CSE 4215 (Network Security)

Chapter 5

Lecture 12:

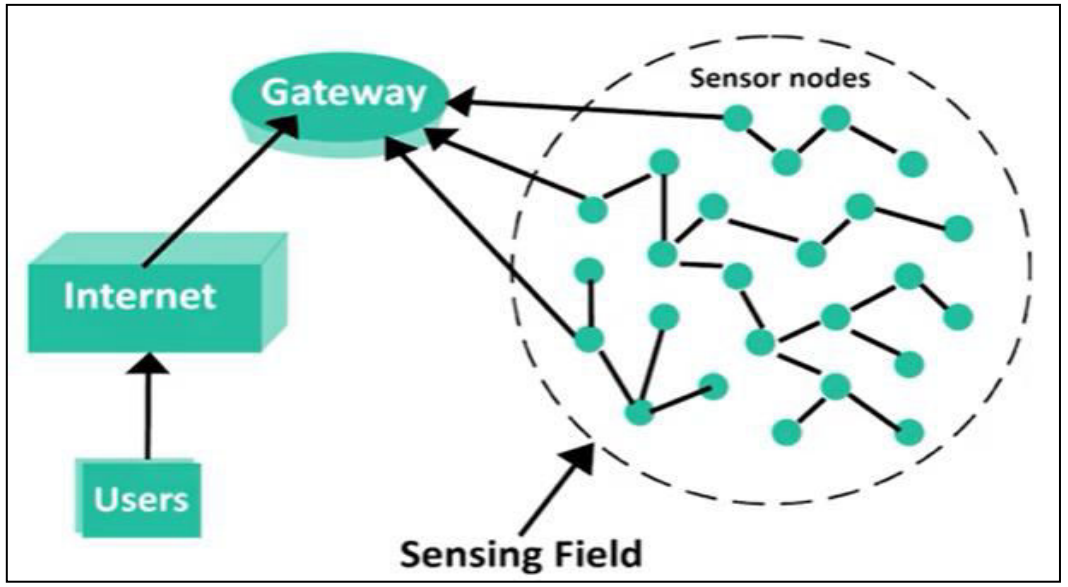
Wireless Networks

Wireless Sensor Network

What is Wireless Sensor Network?

Wireless Sensor Network (WSN) is an infrastructure-less wireless network that is deployed in a large number of wireless sensors in an ad-hoc manner that is used to monitor the system, physical or environmental conditions.

Sensor nodes are used in WSN with the onboard processor that manages and monitors the environment in a particular area. They are connected to the Base Station which acts as a processing unit in the WSN System.
Base Station in a WSN System is connected through the Internet to share data.



Components of Sensor Node

- Sensing Unit
- Communication Unit
- Processing Unit
- Storage Unit
- ADC (Analog to Digital Converter)
- Power
- Options: (Like Location

Types of Sensor Nodes

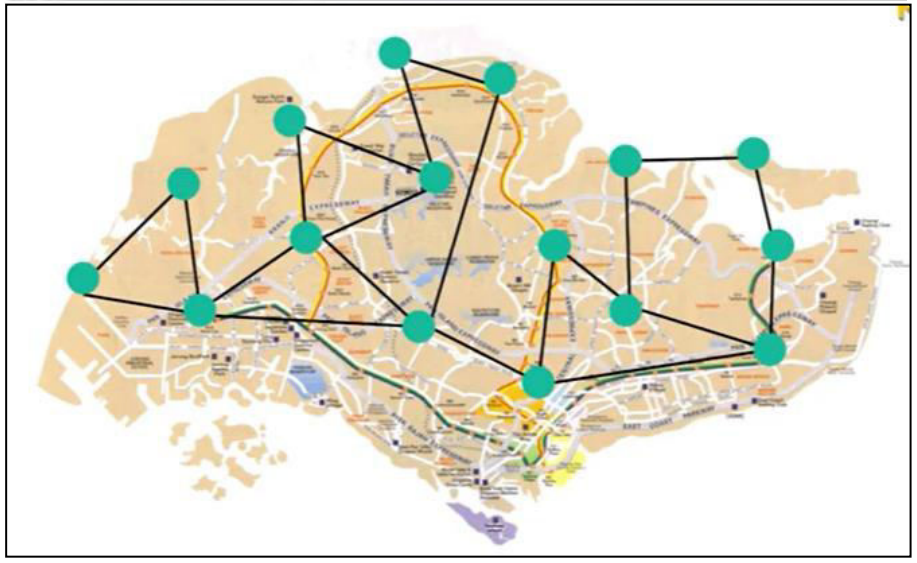
- Arial Sensor Nodes
- Terrestrial Sensor Nodes
- Under Water Sensor Nodes

