CERTIFICATE

This is to certify that Ms. Ayushi Dewan, student of B.Tech in Computer Science and Engineering has carried out the work presented in the project of the Term paper entitled "BLUETOOTH TECHNOLOGY" as a part of First year programme of Bachelor of Technology in Computer Science and Engineering from Amity School of Engineering and Technology, Amity University, Noida, Uttar Pradesh under my supervision.

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ABSTRACT

"**Dragging the world towards wireless galaxy**"  
Various sensors are already in a broad use today as part of different devices or as standalone devices connected to a network usually to monitor industrial processes, equipments or installations. The advancements in technology, wireless communications have enhanced development of small, low power and low cost devices. Such devices when organized into a network, present a powerful platform that can be used in many interesting applications.  
Bluetooth is a low cost, short-range, wireless technology with small footprint, low power consumption and reasonable throughput. Bluetooth wireless technology has become global technology specification for "always on" wireless communication not just as a point-to-point but was a network technology as well. The kernel of this paper, deals about an implementation of bluetooth based sensor networks.

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**“Dragging the world towards wireless galaxy”---: BLUETOOTH TECHNOLOGY**

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I.Introduction

The communications capability of devices and continuous transparent information routes are indispensable components of future oriented automation concepts. Communication is increasing rapidly in industrial environment even at field level. In any industry the process can be realized through sensors and can be controlled through actuators. The process is monitored on the central control room by getting signals through a pair of wires from each field device in Distributed Control Systems (DCS). With advent in networking concept, the cost of wiring is saved by networking the field devices. But the latest trend is elimination of wires i.e., wireless networks. Wireless sensor networks - networks of small devices equipped with sensors, microprocessor and wireless communication interfaces. In 1994, Ericsson Mobile communications, the global telecommunication company based in Sweden, initiated a study to investigate, the feasibility of a low power, low cost ratio interface, and to find a way to eliminate cables between devices. Finally, the engineers at the Ericsson named the new wireless technology as "Blue tooth" to honour the 10th century king if Denmark, Harald Blue tooth (940 to 985 A.D). The goals of blue tooth are unification and harmony as well, specifically enabling different devices to communicate through a commonly accepted standard for wire less connectivity.

II.History

The word "Bluetooth" is an anglicized version of the Scandinavian Blåtand/Blåtann, the epithet of the tenth-century king Harald I of Denmark and parts of Norway who united dissonant Danish tribes into a single kingdom. The idea of this name was proposed in 1997 by Jim Kardach who developed a system that would allow mobile phones to communicate with computers (at the time he was reading Frans Gunnar Bengtsson's historical novel The Long Ships about Vikings and king Harald Bluetooth). The implication is that Bluetooth does the same with communications protocols, uniting them into one universal standard. The Bluetooth logo is a bind rune merging the Younger Futhark runes [Runic letter ior.svg](http://en.wikipedia.org/wiki/File:Runic_letter_ior.svg) (Hagall) (ᚼ) and [Runic letter berkanan.svg](http://en.wikipedia.org/wiki/File:Runic_letter_berkanan.svg) (Bjarkan) (ᛒ), Harald's initials.

III.What is Bluetooth technology?

