WSN Practical-1

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Aim: Understanding the Sensor Node Hardware.

Wireless sensor networks (WSNs) have the power of distributed communication, computing and sensing features. They are characterized as infrastructure less, fault tolerant and self-organizing networks which provide opportunities for low-cost, easy-to-apply, rapid and flexible installations in an environment for various applications.

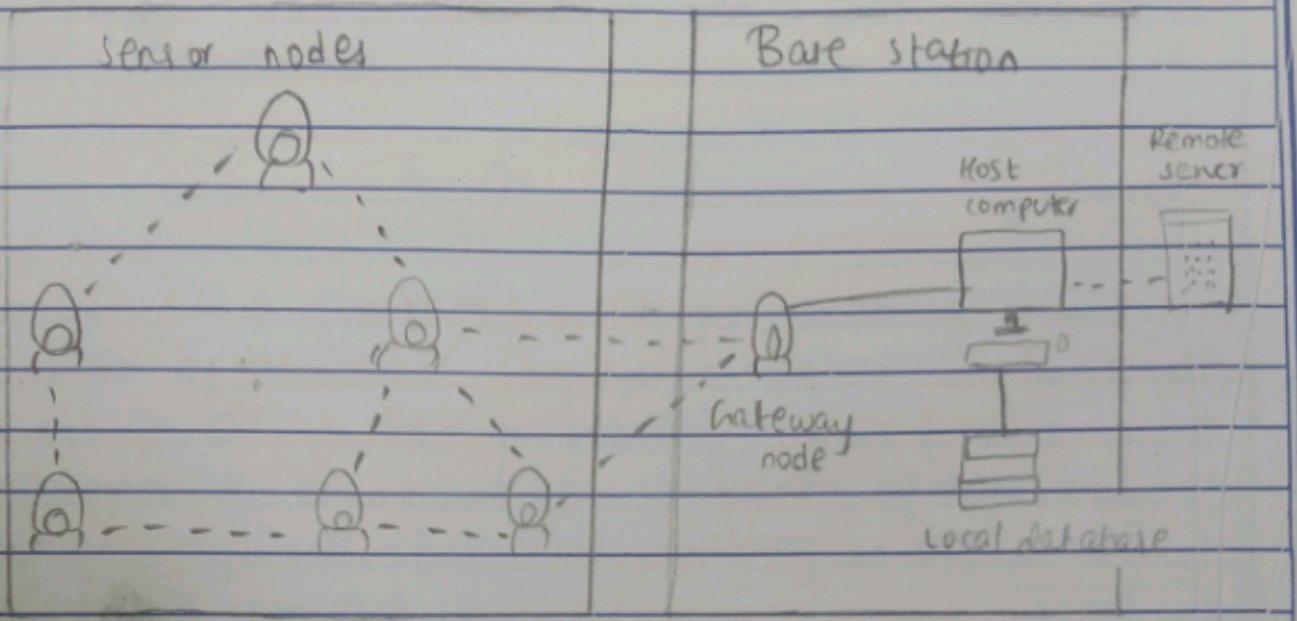
The components of sensor node hardware are as follows:

1. Sensors: Sensors in WSN are used to capture the environmental variables which is used for data acquisition.

2) Nodes: They are used to enhance the network reliability.

3) Base Station: Besides sensor nodes, another fundamental item - a base station - can be found in WSN.

4) Graphical User Interface: GUI is the web-based software package, that allows the data collected by sensors to be viewed.



Example of a Wireless Sensor Network (WSN)

Practical-2

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Aim: Exploring and understanding TinyOS computational concepts: Events, Commands and Task, nesC model, nesC Components

TinyOS

TinyOS has a component-based programming model, codified by the NesC language, a dialect of C. TinyOS is not an OS in the traditional sense; it is a programming framework for embedded systems and set of components that enable building an application. specific OS into each application.

The computational concepts of TinyOS include:

1. Events: When a command is requested, event signals the completion of that service.

2. Commands: A command is typically a request to a component to perform some service, such as initiating a sensor reading.

