AIM:
To create a project for implement a wireless communication protocol on an embedded system- ZigBee.

Introduction
ZigBee is one of the Advanced Wireless Technology and CC2430 is the first single-chip IEEE 802.15.4 compliant and ZigBee System on Chip (SoC) RF transceiver with integrated microcontroller.

Vi-ZigBee Development Kit which includes the Hardware using CC2431(latest version of CC2430) and Software to support the ZigBee Protocol. The included software helps to develop the application based on ZigBee and IEEE 802.15.4 compliant. It also helps to understand the ZigBee Protocol and IEEE 802.15.4 compliant in such a way to perform the research on these standards and protocols.

ZigBee
ZigBee is a wireless communication protocol for low power, low rate, reliable, and secured wireless personal area network, developed by ZigBee Alliance based on IEEE 802.15.4 standard.

A ZigBee network is a multi-hop network with battery-powered devices. This means that two devices that wish to exchange data in a ZigBee network may have to depend on other intermediate devices to be able to successfully do so.

Because of this cooperative nature of the network, proper functioning requires that each device (i) perform specific networking functions and (ii) configure certain parameters to specific values. The set of networking functions that a device performs determines the role of the device in the network and is called a device type.

The set of parameters that need to be configured to specific values, along with those values, is called a stack profile.

Device Types
There are three logical device types in a ZigBee network – (i) Coordinator (ii) Router and (iii) End-device. A ZigBee network consists of a Coordinator node and multiple Router and Enddevice nodes.
An example network is shown in the diagram above, with the ZigBee coordinator (in black), the routers (in red) and the end devices (white).

**Coordinator**

This is the device that “starts” a ZigBee network. It is the first device on the network. The coordinator node chooses a channel and a network identifier (also called PAN ID) and then starts the network. The coordinator node can also be used, optionally, to assist in setting up security and application-level bindings in the network. Note that the role of the Coordinator is mainly related to starting up and configuring the network. Once that is accomplished, the Coordinator behaves like a Router node (or may even go away). The continued operation of the network does not depend on the presence of the Coordinator due to the distributed nature of the ZigBee network.

**Router**

A Router performs functions for (i) allowing other devices to join the network (ii) multihop routing (iii) assisting in communication for its child battery-powered end devices. In general, Routers are expected to be active all the time and thus have to be mains-powered. A special mode of network operation, called “Cluster Tree”, allows Routers to operate on a periodic duty cycle and thus enables them to be battery-powered.

**End Device**

An end-device has no specific responsibility for maintaining the network infrastructure, so it can sleep and wake up as it chooses. Thus it can be a battery-powered node. Generally, the memory requirements (especially RAM requirements) are lower for an end-device.
CC2431

The CC2431 is a true System-on-Chip (SoC) solution specifically tailored for IEEE 802.15.4 and ZigBee applications. It enables ZigBee nodes to be built with very low total bill of material costs. The CC2431 combines the excellent performance of the leading CC2420 RF transceiver with an industry-standard enhanced 8051 MCU, 128 KB flash memory, 8 KB RAM and many other powerful features. Combined with the industry leading ZigBee protocol stack (Z-Stack) from Figure 8 Wireless / Chipcon, the CC2431 provides the market’s most competitive ZigBee solution. The CC2431 is highly suited for systems where ultra low power consumption is required. This is ensured by various operating modes. Short transition times between operating modes further ensure low power consumption.

**Key Features**

- High performance and low power 8051-microcontroller core.
- 2.4 GHz IEEE 802.15.4 compliant RF transceiver (industry leading CC2420 radio core).
- Excellent receiver sensitivity and robustness to interferers.
- 32, 64 or 128 KB in-system programmable flash.
- 8 KB RAM, 4 KB with data retention in all power modes.
- Powerful DMA functionality.
- Very few external components.
- Only a single crystal needed for mesh network systems.
- Low current consumption (RX: 27mA, TX: 25mA, microcontroller running at 32 MHz).
- Only 0.9:A current consumption in power-down mode, where external interrupts or the RTC can wake up the system.
- Less than 0.6:A current consumption in standby mode, where external interrupts can wake up the system.
- Very fast transition times from low-power modes to active mode enables ultra low average power consumption in low duty-cycle systems.
- CSMA/CA hardware support.
- Wide supply voltage range (2.0V – 3.6V).
- Digital RSSI / LQI support.
- Battery monitor and temperature sensor.
- 8-14 bits ADC with up to eight inputs.
- AES security coprocessor.
- Two powerful USARTs with support for several serial protocols.
- Watchdog timer.
- One IEEE 802.15.4 MAC Timer, one general 16-bit timer and two 8-bit timers.
- Hardware debug support.
- 21 general I/O pins, two with 20mA sink/source capability.
- Powerful and flexible development tools available.
- RoHS compliant 7x7mm QLP48 package.
- Internal Location Engine module.
HARDWARE DESCRIPTION

The Vi ZigBee Development Kit includes following hardware modules such as,

- C Vi-Z RF Module
- C Vi-Z Debugger and
- C V-Z Battery Board and

it is more flexible to develop application based on IEEE 802.15.4 standard and ZigBee protocol. The Vi-Z RF Module is consisting of CC2431 (SoC) processor and its corresponding RF circuitry to transmit the data Over The Air (OTA) at ISM band for low power wireless network.

The Vi-Z Debugger is designed with 8051F320 processor for downloading the code to the SoC present in the Vi-Z RF Module and it can also be used as dongle for TI’s Packet sniffer, Location Engine, Daintree Networks SNA software. The Vi-Z Battery Board provides the battery power to Vi-Z RF Module and makes it to work as a standalone system with many user interfaces such light sensor, potentiometer, LEDs, micro switches, and RS232 Interface.