CPUH-Research Journal: **2017,** ***2(2),*** 103-106
ISSN (Online): 2455-6076
http://www.cpuh.in/academics/academic_journals.php

Review on Wireless Sensor Network System and ZigBee Technology

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ABSTRACT: Wireless sensor network (WSN) are used in variety of fields which includes military, healthcare, home and other commercial application. Wireless sensor technology impose an increasing number of organizations are using it for a wide range of purpose. ZigBee technology is a new standard in wireless personal areas after Bluetooth. ZigBee is a standard that defines a set of communication protocols for low-data-rate short-range wireless networking. A new wireless meter- reading system based on ZigBee protocol has evolved. The Maximum data rate is 250 K bits per second. ZigBee targeted mainly for battery-powered application where data rate, low cost low and power consumption wireless sensor network technology has become one of technological basic needs of us.

Keywords: Bluetooth; zigBee; wireless sensor network and healthcare.

INTRODUCTION: Zigbee communication is specially built for control and sensor networks on IEEE 802.15.4 standard for wireless personal area networks (WPANs), and it is the product from Zigbee alliance. This communication standard defines physical and Media Access Control (MAC) layers to handle many devices at low-data rates. These Zigbee's WPANs operate at 868 MHz, 902-928MHz and 2.4 GHz frequencies. The date rate of 250 kbps is best suited for periodic as well as intermediate two way transmission of data between sensors and controllers. Zigbee is low-cost and low-powered mesh network widely deployed for controlling and monitoring applications where it covers 10-100 meters within the range. This communication system is less expensive and simpler than the other proprietary short-range wireless sensor networks as Bluetooth and Wi-Fi.

Zigbee is one of the most widely utilized Wireless Sensor Network standards with low power, low data rate, low cost and short time delay characteristics, simple to develop and deploy and provides robust security and high data reliability. Name of the Zigbee came from zigzagging patterns of honey bees ZigBee is a specification for a suite of high level communication protocols using tiny, low-power digital radios based on an IEEE 802 standard for personal area networks. ZigBee has a defined rate of 250 Kbit/s best suited for periodic or irregular data or a single signal transmission from a sensor or input device. ZigBee based traffic management systems have also been implemented between flowers represents the communication between nodes in a mesh network [1]. Wireless Technology is being developed rapidly nowadays. Advancement in micro electromechanical systems brings integration of sensing, signal processing and RF capability on very small devices. All kind of portable applications tend to be able to communicate without the use of any wires. Aim of wireless communication is to gather information or perform certain task in the environment. A typical sensor node contains three C's, are Collection, Computation and Communication units. Based on the request of sink, gathered information will be transmitted wirelessly. The collection unit has series of sensors. Computation unit contains microcontroller and memory. Finally the communication unit contains transceiver to transmit and receive data; various transceivers (such as RFM TR1000 family, Hardware accelerators, 802.15.4/Ember EM2420 RF transceiver, Conexant RDSSS9M) used for this purpose[2]. The reasons for using Zigbee are,

- Reliable and self-healing
- Supports large number of nodes.
- Easy to deploy • Very long battery life
- Secure
- Low cost
- Can be used globally
- Vibrant industry support with thirty or more vendors supplying products and services
- Open Standards protocol with no or negligible licensing fees
- Chipsets available from multiple sources
- Remotely upgradeable firmware
- No new wires
- Low power (ability to operate on batteries measured in years)
- Low maintenance (meshing, self-organizing) The ZigBee network layer natively supports both star and tree typical networks, and generic mesh networks.

Need for ZIGBEE:

1) There are a multitude of standards that address mid to high data rates for voice, PC LANs, video, etc.

However, up till now there hasn't been a wireless network standard that meets the unique needs of sensors and control devices. Sensors and controls don't need high bandwidth but they do need low latency and very low energy consumption for long battery lives and for large device arrays [3].

2) There are a multitude of proprietary wireless systems manufactured today to solve a multitude of problems that also don't require high data rates but do require low cost and very low current drain.