Applications of Sensor Node

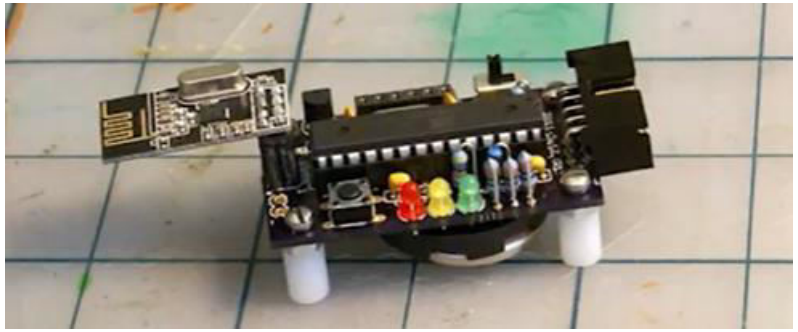
- Internet of Things (IOT)
- Surveillance and Monitoring for security, threat detection
- Environmental temperature, humidity, and air pressure
- Noise Level of the surrounding
- Medical applications like patient monitoring
- Agriculture
- Landslide Detection

Wireless Sensor Network

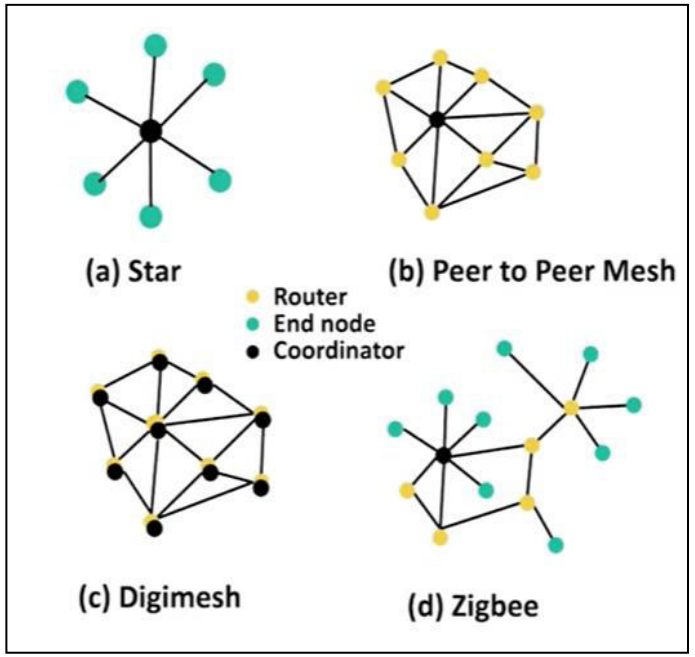
Real-life Applications : SMART CITY



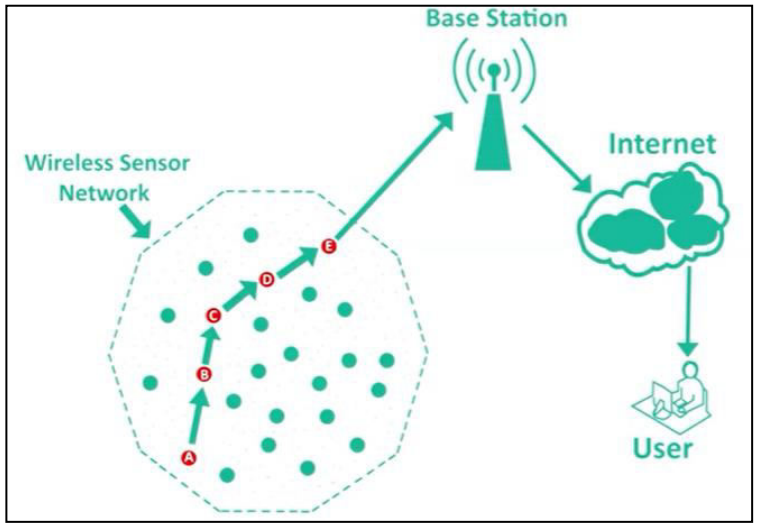
Sensors run on minimal or zero human assistance



Low Power Sensor Node



Topological Configuration



As the radio transmission range is few tens of meters, so they relay the data to reach at gateway known as multi-hop