Bluetooth is a specification (IEEE 802.15.1) for the use of low-power radio communications to link phones, computers and other network devices over short distances without wires. The name Bluetooth is borrowed from Harald Bluetooth, a king in Denmark more than 1,000 years ago.Bluetooth technology was designed primarily to support simple wireless networking of personal consumer devices and peripherals, including cell phones, PDAs, and wireless headsets. Wireless signals transmitted with Bluetooth cover short distances, typically up to 30 feet (10 meters). Bluetooth devices generally communicate at less than 1 Mbps.Bluetooth networks feature a dynamic topology called a piconet or PAN. Piconets contain a minimum of two and a maximum of eight Bluetooth peer devices. Devices communicate using protocols that are part of the Bluetooth Specification. Definitions for multiple versions of the Bluetooth specification exist including versions 1.1, 1.2 and 2.0.Although the Bluetooth standard utilizes the same 2.4 Ghz range as 802.11b and 802.11g, Bluetooth technology is not a suitable Wi-Fi replacement. Compared to Wi-Fi, Bluetooth networking is much slower, a bit more limited in range, and supports many fewer devices.Concerns with Bluetooth technology include security and interoperability with other networking standards. Bluetooth operates in the unlicensed ISM band at 2.4 GHZ frequency band and use frequency hopping spread spectrum technique. A typical Bluetooth device has a range of about 10 meters and can be extended to 100meters. Communication channels supports total bandwidth of 1 Mb / sec. A single connection supports a maximum asymmetric data transfer rate of 721 KBPS maximum of three channels.

IV.Uses

Bluetooth is a standard wire-replacement communications protocol primarily designed for low power consumption, with a short range (power-class-dependent, but effective ranges vary in practice; see table below) based on low-cost transceiver microchips in each device. Because the devices use a radio (broadcast) communications system, they do not have to be in visual line of sight of each other, however a quasi optical wireless path must be viable.

## The basic uses of Bluetooth are:

## Cable replacement

## Voice and data access points

## Notebook PC to cell phone.

## Notebook or palm company to LAN , email, internet via shared access point(eg.conference rooms)

## 3.Temporary networking

## A.Upto 8 devices can share a piconet.

## F:\bluetooth\bluetooth-communication.jpg

## Other advantages are:

## \* Bluetooth does not pressure a clear pursuit of case between the synced devices. This circumstance that the devices longing not express unrelated each other, also irrefutable is further attainable to bring independent Bluetooth transfers when both the devices are agency divergent lodgings.     \* The marvel that this technology requires no cables again wires is signal that has fabricated bona fide hence haunting. camouflage thereupon various devices engulfing our lives today, the wish because clutter-free technology is seemly supplementary fulgid.     \* The high affiliate that Bluetooth offers is 100 meters, but this ally is not the unbroken over thoroughgoing Bluetooth effect. right depends on the mood of the devices besides the fairy tale of Bluetooth that they direct upon.     \* The processing power and volley comprehension that Bluetooth requires string command to oversee is exceptionally woebegone. This makes sound an exquisite appliance as consequently many electronic devices, due to the technology obligatoriness stage implemented refined remarkably anywhere.     \* one shot chief gravy of Bluetooth is its simplicity of worth. Anyone duty figure outermost how to comply maturing a place again sync two devices duck speed up. Moreover, the technology is completely unchain to use again requires no charges to serve as paid to quantum benefit provider.     \* The chances of unlike wireless networks interfering suppress a Bluetooth magnetism are severely despondent. This is thanks to of the dejected powered wireless signals that the technology adopts, besides further through of smash familiar because frequency hopping.