3. Task: Rather than performing a computation immediately, commands and event handlers may post a task, a function executed by the TinyOS scheduler at a later time

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nesC Model

1. nesC is a component-based, event-driven programming language used to build applications for the TinyOS platform.
2. TinyOS is an operating environment designed to run on embedded devices used in distributed wireless sensor networks.
3. nesC is based on the concept of components, and directly supports TinyOS's event based concurrency model

nesC Components

1. nesC applications are built by writing and assembling components.
2. A component provides and uses interfaces. These interfaces are the only point of access to the component.
3. An interface generally models some service and is specified by an interface type.
4. Components are also a clean way to abstract the boundary between hardware and software.
5. A subtle but important point is that bidirectional interfaces make it very easy to support hardware interrupts.

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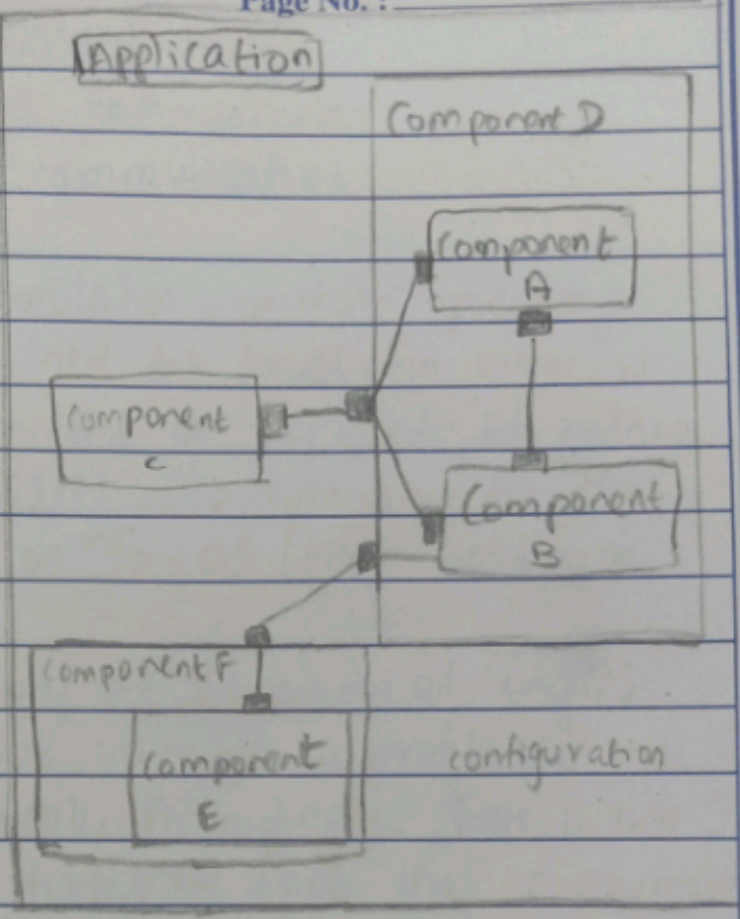
nesC model

- Two key concepts
  1. Interfaces
     - uses
     - provided
  2. Components
     - modules
     - configurations.

Application: graph of components: only point of access to components



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Aim: Understanding TOSSIM for:

- Mote - mote radio communication
- Mote - PC Serial communication

TOSSIM is a discrete simulator, or more precisely emulator, of TinyOS at the bit level. An event is generated for each transmitted or received bit rather than one per packet. TOSSIM is a simulator for the execution of nesC model on TinyOS / MICA hardware.

TOSSIM is conceived to study the behaviour of TinyOS and its applications; it is not intended to profile the performance of new protocols. Accordingly, there is one significant drawback and that is the fact that every mote might run the same code. Consequently, the usability of TOSSIM for applications involving heterogeneous applications TOSSIM has been shown to handle simulation of a sensor network with around a thousand motes.

The simulator engine provides a set of communication services for interacting with external applications. These services allow programs to connect to TOSSIM over a TCP socket to monitor or activate a running simulation. Details of the ADC & radio models such as reading & loss rates, can be both queried and set. Programs can also receive higher level information, such as the packet transmissions and receptions or application-level events.

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Practical No.: 4 Topic : WSN

Aim: Create and simulate a simple adhoc network.

Software used: Omnetapp 5.7. INET 4.3.6 framework.

Theory:

- As adhoc network is one that is spontaneously formed when devices connect & communicate with each other
- Adhoc networks are mostly wireless LAN
- The devices communicate with each other directly instead of relying on a base station or access points as in wireless LANs for data transfer coordination.
- Each device partipates in routing activity, by determing the route using the routing algorithm & forwarding data to other devices via this route.

- There are different types of Wireless Ad Hoc Networks.