Wireless Sensor Network

ZigBee

There are two short range wireless technologies

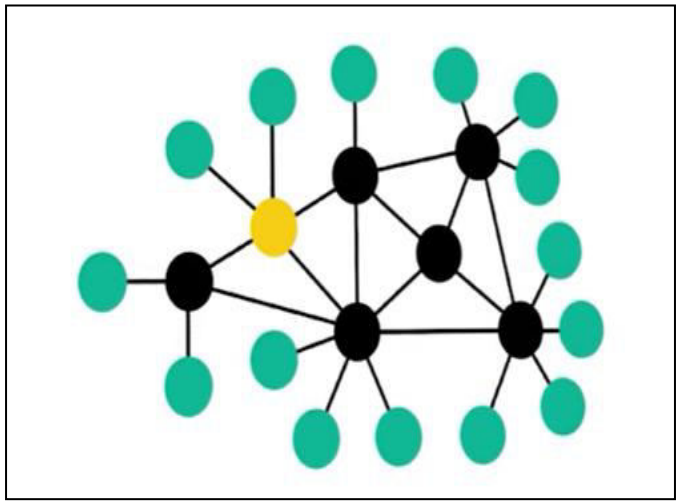
For small file use BT

For larger file use WiFi

To connect large number of battery operated devices, Wifi is not suitable because its takes lot of power. However, Bluetooth takes low power but can connect limited number of devices. The solution is Zigbee.

TECHNOLOGY	DATA RATE
	≥1Gbps
	1-3 Mbps
ZigBee	250 Kbps

ZigBee Device

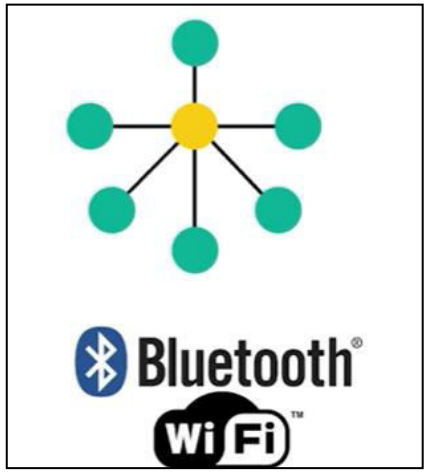


ZigBee Topology (Mesh)

- Sends the information
- Carries forward the information
- End device receive information

Advantages of ZigBee

1. Zigbee follow mesh topology whereas Bluetooth & WiFi uses Star topology
2. It increases the system reliability
3. Large number of end devices can be connected to the neighboring node.
4. It uses 128 bit AES encryption for message signal



Wireless Sensor Network

Hardware of Zigbee Network

ZigBee Co-ordinator (ZC): This is the most important device as it forms the root of the network tree and helps to bridge to other networks. This means that you will find one ZigBee coordinator in each network as this is the device responsible for the start of the network. This device contains all the information of the network and functions as a Trust Center & repository for the security keys.
ZigBee Router (ZR): In addition to running an application function, its is used to route the data from other devices and help it reach the destination.
ZigBee End-Device (ZED): The end device contains just enough functionality to talk to either the co-ordinator or the router. Note that it cannot rely data from other devices. This causes the node to stay asleep for a significant time thereby increasing battery life to a considerable extent. A **ZED** device requires least amount of energy as compared to the **ZC or ZR.**

Properties of Zigbee Network

- The ZigBee protocol operates globally on a single frequency of 2.4 GHz.
- ZigBee offers wireless range of 70m indoors and and 400m outdoors.
- It offers networking flexibility to covers homes of all size by offering support for multiple networks like point-to-point, point-to-multipoint mesh-networks.
- Low latency and Low Duty cycle leads to lower power consumption giving sensors the long-lasting battery life for up to 7 years.
- Caters to thousands of devices for spread networks.
- ZigBee uses AES 128 encryption (government, commercial and military grade encryption used across the Internet) thus protecting your information over the air transfers.
- ZigBee can easily integrate monitoring and control of lights systems, security systems, convenience and motion detection.
- The mesh-network operability of ZigBee reduces the chances of failure at nodes and the ad-hoc routing offers greater stability.