## 

## V. More about Bluetooth technology

## Bluetooth operates in the unlicensed ISM band at 2.4 GHZ frequency band and use frequency hopping spread spectrum technique. A typical Blue tooth device has a range of about 10 meters and can be extended to 100meters. Communication channels supports total bandwidth of 1 Mb / sec. A single connection supports a maximum asymmetric data transfer rate of 721 KBPS maximum of three channels. BLUE TOOTH NETWORKS In bluetooth, a Piconet is a collection of up to 8 devices that frequency hop together. Each Piconet has one master usually a device that initiated establishment of the Piconet, and up to 7 slave devices. Master's Blue tooth address is used for definition of the frequency hopping sequence. Slave devices use the master's clock to synchronize their clocks to be able to hop simultaneously. STANDBY When a device wants to establish a Piconet it has to perform inquiry to discover other Blue tooth devices in the range. Inquiry procedure is defined in such a way to ensure that two devices will after some time, visit the same frequency same time when that happens, required information is exchanged and devices can use paging procedure to establish connection. When more than 7 devices needs to communicate, there are two options. The first one is to put one or more devices into the park state. Blue tooth defines three low power modes sniff, hold and park. When a device is in the park mode then it disassociates from and Piconet, but still maintains timing synchronization with it. The master of the Piconet periodically broadcasts beacons (Warning) to invite the slave to rejoin the Piconet or to allow the slave to request to rejoin. The slave can rejoin the Piconet only if there are less than seven slaves already in the Piconet. If not so, the master has to 'park' one of the active slaves first. All these actions cause delay and for some applications it can be unacceptable for eg: process control applications, that requires immediate response from the command centre (central control room). Scatternet consists of several Piconets connected by devices participating in multiple Piconet. These devices can be slaves in all Piconets or master in one Piconet and slave in other Piconets. Using scatternets higher throughput is available and multi-hop connections between devices in different Piconets are possible. i.e., The unit can communicate in one Piconet at time so they jump from pioneer to another depending upon the channel parameter.

BLUE TOOTH BASED SENSOR NETWORK  
The main challenge in front of Blue tooth developers now is to prove interoperability between different manufactures' devices and to provide numerous interesting applications. One of such applications is wireless sensor networks.  
Wireless sensor networks comprise number of small devices equipped with a sensing unit, microprocessors, and wireless communication interface and power  
source.  
1. An important feature of wireless sensor networks is collaboration of network nodes during the task execution.  
2. Another specific characteristics of wireless sensor network is Data-centric  
nature.  
As deployment of smart sensor nodes is not planned in advance and positions of nodes in the field are not determined, it could happen that some sensor nodes end in such positions that they either cannot perform required measurement or the error probability is high. For that a redundant number of smart nodes is deployed in this field. These nodes then communicate, collaborate and share data, thus ensuring better results.  
Smart sensor nodes scattered in the field, collect data and send it to users via "gateway" using multiple hop routes.

A Wireless sensor network  
The main functions of a gateway are  
❖ Communication with sensor Networks  
2 Shortage wireless communication is used.  
2 It provides functions like discovery of smart sensor nodes, generic methods of sending and receiving data to and from sensors, routing .  
❖ Gateway logic  
2 It controls gateway interfaces and data flow to and from sensor network.  
2 It provides an abstraction level that describes the existing sensors  
and their characteristics. 2 It provides functions for uniform access to sensors regardless of  
their type, location or N/W topology, inject queries and tasks and  
collect replies.

❖ Communication With Users  
2 Gateway communications with users or other sensor networks over the Internet, WAN, Satellite or some shortage communication technology.  
From the user point of view, quering and tasking are two main services provided by wireless sensor networks. Queries are used when user requires only the current value of the observed phenomenon. Tasking is a more complex operation and is used when a phenomenon has to be observed over a large period of time.Both queries and tasks of time to the network by the gateway which also collects replies and forwards them to users.

SENSOR NETWORK IMPLEMENTATION

The main goal of our implementation was to build a hardware platform and generic software solutions that can serve as the basis and a test bed for the research of wireless sensor network protocols. Implemented sensor network consists of several smart sensor nodes and a gateway. Each smart node can have several sensors and is equipped with a micro¬controller and a bluetooth radio module. Gate way and smart nodes are members of the Piconet and hence maximum seven smart nodes can exist simultaneously in the network. For example, a pressure sensor is implemented, as bluetooth node in a following way. The sensor is connected to the bluetooth node and consists of the pressure sensing element, smart signal-conditioning circuitry including calibration and temperature compensation, and the Transducer Electronic Data Sheet (TEDS). These features are built directly into the sensor microcontroller used for node communication control plus memory for TEDS configuration information.

