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| **Experiment-10**  **Demonstration of communication protocol ZigBee:**   1. **What is the range supported by ZigBee?**   ZigBee is widely used to control several devices within the range of 10–100 m. The communication system is cost-effective and simple to use that any other short range wireless technology as Bluetooth and Wi-Fi.   1. **Compare ZigBee and Bluetooth.**   Bluetooth was developed under IEEE 802.15.1, which is used for providing wireless communication through radio signals. The frequency range supported in Bluetooth vary from 2.4 GHz to 2.483 GHz. It covers less distance than Zigbee. In bluetooth, GFSK modulation technique is used. Whereas in Zigbee, BPSK and QPSK modulation techniques are used like UWB (Ultra-Wide Band). the frequency range supported in Zigbee mostly 2.4 GHz worldwide, it means 2.4 GHz is not supported all times. It covers more distance as compared with Bluetooth.   1. **What is mesh networking? How is this helpful?**   A mesh network is a network in which devices -- or nodes -- are linked together, branching off other devices or nodes. These networks are set up to efficiently route data between devices and clients. They help organizations provide a consistent connection throughout a physical space.   1. **How do we configure ZigBee node as coordinator?**  |  |  |  | | --- | --- | --- | | **Param** | **XBee A** | **Effect** | | **ID** | 2015 | Defines the network that a radio will attach to. This must be the same for all radios in your network. | | **JV** | — | Verifies if a coordinator exists on the same channel to join the network or to leave if it cannot be found. | | **CE** | Enabled [1] | Sets the device as coordinator. | | **DH** | — | Defines the destination address (high part) to transmit the data to. | | **DL** | — | Defines the destination address (low part) to transmit the data to. The address 0000000000000000 can be used to address the coordinator. | | **NI** | COORD | Defines the node identifier, a human-friendly name for the module.The default NI value is a blank space. Make sure to delete the space when you change the value. | | **SP** | 1F4 | Defines the duration of time spent sleeping. 1F4 (hexadecimal) = 500 (decimal) x 10 ms = 5 seconds. | | **SM** | — | Enables cyclic sleep mode in the end device. | | **SO** | — | Keeps the module awake during the entire period. |  1. **Write five application areas where Zigbee can be used?**  * Home automation. * Wireless sensor networks. * Industrial control systems. * Building automation. * Remote wireless microphone configuration.  1. **Identify the countries where Zigbee is prominently used and for what applications.**   Zigbee is a low-cost, low-power, wireless mesh network standard targeted at battery-powered devices in wireless control and monitoring applications. Zigbee delivers low-latency communication. Zigbee chips are typically integrated with radios and with microcontrollers. Zigbee operates in the industrial, scientific and medical (ISM) radio bands: 2.4 GHz in most jurisdictions worldwide; though some devices also use 784 MHz in China, 868 MHz in Europe and 915 MHz in the US and Australia, however even those regions and countries still use 2.4 GHz for most commercial Zigbee devices for home use.  **Lab Experiments:**   1. **Interfacing with Zigbee using Raspberry Pi.**   **Components Required:**  Raspberry Pi  -The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse.  - It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.  - It’s capable of doing everything you’d expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games.  Zigbee  - Zigbee is a standards-based wireless technology developed to enable low-cost, low-power wireless machine-to-machine (M2M) and internet of things (IoT) networks. Zigbee is for low-data rate, low-power applications and is an open standard.  **Code for Router and End device:**  import time  import serial  ser=serial.Serial(port='/dev/ttyUSBO',baudrate=9600,parity=serial.PARITY\_NONE,  stopbits=serial.STOPBITS\_ONE,bytesize=serial.EIGHTBITS,timeout=1  counter=0  while True:  text=raw\_input("enter your message: ")  ser.write(text)  print "Sent: " + text  time.sleep (2)  if text == "quit":  break  **Output:**  Enter your message: Message from router  Quit  **Code for Coordinator:**  import time  import serial  ser=serial.Serial(port='/dev/ttyUSBO',baudrate=9600,parity=serial.PARITY\_NONE,  stopbits=serial.STOPBITS\_ONE,bytesize=serial.EIGHTBITS,timeout=1  counter=0  while True:  text=ser.readline().strip()  print(text)  **Output:**  Message from router  quit |