Assignment Number - 7

Title: Write a network application for communication between two devices using Zigbee.

Problem Definition: Understanding and connectivity of Raspberry-Pi / BeagleBoard with a Zigbee module. Write a network application for communication between two devices using Zigbee.

Objectives:

- ➔ To understand functionalities of various single board embedded platform fundamentals.
- ➔ Develop applications for Communication between more Raspberry-Pi hardware.

Outcomes:

Students will be able to:

- ➔ Perform the connectivity with Raspberry-Pi, BeagleBoard, Arduino and other microcontrollers.
- ➔ Implement the transmitter and receiver program using Python by using Zigbee devices.

Software and Hardware Requirements:

Python, two Raspberry-Pi devices, Zigbee device, Latest Version of 64 bit Operating Systems, Open Source Fedora-GHz, 8 GB RAM, 500 GB HDD, 15'' Color Monitor, Keyboard, Mouse

Theory:

ZigBee Communication Using Raspberry Pi ZigBee is a communication device used for the data transfer between the controllers, computers, systems, really anything with a serial port. As it works with low power consumption, the transmission distance is limited to 10–100 meters line-of-sight. ZigBee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. ZigBee is typically used in low data rate applications that require long battery life and secure networking. Its main applications are in the field of wireless sensor network based on industries as it requires short-range low-rate wireless data transfer. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other wireless networks.

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 a 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 supports different network configurations for master to master or master to slave communications, and also, it can be operated in different modes as a result the battery power is conserved. Zigbee networks are extendable with the use of routers and allow many nodes to interconnect with each other for building a wider area network.

Steps:

These instructions describe how to add two XBee modules to XCTU. However, it can be used to add any number of XBee modules.

1. Connect two XBee modules to the computer using the USB cables.
2. Launch XCTU.
3. Click the Configuration working modes button.
4. Click the Discover radio modules button.
5. In the Discover radio devices dialog, select the serial ports where you want to look for XBee modules, and click Next.
6. In the Set port parameters window, maintain the default values and click Finish.

   As XCTU locates radio modules, they appear in the Discovering radio modules dialog box.
7. Click Add selected devices once the discovery process has finished.
8. Click Finish.

XBee TH Grove Development Board:

XBee SMT Grove Development Board:

To transmit data wirelessly between the XBee modules, configure them to be in the same network.

1. Set up the first XBee module (XBEE_A):
    1. Select the first XBee module.
    2. Click the Load default firmware settings button.
    3. Configure the following parameters:

        ID: D161

        DH: 0013A200

        DL: SL of XBEE_B (Enter the last eight characters of the MAC address for XBEE_B. Or select XBEE_B and find its SL value.)

        NI: XBEE_A

        PL: 0
    4. Click the Write radio settings button.
2. Set up the second XBee module (XBEE_B):
    1. Select the second XBee module.
    2. Click the Load default firmware settings button.
    3. Configure the following parameters:

        ID: D161

        DH: 0013A200

        DL: SL of XBEE_A (Enter the last eight characters of the MAC address for XBEE_A. Or select XBEE_A and find its SL value.)

NI: XBEE_B

PL: 0

4. Click the Write radio settings button.

3. After you write the radio settings for the XBee modules, their names appear in the Radio Modules area.
4. For more information about the parameters, see the following table:

Paramet	XBEE_A	XBEE_B	Effect
ID	D161	D161	Defines the network that a radio will attach to. This must be the same for all devices in your network.
DH	0013A200	0013A200	Defines the destination address (high part) for the message.
DL	SL of XBEE_B	SL of XBEE_A	Defines the destination address (low part) for the message. The value of this setting is the SL (Serial Number Low) of the other module.
NI	XBEE_A	XBEE_B	Defines the node identifier. Note The default NI value is a blank space. Delete the space when you change the value.
PL	0	0	Defines the transmitter output power level. When you are creating a mesh network, set this parameter to the lowest value (0) to help reduce the distance between the two devices.

Use the XCTU console to have your two XBee modules send messages to each other.

1. Switch both XBee modules to the console's working mode.
2. Open a serial connection for each XBee.
    1. Select XBEE_A and click.
    2. Select XBEE_B and click.
3. Click the Detach view button to see both consoles at the same time.

    1. In the Console log area for XBEE_A, type "Hello XBEE_B!"
    2. In the Console log area for XBEE_B, type "Hello XBEE_A!"
4. The message of the sender is in blue font, and the message of the receiver is in red font.
5. Close the window for XBEE_B.
6. Keep the serial connections open for both XBee modules.

Conclusion:

We have successfully implemented an application that enables communication between two Raspberry-Pi devices using ZigBee.