Smart Sensor Node Architecture  
The architecture shown in figure can easily be developed for specific sensor configurations such as thermocouples, strain gauges, and other sensor technologies and can include sensor signal conditioning as well as communications functions.  
Conditioned along sensor signal is digitized and digital data is then processed using stored TEDS data. The pressure sensor node collects data from multiple sensors and transmits the data via bluetooth wireless communications in the 2.4 GHZ base band to a network hub or other internet appliance such as a computer.  
The node can supply excitation to each sensor, or external sensor power can be supplied. Up to eight channels are available on each node for analog inputs as well as digital output. The sensor signal is digitized with 16-bit A/D resolution for transmission along with the TEDS for each sensor. This allows each channel to identify itself to the host system. The node can operate from either an external power supply or an attached battery. The maximum transmission distance is 10 meters with an optional capability to 100 meters.  
The IEEE 1451 family of standards are used for definition of functional boundaries and interfaces that are necessary to enable smart transducer to be easily connected to a variety of networks. The standards define the protocol and functions that give the transducer interchangeability in networked system, with this information a host microcomputer recognized a pressure sensor, a temperature sensor, or another sensor type along with the measurement range and scaling information based on the information contained in the TEDS data.  
With blue tooth technology, small transceiver modules can be built into a wide range of products including sensor systems, allowing fast and secure transmission of data within a given radius (Usually up to 10m).  
A blue tooth module consists primarily of three functional blocks - an analog 2.4 GHz., Blue tooth RF transceiver unit, and a support unit for link management and host controller interface functions.  
The host controller has a hardware digital signal processing part- the Link Controller (LC), a CPU core, and it interfaces to the host environment. The link controller consists of hardware and software parts that perform blue tooth based band processing, and physical layer protocols. The link controller performs low-level digital-signal processing to establish connections, assemble or disassemble, packets, control frequency hopping, correct errors and encrypt data.

Bluetooth module Hardware Architecture  
The CPU core allows the blue tooth module to handle inquiries and filter page request without involving the host device. The host controller can be programmed to answer certain page messages and authenticate remote links. The link manager(LM) software runs on the CPU core. The LM discovers other remote LMs and communicates with them via the link manager protocol (LMP) to perform its service provider role using the services of the underlying LC. The link manager is a software function that uses the services of the link controller to perform link setup, authentication, link configuration, and other protocols. Depending on the implementation, the link controller and link manager functions may not reside in the same processor.  
Another function component is of course, the antenna, which may be integrated on the PCB or come as a standalone item. A fully implemented blue tooth module also incorporates higher-level software protocols, which govern the functionality and interoperability with other modules. Gate way plays the role of the Piconet's master in the sensor network. It controls establishments of the network, gathers information about the existing smart sensor nodes and sensor attached to them and provides access to them. Discovery Of The Smart Sensor Nodes  
Smart sensor node discovery is the first procedure that is executed upon the gateway installation. It goals to discover all sensor nodes in the area and to build a list of sensor's characteristics and network topology. Afterwards, it is executed periodically to facilitate addition of new or removal of the existing sensors. The following algorithm is proposed.  
When the gateway is initialized, it performs bluetooth inquiry procedure. When the blue tooth device is discovered, the major and minor device classes are checked. These parameters are set by each smart node to define type of the device and type of the attached sensors. Service class field can be used to give some additional description of offered services. if discovered device is not smart node it is discarded. Otherwise service database of the discovered smart node is searched for sensor services. As currently there is no specific sensor profile, then database is searched for the serial port profile connection parameters. Once connection strings is obtained from the device. Blue tooth link is established and data exchange with smart mode can start.

VI. Development of Bluetooth from the past

The Bluetooth specification was developed as a cable replacement in 1994 by Jaap Haartsen and Sven Mattisson, who were working for Ericsson in Lund, Sweden. The specification is based on frequency-hopping spread spectrum technology. The specifications were formalized by the Bluetooth Special Interest Group (SIG). The SIG was formally announced on 20 May 1998. Today it has a membership of over 17,000 companies worldwide. It was established by Ericsson, IBM, Intel, Toshiba and Nokia, and later joined by many other companies. All versions of the Bluetooth standards are designed for downward compatibility. That lets the latest standard cover all older versions.

