

Kadi Sarva Vishwavidyalaya, Gandhinagar

MCA Semester II

MCA-24 (C) : Wireless Sensor Networks

Rationale: The objective of this course is based on understanding Overview, Technology, Protocol and Application of wireless sensor networks (WSN). It covers theoretical as well as applied aspects of wireless sensor networks platform and analyzes a number of working systems (case studies).

Prerequisite:

Knowledge of Knowledge of Wireless Networks, Protocols, Transmission Media, Computer Network Operating Systems

Learning Outcomes:

Students will learn 5 aspects of WSN in this course, which are as under:

1. They will learn about basic concepts of WSN
2. They will learn concepts of protocols used in WSN.
3. They will learn various strategies used in WSN.
4. They will learn how to implement the TCP protocol in with respect to WSN
5. They will learn different middleware used in WNS, WNS management challenges and models and Operating System environment used.

Sub Total Credit	Teaching scheme		Examination scheme				
	(per week)		MID	CEC	External		Total Marks
	Th	Pr	Th	Th	Th.	Pr.	
5	3	4	25	25	50	50	150

Course content:

UNIT- I: Overview of Wireless Sensor Networks & Technology

[10%]

- Basics of wireless sensors network's
- Commercial and Scientific Applications of Wireless Sensor Networks
- Wireless sensors network technology
 - a. Sensor Node Technology
 - b. WN Operating Environment

UNIT-II: Wireless Sensors Network Protocols

[20%]

- MAC Protocols for WSNs
 - Schedule-Based Protocols
 - Random Access-Based Protocols
- IEEE 802.15.4 LR-WPANs Standard Case Study - PHY Layer & MAC Layer
- Routing Challenges and Design Issues

- Network Scale and Time-Varying Characteristics
- Resource Constraints
- Sensor Applications Data Models

UNIT-III: Routing Strategies

[25%]

- WSN Routing Techniques
- Flooding and Its Variants
- Sensor Protocols for Information via Negotiation
- Low-Energy Adaptive Clustering Hierarchy
- Power-Efficient Gathering in Sensor Information Systems
- Directed Diffusion
- Geographical Routing

UNIT-IV: Transport Control Protocols

[25%]

- CODA (Congestion Detection and Avoidance)
- ESRT (Event-to-Sink Reliable Transport)
- RMST (Reliable Multi-segment Transport)
- PSFQ (Pump Slowly, Fetch Quickly)
- GARUDA
- ATP (Ad Hoc Transport Protocol)
- Problems with Transport Control Protocols

UNIT-V: WSN- Middleware, Management and Operating System

[20%]

- Middleware - MiLAN (Middleware Linking Applications and Networks) & Impala
- Management
 - a. Network Management Requirements
 - b. Network Management Models
 - c. Network Management Design Issues
- Operating Systems – TinyOS & Mate

Text Book:

Wireless Sensor Networks Technology, , Protocols and Application by KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, Wiley

Unit wise coverage from text book(s):

UNIT 1 :	BOOK 1	CH 1 ,2,3 (FULL)
UNIT II	BOOK 1	CH 5 (5.4,5.6) CH 6(6.4)
UNIT III	BOOK 1	CH 6 (6.5)
UNIT IV	BOOK 1	CH 7 (7.3,7.4)
UNIT V	BOOK 1	CH 8 (8.4.1, 8.4.8) CH 9 (9.2, 9.3, 9.4) CH 10(10.3.1,10.3.2)

Practical Programs: To be done in NS-2 or NS-3 simulator. TCL scripts to be used for simulation.