- There are certain limitations of Addhoc Wireless Network.

- We can create an Adhoc network with 7 hosts using Omnetpp & INET.

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Practical No.: 5 Topic : WSN

Aim: Understanding, Reading, Analyzing the Routing Table of a network.

Software Used: Cisco Packet Tracer 7.2.0.026

Theory:

A routing table is similar to a distribution map in package delivery. Whenever a node needs to send data to another node on a network, it must first know where to send it. If the node cannot directly connect to the destination node, it has to send it via other nodes along a route to the destination node.

Each node needs to keep track of which way to deliver various packages of data, and for this it uses a routing table.

A routing table is data file in RAM that is used to store route information about directly connected and remote networks.

Nodes can also share the contents of their routing table with other nodes.

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Practical No.: 6 Topic : WSN

Aim: Create a basic MANET implementation simulation for Packet animation & Packet Trace.

Software Used : Omnet++ 5.7, INET 4.3.6. framework.

Theory:

- MANET (Mobile Adhoc Network) also called as wireless Adhoc network that usually has a routable networking environment on top of a Link layer adhoc network.
- They consist of a set of mobile nodes connected wirelessly in a self-configured, self-healing network without having a fixed infrastructure.
- MANET nodes are free to move randomly as the network topology changes frequently.
- Each node behaves as a router as they forward traffic to other specified nodes in the network.
- MANET may operate a standalone fashion or they can be part of large internet.
- They form a highly dynamic autonomous topology with the presence of one or multiple different transceivers between nodes.

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Practical No.: 7 Topic : WSN

Aim: Implement a Wireless Sensor Network Simulation.

Steps:

1) Create a network using 1 Router-PT, 2 Access Point-PT-N and some end devices like tablets, smartphones & laptop

2) Connect access points and router using coaxial cable.

3) In laptop connect Linksys WPC300N (The linksys-WPC300N provides one 2.4 GHz wireless interface suitable for connection to wireless networks. The module supports protocols that use Ethernet for LAN access)

4) If connecting PC then connect PT-HOST-NM-1W (The PT-HOST-NM-1N module provides one 2.4 GHz wireless interface suitable for connection to wireless networks. The module supports protocols that use Ethernet for LAN access).

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Practical No.: 8 Topic : WSN

Aim : Create MAC protocol simulation implementation for WSN.

Steps :

1) Create a network using Linksys WRT300N & some end devices like smart phones, laptop PC
2) In laptop connect Linksys WPC300 N (The Linksys-WPC300N module provides one 2.4GHz wireless interface suitable for connection to wireless networks. The module supports protocols that use Ethernet for LAN access).
3) In the GUI of wireless router go to Wireless MAC filter and enable it.
4) For the MAC address go to the config tab of the end device under fast Ethernet copy the MAC address put colon after 2 digits & save it in textbox below end devices.
5) Now enter the MAC Address in the MAC address filter list of the end devices to prevent end devices from accessing the wireless routers.

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Practical No.: 9 Topic : WSN

Aim: Simulate Mobile Adhoc Network with Directional Antenna.

Steps :

1) Create a network using Home gateway, and IOT devices.

2) The Home Gateway provides 4 Ethernet ports as well as a wireless access point configured with the "HomeGateway" ssid on channel 6. WEP / WPA-PSK / WPA2 enterprise can be configured to secure wireless connections. The picture below shows 4 IOT Things attached to a Home Gateway. The Home Gateway is connected to the Internet through it's Internet WAN ethernet port.

3) For fan go to Config > Advance > IO config > network adapter : W

4) Copy the SSID of home gateway (Config > wireless > SSID)

5) In fan and window select home gateway in IO config.

6) Go to Smartphone > desktop > IOT monitor > Control the IOT devices.

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Practical No.: 10 Topic : WSN

Aim: Create a mobile network using Cell Tower, Central Office Server, Web Browser & Web Server. Simulate connection between them.

Steps: 1) Create a network using smartphone, wireless router WRT300N, Hub-pt, 1841 Router, central-office-server, Cell-Tower.

2) Connect cell tower & central office server using coaxial cable.

3) Connect wireless router WRT300N, Hub-pt, 1841 Router, central-office-sever using copper straight through wire.

4) Click on wireless router. In config tab, select internet. In internet, choose IP configuration as static & set IP address & default gateway.

5) Click on router 1841. In config tab select interface & give IP address

6) Click on smartphone & ping router 1841