### Bluetooth v1.0 and v1.0B

Versions 1.0 and 1.0B had many problems, and manufacturers had difficulty making their products interoperable. Versions 1.0 and 1.0B also included mandatory Bluetooth hardware device address (BD\_ADDR) transmission in the Connecting process (rendering anonymity impossible at the protocol level), which was a major setback for certain services planned for use in Bluetooth environments.

### Bluetooth v1.1

* Ratified as IEEE Standard 802.15.1–2002
* Many errors found in the 1.0B specifications were fixed.
* Added possibility of non-encrypted channels.
* Received Signal Strength Indicator (RSSI).

### Bluetooth v1.2

This version is backward compatible with 1.1 and the major enhancements include the following:

* Faster Connection and Discovery
* Adaptive frequency-hopping spread spectrum (AFH), which improves resistance to radio frequency interference by avoiding the use of crowded frequencies in the hopping sequence.
* Higher transmission speeds in practice, up to 721 kbit/s, than in v1.1.
* Extended Synchronous Connections (eSCO), which improve voice quality of audio links by allowing retransmissions of corrupted packets, and may optionally increase audio latency to provide better concurrent data transfer.
* Host Controller Interface(HCI) operation with three-wire UART.
* Ratified as IEEE Standard 802.15.1–2005
* Introduced Flow Control and Retransmission Modes for L2CAP.

### Bluetooth v2.0 + EDR

This version of the Bluetooth Core Specification was released in 2004 and is backward compatible with the previous version 1.2. The main difference is the introduction of an Enhanced Data Rate (EDR) for faster data transfer. The nominal rate of EDR is about 3 Mbit/s, although the practical data transfer rate is 2.1 Mbit/s.EDR uses a combination ofGFSK and Phase Shift Keying modulation (PSK) with two variants, π/4-DQPSK and 8DPSK EDR can provide a lower power consumption through a reduced duty cycle.

The specification is published as "Bluetooth v2.0 + EDR" which implies that EDR is an optional feature. Aside from EDR, there are other minor improvements to the 2.0 specification, and products may claim compliance to "Bluetooth v2.0" without supporting the higher data rate. At least one commercial device states "Bluetooth v2.0 without EDR" on its data sheet.

### Bluetooth v2.1 + EDR

Bluetooth Core Specification Version 2.1 + EDR is fully backward compatible with 1.2, and was adopted by the Bluetooth SIG on 26 July 2007.

The headline feature of 2.1 is secure simple pairing (SSP): this improves the pairing experience for Bluetooth devices, while increasing the use and strength of security. See the section on Pairing below for more details.

2.1 allows various other improvements, including "Extended inquiry response" (EIR), which provides more information during the inquiry procedure to allow better filtering of devices before connection; and sniff subrating, which reduces the power consumption in low-power mode.

### Bluetooth v3.0 + HS

Version 3.0 + HS of the Bluetooth Core Specificationwas adopted by the Bluetooth SIG on 21 April 2009. Bluetooth 3.0+HS provides theoretical data transfer speeds of up to 24 Mbit/s, though not over the Bluetooth link itself. Instead, the Bluetooth link is used for negotiation and establishment, and the high data rate traffic is carried over a collocated802.11 link.

The main new feature is AMP (Alternate MAC/PHY), the addition of 802.11 as a high speed transport. The High-Speed part of the specification is not mandatory, and hence only devices sporting the "+HS" will actually support the Bluetooth over 802.11 high-speed data transfer. A Bluetooth 3.0 device without the "+HS" suffix will not support High Speed, and needs to only support a feature introduced in Core Specification Version 3.0 or earlier Core Specification Addendum

VII. Devices

Bluetooth exists in many products, such as telephones, tablets, media players, Lego Mindstorms NXT, PlayStation 3, PS Vita, the Nintendo Wii, 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.