WIRED SCENARIO

1. Write a script in NS to simulate the following scenario –
A network consists of 3 nodes (Node 0, 1 and 2). The duplex link between node 0 and node 1 has 1 Mbps of bandwidth and 10 ms of delay. The duplex link between node 1 and node 2 has 2Mbps of bandwidth and 10 ms of delay. Each link uses a Drop Tail queue. A "TCP" agent is attached to node 0. "TCPSink" agent is attached to node 2. Both the agents are connected. As default, the maximum size of a packet that a "TCP" agent can generate is 1000bytes. A "TCPSink" agent generates and sends ACK packets to the sender (tcp agent) and frees the received packets. The ftp is set to start at 0.2 sec and stop at 3.0 sec.
2. Write a script in NS to simulate the following scenario –
A network consists of 5 nodes (Client1, Client2, Router1, Router2 and Endserver1). The duplex links between Client1 Client2 and Router1 have 2 Mbps of bandwidth and 100 ms of delay. The duplex link between Router1 and Router2 has 2Mbps of bandwidth and 100 ms of delay. The duplex link between Router2 and Endserver1 has 200Kbps of bandwidth and 100 ms of delay. Each link uses a Drop Tail queue. A "TCP" agent is attached to Client1, and Client2. "TCPSink" agent is attached to Endserver1. Both the agents are connected. As default, the maximum size of a packet that a "TCP" agent can generate is 1000bytes. A "TCPSink" agent generates and sends ACK packets to the sender (tcp agent) and frees the received packets. The ftp is set to start at 0.5 sec and stop at 5.5 sec.
3. Write a script in NS to simulate the following scenario –
A network consists of 6 nodes (Client1, Client2, Router1, Router2, Router3 and Server1). The duplex links between Client1 Client2 and Router1 have 3 Mbps of bandwidth and 200 ms of delay. The duplex link between Router1 and Router2 has 2Mbps of bandwidth and 100 ms of delay. The duplex link between Router2 and Server1 has 100Kbps of bandwidth and 300 ms of delay. Each link uses a Drop Tail queue. A "TCP" agent is attached to Client1, and Client2. "TCPSink" agent is attached to Server1. Both the agents are connected. As default, the maximum size of a packet that a "TCP" agent can generate is 2000bytes. A "TCPSink" agent generates and sends ACK packets to the sender (tcp agent) and frees the received packets. The ftp is set to start at 0.3 sec and stop at 4.0 sec.
4. Write a script in NS to simulate the following scenario –
A network consists of 15 nodes. Create mesh topography. The duplex links between nodes have 10 Mbps of bandwidth and 100 ms of delay. Each link uses a Drop Tail queue. A "TCP" agent is attached to node 0. "TCPSink" agent is attached to Node 14. Both the agents are connected. As default, the maximum size of a packet that a "TCP" agent can generate is 1500bytes. Use CBR application type. The CBR is set to start at 0.2 sec and stop at 8.0 sec.

WIRELESS SCENARIO

5. Write a script in NS to simulate the following wireless scenario –
A network consists of 4 mobile (wireless) nodes. A TCP connection is setup between the mobile nodes. Packets are exchanged between the nodes. Apply all the wireless scenario parameters.

6. Write a script in NS to simulate the following wireless scenario –
A network consists of two mobile (wireless) nodes, node 0 and node 1. The mobile nodes move about within an area whose boundary is defined as 500m X 500m. The nodes start out initially at two opposite ends of the boundary. Then they move towards each other in the first half of the simulation and again move away for the second half. A TCP connection is setup between the two mobile nodes. Packets are exchanged between the nodes as they come within hearing range of one another. As they move away, packets start getting dropped.
7. Write a script in NS to simulate the following wireless scenario –
A network consists of 10 mobile (wireless) nodes. The mobile nodes move about within an area whose boundary is defined as 400m X 400m. 3 nodes move from left to right and 2 nodes move from right to left. Protocol used is AODV. Maximum packet size is 100 bytes. A TCP connection is setup between mobile nodes. Packets are exchanged between the nodes. FTP starts at 0.8 sec and stops at 4.0 sec. Color of node changes to blue at 1.5sec.
8. Write a script in NS to simulate the following wireless scenario –
A network consists of 20 mobile (wireless) nodes. The mobile nodes move about within an area whose boundary is defined as 600m X 500m. 5 nodes move from bottom to up. Protocol used is DSDV. Maximum packet size is 50 bytes. A TCP connection is setup between mobile nodes. Packets are exchanged between the nodes. FTP starts at 0.6 sec and stops at 5.0 sec. Color of node changes to yellow at 1.5sec.