GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS & COMMUNICATION (WIRELESS COMMUNICATION TECHNOLOGY) (44)
WIRELESS SENSOR NETWORKS & ITS ENERGY MANAGEMENT
SUBJECT CODE: 2744402
M.E. 4TH SEMESTER

Type of course: Mobile Computing related branch

Prerequisite: Fundamentals of Communication (Analog/Digital), basics of Wireless communication, The concept of Data Communication & Networking, Basic Knowledge of existing Cellular Networks (2G, 2.5G, 3G, etc.)

Rationale:
Sensor networks fundamentals, Protocols, Major areas of thrust, Energy efficiency, Routing and applications

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
4	0	2#	5	70	30	20	10	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction** : The vision of Ambient Intelligence, Application examples, Types of applications , Challenges for WSNs , Difference between Mobile ad hoc networks and wireless sensor networks	4	25%
2	**Single-node architecture**: Hardware components, Energy consumption of sensor nodes , Operating systems and execution environments , Some examples of sensor nodes, Network architecture: Sensor network scenarios , Optimization goals and figures of merit , Design principles for WSNs , Service interfaces of WSNs , Gateway concepts	6	25%
3	**Communication Protocols:** Physical layer: Introduction, Wireless channel and communication fundamentals , Physical layer and transceiver design considerations in WSNs , MAC protocols: Fundamentals of (wireless) MAC protocols , Low duty cycle protocols and wakeup concepts , Contention-based protocols , Schedule-based protocols , The IEEE 802.15.4 MAC protocol , How about IEEE 802.11 and bluetooth? Link-layer protocols: Fundamentals: tasks and requirements , Error control , Framing , Link management	10	25%
4	**Routing protocols:** The many faces of forwarding and routing, Gossiping and agent-based unicast forwarding, Energy-efficient unicast, Broadcast and multicast, Geographic routing, Mobile nodes	5	14-16%

5	**Transport layer and quality of service**: The transport layer and QoS in wireless sensor networks, Coverage and deployment, Reliable data transport, Single packet delivery, Block delivery, Congestion control and rate control	6	16-18%
6	**Energy Effiecient Design of Wireless Sensor Nodes:** Introduction, Where does the power go?, Node Level Energy Optimization, Energy aware Wireless Communication.	4	14-16%

Reference Books:

1. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley and Sons, 2007.
2. C.S.Raghavendra, K.M. Sivalingam, T. Znati, "Wireless Sensor Networks", Springer
3. Waltenegus Dargie and Christian Poellabauer, "Fundamentals of Wireless Sensor Networks – Theory and Practice", John Wiley and Sons, first edition, 2010.
4. Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks', A John Wiley & Sons Inc. Publication, 2007
5. Carlos de Morais Cordeiro and Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks : Theory and Applications", Second Edition, World Scientific Publishers, 2011

Course Outcome:
After learning the course the students should be able to:

1. Understand the needs of Wireless Sensor Network in current scenario of technology.
2. Describe current technology trends for the implementation and deployment of wireless sensor networks.
3. Discuss the challenges in designing MAC, routing and transport protocols for wireless sensor networks.
4. Explore the scope of designing energy efficient protocols and nodes wireless sensor networks

List of Experiments:

Based on syllabus

Design Engineering Problems/Open Ended Problems:

1. Design and simulate energy efficient broadcast routing protocol in NS2.
2. Design and simulate Energy Effiecient IEEE 802.15.4 MAC protocol in NS2

List of Open Source Software/learning website: Network Simulator Softwares (NS2, NS3),
Learning Web: *nptel.ac.in*

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.