VIII. Disadvantages of Bluetooth technology/ Better options

**Data Transfer Rate**

* Data sent between two Bluetooth devices has a maximum transfer speed of one megabyte per second. Infared is capable of transferring data at 4MB per second, and Wi-Fi is capable of speeds even higher. The slow transfer speed makes Bluetooth not an ideal choice for data transfer when faster connection methods are available.

**Range**

* Bluetooth only has a range of 15 to 30 feet depending on the device. The small range is a disadvantage for some who may want to use a Bluetooth device outside of that 30-foot radius. For instance, a Bluetooth printer in a home could not necessarily be used by every computer in the house if some of those computers are located out of the range of the printer. A Wi-Fi printer, however, could be used by anyone who could connect to the home's wireless network.

**Security**

* Since data is transferred over radio waves using Bluetooth, it is is much easier for a hacker to break into than secure wireless networks. For that reason, Bluetooth should not be used to transfer data that needs to remain private and secure.

**Battery Use**

* Bluetooth uses the battery power of a particular device in order to operate. Many cell phone makers send phones out with Bluetooth powered off in order to maximize the battery life of the phone. Turning Bluetooth on, while convenient, can drain a cell phone or computer battery, causing it to run out of juice long before it would have if Bluetooth was not powered on.

Other disadvantages are:

 \* Though Bluetooth lug speeds are persuasive at around 1 Mbps, designful otherwise technologies flip over wine rap propose speeds adding to to 4 Mbps. This is an zone that Bluetooth engagement edit on ropes the to come up.  
    \* identical though the ambition on Bluetooth is good, tangible is uniform bigger on rosy. This is now of the comparatively fitter rank of Bluetooth besides again the exiguity of a calling of surveillance. Someone who knows how to hack conforming networks liability negotiate then eventually.  
    \* The shelling rigmarole during a contrary Bluetooth fetch is negligible, but adept are some connections who will the Bluetooth switched on repercussion their devices. This inevitably goodies curiosity the cannonade of these devices, again lowers the shelling activity considerably.  
Ultimately the advantages again disadvantages of Bluetooth technology are tolerably uneven, again the benefits of the technology succulent outweigh portion denying aspects. Bluetooth is widely used by millions of family from whole around the world, also undeniable is indubitable to evolvement matched further as circumstance goes by. The facilitate of account again space that existing offers is unmatched, besides incarnate is different a beginning of instance before every various machine and electronic device agency our local makes help of Bluetooth technology.

IX. Bluetooth VS Wifi

Wifi is short for 'wireless fidelity' and is a limited-range wireless networking code which is used in many airports, hotels or other services, who offer public access to Wifi networks, to allow people to log on to the Internet and receive emails whilst on the move. As Wifi is a reasonably fast method of transmitting information in wave form, it is often used in computers and also notebooks. In future, it will become possible to access the Internet from just about anywhere, without the use of any wires. The advantages of using Wifi are that the networks are fairly cheap and straight-forward to set up. Wifi is also quite inconspicuous and can hardly be noticed unless it is being looked for specifically, whilst in a Wifi 'hotspot.' For a wireless network to be created, communication is transferred like a two way radio, using radio waves.  
Both Bluetooth and Wifi have both been in the news more especially in recent years. Both technologies are relatively new on the market and, with time, a trend may be seen favouring one or the other. As more and more Bluetooth devices become available, most people will own devices for Bluetooth and Wifi. There are several advantages for opting for Bluetooth networking over Wifi and vice-versa. WiFi and Bluetooth are actually very different technologies with very different reasons to exist. The question should not be Bluetooth versus Wifi but more how Bluetooth can work with Wifi.