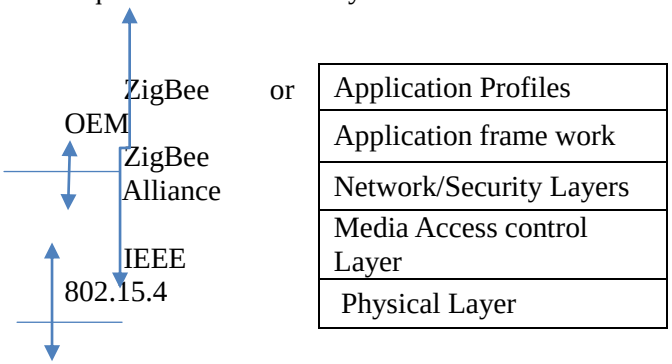

Figure 1: ZigBee protocol stack

3) These proprietary systems were designed because there were no standards that met their requirements. These legacy systems are creating significant interoperability problems with each other and with newer technologies.

Zigbee Device Tyeps:

Zigbee devices are of three types:

1) ZigBee coordinator (ZC): The most capable device, the coordinator forms the root of the network tree and might bridge to other networks. There is exactly one ZigBee coordinator in each network since it is the device that started the network originally. It stores information about the network, including acting as the Trust Center & repository for security keys.

2) ZigBee Router (ZR): As well as running an application function, a router can act as an intermediate router, passing on data from other devices.

3) ZigBee End Device (ZED): Contains just enough functionality to talk to the parent node (either the coordinator or a router); it cannot relay data from other devices. This relationship allows the node to be asleep a significant amount of the time thereby giving long battery life. A ZED requires the least amount of memory, and therefore can be less expensive to manufacture than ZR or ZC.

Short-Range Wireless Networking Classes: Short-range wireless networking methods are divided into two main categories: wireless local area networks (WLANs) and wireless personal area networks (WPANs).

WLAN is a replacement or extension for wired local area networks (LANs) such as Ethernet (IEEE 802.3). A WLAN device can be integrated with a wired LAN network, and once the WLAN device becomes part of the network, the network treats the wireless device the same as any other wired device within the network [4]. The goal of a WLAN is to maximize the range and data rate.

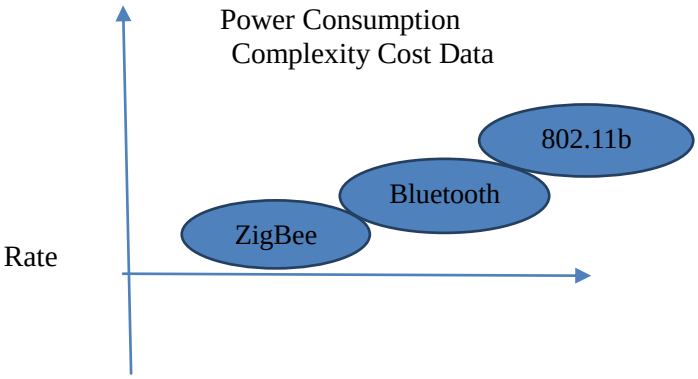

Figure 2: Comparing the ZigBee Standard with Bluetooth and IEEE 802.11b

Advantages of ZigBee: ZigBee is poised to become the global control/sensor network standard. It has been designed to provide the following features:

1) Low power consumption, simply implemented.

2) Users expect batteries to last many months to years! Consider that a typical single family house has about 6 smoke/CO detectors. If the batteries for each one only lasted six months, the home owner would be replacing batteries every month.

3)Bluetooth has many different modes and states depending upon your latency and power requirements such as sniff, park, hold, active, etc.; ZigBee/IEEE 802.15.4 has active (transmit/receive) or sleep. Application software needs to focus on the application, not on which power mode is optimum for each aspect of operation.

4) Even mains powered equipment needs to be conscious of energy. Consider a future home with 100 wireless control/sensor devices [5].

Wireless Sensor Network: A wireless sensor network has little or on infrastructure. It has number of sensor node and can work together to monitor a region to obtain data about the environment. There are two types of WSNs called as structured WSN and unstructured WSNs. Unstructured WSN contain dense collection of sensor nodes and often deployed in ad-hoc manner in field i.e. nodes are deployed randomly in the target area. In structured WSN sensor nodes are deployed in pre-determined location. There sensor nodes are energy limited and specific

application oriented. A sensor network is composed of a large number of nodes, which are densely deployed either inside the phenomenon or very close to it. The position of sensor node need not be engineered of pre-determined. On the other hand this also means that sensor network protocols and algorithms must process self-organizing capabilities. Some of the application area is health, military and security [6].

