data transmission through packets.

V. References

[1] "IEEE standard for telecommunications and information exchange between systems - lan/man - specific requirements - part 15: Wireless medium access control (Mac) and physical layer (phy) specifications for wireless personal area networks (wpans)," ***IEEE Std 802. J***5. ***J, 2002.***

[2] J. Jiang and B. Lin, "Analysis of bluetooth device discovery and some speedup mechanisms," ***Journal of the Institute of Electrical, 2004.***

[3] E. Welsh, P. Murphy, and P. Frantz, "Improving connection time for bluetooth devices in mobile environments," in ***Inter. Con! on Fundamentals of Electronics, Communications and Computer Sciences, 2002.***

[4] "Strategy analytics: Automotive bluetooth: Profile strategy key to infotainment success," Available at http://www.strategyanalytics.conl1.

[5] D. Puckett and M. Vickich, "Bluetooth-based travel time/speed measuring systems development," Texas Trans. Inst., Tech. Rep., June 2010.

[6] G. Leduc, "Road traffic data: Collection methods and applications," JCR ED, Tech. Rep., 2008.

[7] E. Linde, "An Investigation Into The Viability Of UWB As lower-Layer For Bluetooth", Masters Thesis, University of Pretoria, Department of Electrical, Electronic and Computer Engineering, 2009.