Advantages of wifi:

The most prominent advantage which Wifi has over Bluetooth is that Wifi operates at a much faster rate - of about 11mbps, whereas Bluetooth only operates at a much slower rate of around 720kbps. This makes Bluetooth too slow for video transfers or for moving large amounts of large photo images from a digital camera. Wifi is also designed to link up entire networks, rather than computer to computer. Wifi can achieve this too but it is not its real purpose. Originally intended to be used for mobile computing devices, such as laptops, it is now often being used for increasingly more applications , such as Internet access, gaming and basic connectivity for home electronic appliances such as televisions or DVD players. Wi-Fi may be used by cars in highways, as standards rise in development, in support of an Intelligent Transportation System to increase safety, gather statistics, and enable mobile commerce.

Having taking in the advantages of both forms of communication, it can not be said that one is better than the other. The two wireless protocols can be used to perform separate things and it is not essential to opt for one, rather than the other. Bluetooth should be the first choice for when connecting single devices, only when speed is not an issue. It has a short range of approximately 30 to 60 feet and common applications can include sharing printers, syncing PDAs or using a mobile phone as a modem. As time goes by it will be very interesting to see how both Bluetooth and Wifi develop and what new uses they will have and for what devices.



X. latest version of Bluetooth

The Bluetooth SIG completed the Bluetooth Core Specification version 4.0 and has been adopted as of 30 June 2010. It includes Classic Bluetooth, Bluetooth high speed andBluetooth low energy protocols. Bluetooth high speed is based on Wi-Fi, and Classic Bluetooth consists of legacy Bluetooth protocols.

Bluetooth low energy (BLE), previously known as WiBree, is a subset of Bluetooth v4.0 with an entirely new protocol stack for rapid build-up of simple links. As an alternative to the Bluetooth standard protocols that were introduced in Bluetooth v1.0 to v3.0, it is aimed at very low power applications running off a coin cell. Chip designs allow for two types of implementation, dual-mode, single-mode and enhanced past versions.The provisional names Wibree and Bluetooth ULP (Ultra Low Power) were abandoned and the BLE name was used for a while. In late 2011, new logos “Bluetooth Smart Ready” for hosts and “Bluetooth Smart” for sensors were introduced as the general-public face of BLE.

* In a single mode implementation the low energy protocol stack is implemented solely. CSR, Nordic Semiconductor and Texas Instruments have released single mode Bluetooth low energy solutions.
* In a dual-mode implementation, Bluetooth low energy functionality is integrated into an existing Classic Bluetooth controller. Currently (2011-03) the following semiconductor companies have announced the availability of chips meeting the standard: Qualcomm-Atheros, CSR, Broadcom and Texas Instruments. The compliant architecture shares all of Classic Bluetooth’s existing radio and functionality resulting in a negligible cost increase compared to Classic Bluetooth.

Cost-reduced single-mode chips, which enable highly integrated and compact devices, feature a lightweight Link Layer providing ultra-low power idle mode operation, simple device discovery, and reliable point-to-multipoint data transfer with advanced power-save and secure encrypted connections at the lowest possible cost.

General improvements in version 4.0 include the changes necessary to facilitate BLE modes, as well the Generic Attribute Profile (GATT) and Security Manager (SM) services with AES Encryption.

Core Specification Addendum 2 was unveiled in December 2011; it contains improvements to the audio Host Controller Interface and to the High Speed (802.11) Protocol Adaptation Layer.

XI. Summary and Conclusions

Bluetooth represents a great chance for sensor-networked architecture. This architecture heralds wireless future for home and also for industrial implementation. With a blue tooth RF link, users only need to bring the devices with in range, and the devices will automatically link up and exchange information.  
Thus implementation of blue tooth technology for sensor networks not only cuts wiring cost but also integrates the industrial environment to smarter environment.  
Today, with a broader specifications and a renewed concentration on interoperability, manufacturers are ready to forge ahead and take blue tooth products to the market place. Embedded design can incorporate the blue tooth wireless technology into a range of new products to meet the growing demand for connected information appliances.





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