Wireless multimedia sensor networks will not only enhance existing sensor network applications such as tracking, home automation, and environmental monitoring, but they will also enable several new applications such as:

Multimedia surveillance sensor networks: Wireless video sensor networks will be composed of interconnected, battery-powered miniature video cameras, each packaged with a low-power wireless transceiver that is capable of processing, sending, and receiving data. Video and audio sensors will be used to enhance and complement existing surveillance systems against crime and terrorist attacks. Large-scale networks of video sensors can extend the ability of law enforcement agencies to monitor areas, public events, private properties and borders [7].

Storage of potentially relevant activities: Multimedia sensors could infer and record potentially relevant activities (thefts, car accidents, traffic violations), and make video/audio streams or reports available for future query [8].

Traffic avoidance, enforcement and control systems: It will be possible to monitor car traffic in big cities or highways and deploy services that offer traffic routing advice to avoid congestion. In addition, smart parking advice systems based on WMSNs will allow monitoring available parking spaces and provide drivers with automated parking advice, thus improving mobility in urban areas. Moreover, multimedia sensors may monitor the flow of vehicular traffic on highways.

Environmental monitoring: Several projects on habitat monitoring that use acoustic and video feeds are being envisaged, in which information has to be conveyed in a time-critical fashion. For example, arrays of video sensors are already used by oceanographers to determine the evolution of sandbars via image processing techniques.

Person locator services: Multimedia content such as video streams and still images, along with advanced signal processing techniques, can be used to locate missing persons, or identify criminals or terrorists [9].

The combination of ZigBee wireless sensor networks and RFID technology, make up for the drawback of short transmission distance of the RFID which can also solve some of the following problems.

1) **RFID data transmission problem:** GIS and RFID to achieve the separate wiring problem of personnel location under the traditional way; Because of geographical complexity of the mine, bad environment, wired connections will cause the data route in the mine complex and redundant and data lines will be influenced by poor environments to rotten skin, breaking leading to data transfer instability.; and effective data are collected precisely to ensure personnel safety of important security; relying on wireless sensor networks to transmit data, security, high reliability and eliminating the need for separate wiring problems, reducing input costs.

2) **Personnel positioning problem:** The combination of RFID technology and GIS, can solve based on ZigBee technology the personnel positioning inaccuracy of the problem; Under the ZigBee technology to realize personnel positioning mode, Personnel to wear the positioning of a ZigBee module which regularly sent the existed information, the sensor node which distributed in mine roadway to receive this signal, according to signal strength to determine its location ; When the mine tunnel barrier is greater, the existed signal attenuation occurs during transmission, detection accuracy of sensor nodes will be reduced or even fail. And when the network transmission links due to the malfunctioning of a node failure, the data will not reach the ground control center. Using RFID technology, Anti-pollution features of the electronic tag and the reader transmission and the diffraction function, to minimize the environmental impact of geography; with GIS analysis of the surrounding environment, truly accurate personnel positioning. And when the mine accidents occur, RFID tag will bring help to rescue; use of handheld devices that have targeted the location of facilities, staff side edge detection rescue, relief to improve greatly [10].

3) **Under the mine the personal safety of staff problem:** Implantation of clothes in the wireless data receiver can be realized well into the double protection of personnel; it apart from the ground control center received a warning message sent over in addition to the autonomy of the receiving sensor node detection data; when the data transmission is not stability or failure of data link control center to send the correct data can't be reached, it still can be achieved well into the safety of the personnel on alert [11].

CONCLUSIONS: In this paper, a technical overview of the ZigBee technology has been presented. The main features of the ZigBee technology have been highlighted in this paper. .In this paper wireless sensor network technology is discussed along with application and it is clear that WSN proves to be emerging

technology. This paper describes a wireless sensor system that is able to be monitored all over the world using the internet. The development of wireless sensor network with the integration of internet of thing arise new several fields. This system includes two aspects hardware and software. It is likely that ZigBee will increasingly play a vital role in the future of computer and communication technology. In terms of protocol stack size, ZigBee's 32 KB is about one third of the stack size necessary in other wireless technologies. The IEEE 802.15.4–based ZigBee is designed for remote controls and sensors, which are very many in number, but need only small data packets and, extremely low power consumption for longer life

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