International Journal on Emerging Technologies (Special Issue NCETST-2017) **8**(1): 295-297(2017)
(Published by Research Trend, Website: www.researchtrend.net*)*

ISSN No. (Print) : 0975-8364
ISSN No. (Online) : 2249-3255

An analysis of Low Cost, low power and futuristic wireless Technology- ZIGBEE

Komal Pasricha[1], Harshita Jha[1] and Dr. Sadhana Rana[2]
[1]Student –CSE, Amrapali Institute-AITS, Haldwani , (Uttarakhand), INDIA
[2]Assistant Professor-CSE, Amrapali Institute-AITS, Haldwani (Uttarakhand), INDIA

ABSTRACT: With the advancement of technology, zigbee is the need for today's era. Developing a low cost, low power wireless technology has made data transfer easier by supporting more than 64000 devices being connected on a single network. There are various wireless technologies in the market but zigbee supports some features which makes it superior than others. It is more proliferated because of network resilience, interoperability and low power consumption feature. In this paper we focus on zigbee low cost, Low power, and also wireless technology is introduced and an analysis is being done on applications of zigbee.

Keywords: zb, azb and tzb

I. INTRODUCTION

In this present communication world there are numerous high data rate communication standards that are available, but none of these meet the sensors' and control devices' communication standards. These high-data rate communication standards require low-latency and low-energy consumption even at lower bandwidths. The available proprietary wireless systems' Zigbee technology is low-cost and low-power consumption and its excellent and superb characteristics makes this communication best suited for several embedded applications, industrial control, and home automation, and so on.

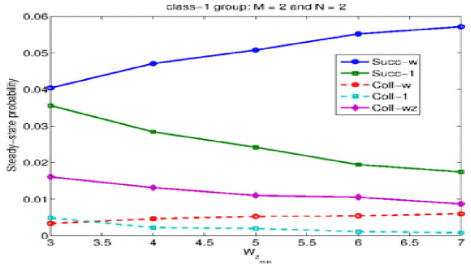
II. ZIBBEE TECHNOLOGY

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 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 2007 is sometimes called "Pro", but Pro is a stack profile, which defines certain stack settings and Mandatory features.

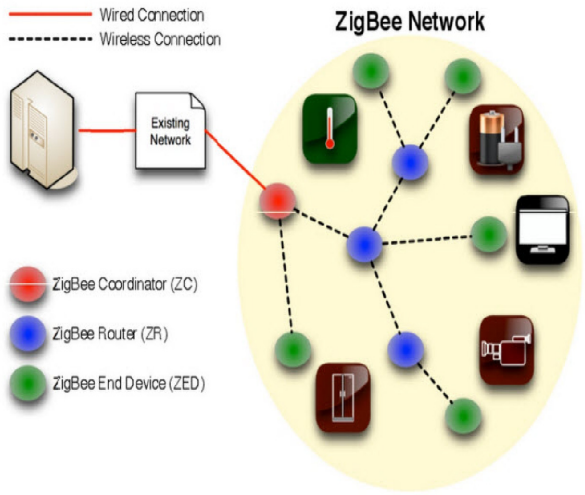
ZigBee 2007 at the network level is not backwards-compatible with ZigBee 2004/2006, although a ZigBee 2004/2006 RFD node can join a 2007 network, and vice-versa. It's not possible to mix 2004/2006 routers, With 2007 routres/coordinator.

ZigBee protocols are intended for use in embedded applications requiring low data rates and low power consumption. ZigBee's current focus is to define a general-purpose, inexpensive, self-organizing, mesh network that can be used for industrial control, embedded sensing, medical data collection, smoke and intruder warning, building automation, home automation, etc. The resulting network will use very small amounts of power so individual devices might run for a year or two using the originally installed battery.



III. ZIGBEE ARCHITECTURE

Zigbee system structure consists of three different types of devices such as Zigbee coordinator, Router and End device. Every Zigbee network must consist of at least one coordinator which acts as a root and bridge of the network. The coordinator is responsible for handling and storing the information while performing receiving and transmitting data operations. Zigbee routers act as intermediary devices that permit data to pass to and fro through them to other devices.



End devices have limited functionality to communicate with the parent nodes such that the battery power is saved as shown in the figure. The number of routers, coordinators and end devices depends on the type of network such as star, tree and mesh networks. Zigbee protocol architecture consists of a stack of various layers where IEEE 802.15.4 is defined by physical and MAC layers while this protocol is completed by accumulating Zigbee's own network and application layers.