Wireless Sensor Network

Applications of Zigbee Network

SMART HOME

Welcome to ZigBee City

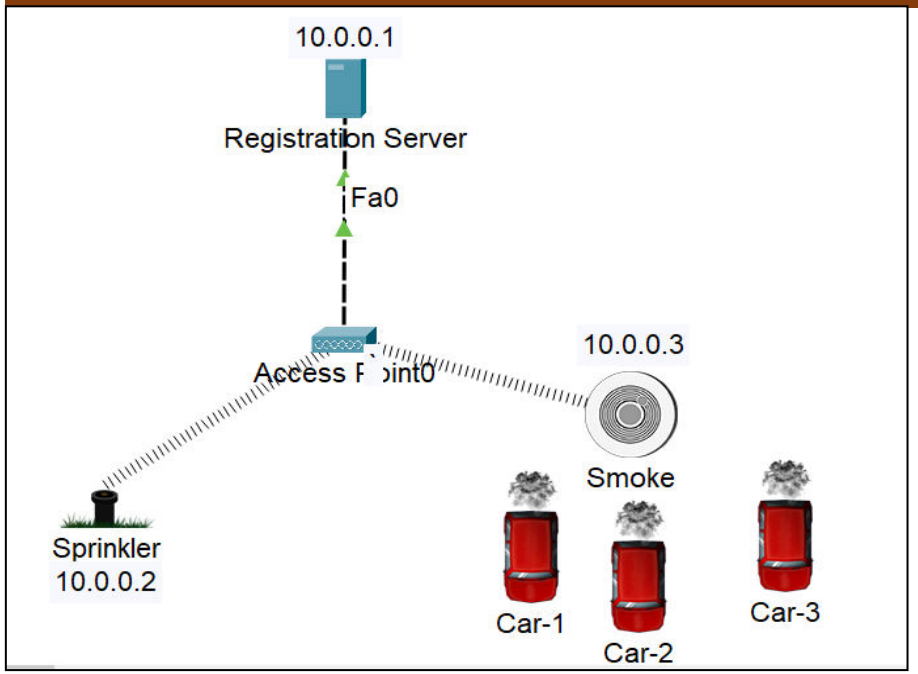
Gothenburg, Sweden, will be the site of the world's largest ZigBee network.

October 25, 2007 EH Staff

Employing a metering infrastructure that uses ZigBee wireless technology, the city of Gothenburg, Sweden (270,000 homes) will become home to the largest ZigBee network in the world. The city chose the NURI AiMiR Advanced Meter-reading Management (AMM) system, which is based on Ember Corporation's ZigBee-powered sensors, software, and wireless mesh networking. The system will allow the electric company to save time and money by remotely accessing each home's meters to measure and record energy usage. It will also allow each home's metering system to communicate with others, and will give homeowners accurate readings on their energy usage.

Wireless Sensor Network

Applications of Sensor Node: Smoke Detector




```
//Wireless Smoke Detector
//Place i) Server-PT ii) AccessPoint-PT iii)Lawn Sprinkler-IOT
  iv) Smoke Detector-IOT v) Three Old Car for smoke
//For Access-Point go to Config-->Port1-->SSID to cisco
//For Lawn Sprinkler go to Config-->Wireless0-->Set SSID to cisco
//For Smoke Detector go to Config-->Wireless0-->Set SSID to cisco
//For Server-PT, Set IP 10.0.0.1 subnet 255.0.0.0
//For Lawn Sprinkler go to Config-->Wireless0
        Set IPV4 10.0.0.2 subnet 255.0.0.0
//For Smoke Detector go to Config-->Wireless0
        Set IPV4 10.0.0.3 subnet 255.0.0.0
```

```
//For Server-PT, go to Service-->IOT-->Set on
   go to Deskop-->Web Browser-->set url to 10.0.0.1
   use signup set username-->admin  and   password-->admin
   click create to complete the registration
//For Lawn Sprinkler go to Config-->Settings-->Remote Server from IOT
     Server address: 10.0.0.1
     User Name: admin  and   Password:adminp
     click Connect
/For Smoke Detector go to Config-->Settings-->Remote Server from IOT
     Server address: 10.0.0.1
     User Name: admin     Password:adminp
     click Connect
//For Server Go to Destop-->Web Browser-->login to admin
    Both Sprinkler and Smoke Detector are seen as green
    Now Select Condition tab
    Select Add-->Type a name Smoke on and Tic Enabled
    From match Select-->Smoke-->level-->select >= and type 0.5
    Then set Sprinkler-->status-->true
    Click OK from bottom
    Again Select Add and Tic Enabled
    From match Select-->Smoke-->level-->select < and type 0.5
    Then set Sprinkler-->status-->false
    Click OK from bottom
    Repeat above to Add another condition smoke<0.5 then Sprinkler false
    Go to Home and maximize Sprinkler and Smoke
    Now Alt+Click to start smoke of cars and
    look at the level of smoke and when it is more than
    0.5 Sprinkler starts
```