A. Zigbee protocol architecture

Physical Layer: This layer does modulation and demodulation operations up on transmitting and receiving signals respectively. This layer's frequency, date rate and number of channels are given below.

Physical Layer of Zigbee Protocol:

MAC Layer: This layer is responsible for reliable transmission of data by accessing different networks with the carrier sense multiple access collision avoidance (CSMA). This also transmits the beacon frames for synchronizing communication.

Network Layer: This layer takes care of all network related operations such as network setup, end device connection and disconnection to network, routing, device configurations, etc.

Application Support Sub-Layer: This layer enables the services necessary for Zigbee device object and application objects to interface with the network layers for data managing services. This layer is responsible for matching two devices according to their services and needs.

Application Framework: It provides two types of data services as key value pair and generic message services. Generic message is a developer defined structure, whereas the key value pair is used for getting attributes within the application objects. ZDO provides an interface between application objects and APS layer in Zigbee devices. It is responsible for detecting, initiating and binding other devices to the network.

IV. APPLICATIONS OF ZIGBEE TECHNOLOGY

Industrial Automation: In manufacturing and production industries, a communication link continually monitors various parameters and critical equipments. Hence Zigbee considerably reduce this communication cost as well as optimizes the control process for greater reliability. Home Automation: Zigbee is perfectly suited for controlling home appliances remotely as a lighting system control, appliance control, heating and cooling system control, safety equipment operations and control, surveillance, and so on.

Smart Metering: Zigbee remote operations in smart metering include energy consumption response, pricing support, security over power theft, etc.

Smart Grid monitoring: Zigbee operations in this smart grid involve remote temperature monitoring, fault locating, reactive power management, and so on.

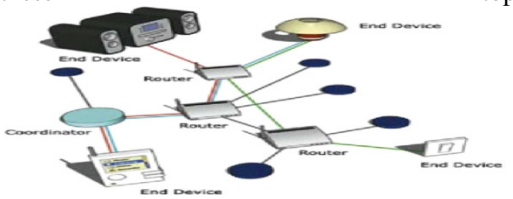
V. OPERATING MODES OF ZIGBEE AND ITS TECHNOLOGY

Zigbee two way data is transferred in two modes: Non-beacon mode and Beacon mode. In a beacon mode, the coordinators and routers continuously monitor active state of incoming data hence more power is consumed. In this mode, the routers and coordinators do not sleep because at any time any node can wake up and communicate. However, it requires more power supply and its overall power consumption is low because most of the devices are in an inactive state for over long periods in the network.

In a beacon mode, when there is no data communication from end devices, then the routers and coordinators enter into sleep state. Periodically this coordinator wakes up and transmits the beacons to the routers in the network. These beacon networks are work for time slots which means, they operate when the communication needed results in lower duty cycles and longer battery usage. These beacon and non-beacon modes of Zigbee can manage periodic (sensors data), intermittent (Light switches) and repetitive data types.

VI. ZIGBEE TOPOLOGIES

Zigbee supports several network topologies; however, the most commonly used configurations are star, mesh and cluster tree topologies. Any topology consists of one or more coordinator. In a star topology, the network consists of one coordinator which is responsible for initiating and managing the devices over the network. All other devices are called end devices that directly communicate with coordinator. This is used in industries where all the end point devices are needed to communicate with the central controller, and this topology is simple and easy to deploy. In mesh and tree topologies, the Zigbee network is extended with several routers where coordinator is responsible for staring them. These structures allow any device to communicate with any other adjacent node for providing redundancy to the data. If any node fails, the information is routed automatically to other device by these topologies.



As the redundancy is the main factor in industries, hence mesh topology is mostly used. In a cluster-tree network, each cluster consists of a coordinator with leaf nodes, and these coordinators are connected to parent coordinator which initiates the entire network. Due to the advantages of Zigbee technology like low cost and low power operating modes and its topologies, this short range communication technology is best suited for several applications compared to other proprietary communications, such as Bluetooth, Wi-Fi, etc. some of these comparisons such as range of Zigbee, standards, etc., are given below.

VII. CONCLUSION

Paper presented that ZigBee will increasingly play an important role in the future of computer and communication technology. 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, mainly, extremely low power consumption for (long) life. Therefore they are naturally different in their approach to their respective application arenas. The ZigBee Alliance targets applications "across consumer, commercial, industrial and government markets worldwide". Unwired applications are highly sought after in many networks that are characterized by numerous nodes consuming minimum power and enjoying long battery lives. In this paper we focus that ZigBee technology is designed to best suit for Low cost, low power, futuristics wireless Technology, for the reason that it enables reduced costs of development and very fast market adoption.

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