Kadi Sarva Vishwavidyalaya, Gandhinagar

MASTERS OF COMPUTER APPLICATION (MCA)

Year – II (Semester – IV) (W.E.F. January 2015)

Subject Name: Wireless Sensor's Network (WSN)- MCA-404(C)

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

Course Description:

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

Learning Objectives:

Students will learn Five aspect of WSN in this course, which is as under:

- In "**Overview of Wireless Sensor Networks & Technology**" they will learn about basic concepts of WSN
- In "**Wireless sensors network Protocols** " they will learn concepts of protocols used in WSN.
- In "**Routing Strategies**" they will learn various strategies used in WSN.
- In "**Transport Control Protocols**" they will learn how to implement the TCP protocol in with respect to WSN
- In "**WSN- Middleware, Management and Operating Systems** " they will learn different middleware used in WNS, WNS management challenges and models and Operating System environment used.

Prerequisites :

- Knowledge of Wireless networks, Protocols, Transmission Media
- Knowledge of Computer Network Operating Systems

UNIT- I: Overview of Wireless Sensor Networks & Technology

- 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

- MAC Protocols for WSNs
    a. Schedule-Based Protocols
    b. Random Access-Based Protocols
- IEEE 802.15.4 LR-WPANs Standard Case Study
    i. PHY Layer
    ii. MAC Layer
- Routing Challenges and Design Issues

a. Network Scale and Time-Varying Characteristics
b. Resource Constraints
c. Sensor Applications Data Models

UNIT-III Routing Strategies

a. WSN Routing Techniques
b. Flooding and Its Variants
c. Sensor Protocols for Information via Negotiation
d. Low-Energy Adaptive Clustering Hierarchy
e. Power-Efficient Gathering in Sensor Information Systems
f. Directed Diffusion
g. Geographical Routing

UNIT-IV Transport Control Protocols

- 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 Systems

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

Text Book:

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

1. TAIEB ZNATI, Wiley

Web References : WIRELESS SENSOR NETWORKS (WSN)- MCA-404(C)

1. Ref: http://tinyos.stanford.edu/tinyos-wiki/index.php/TOSSIM#Running_TOSSIM_with_Python
2. (**Online**) Wireless Sensor Networks: Application - Centric Design, Edited by Geoff V Merrett and Yen Kheng Tan, ISBN 978-953-307-321-7, 504 pages, Publisher: InTech, Chapters published December 14, 2010 under CC BY-NC-SA 3.0 license DOI: 10.5772/658
3. (**Download: http://it-ebooks.info/book/538/**) Arduino Cookbook Recipes to Begin, Expand, and Enhance Your Projects , O'Reilly Media, By: Michael Margolis
4. (**Download: http://it-ebooks.info/book/625/**) Building Wireless Sensor Networks with Zigbee, Xbee, Arduino Processing, Oreliey
5. (**Download: http://it-ebooks.info/book/1796/**) Foundations of Python Network Programming, 3rd Edition, Apress, By:John Goerzen, Brandon Rhodes

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)

Continuous Evaluation Management(Internal Marks)

The continuous evaluation will be organized as follows:

Project: There will be one mini project where each student has to solve a real-life problem and develop acceptable solution. This project will generate an outcome with its documentation. The documentation should be in a form of mini project report with core elements of Introduction, Study analysis of existing projects , used technology and tools. Proposed innovative solution , development and implementation platform. Student can take a project in the area of **Bluetooth low energy/Zigbee utilizing Arduino, Android hardware platforms.**

Internal Marks: The final internal marks will be obtained on the basis of the quality of the seminar, participation in the class discussion, and the quality of the research report. Students are encouraged to join in the class discussion and present their thoughts and ideas on the all distributed system problems.

Ppractical's Domain: WIRELESS SENSOR NETWORKS (WSN)- MCA-404(C)

- Tiny OS through TOSSIM simulator (**Web Reference 1**)
  - Compile TOSSIM.
  - Configure a simulation in Python / C++.
  - Inspect variables.
  - Inject packets.
- WSN- Middleware MiLAN and Impala
  (Study Analysis of Research Papers for experimental work)

- IEEE 802.15.4 LR-WPANs Standard (**Web Reference 3,4,5**)

Practical's Exercises:

1. Compile and running demo application in Tossim simulation based on tinyos using python language
2. Write a python program to check the functionality of each object functions with tossim:- currentNode(), getNode(id), runNextEvent(), time(), timeStr(), init(), mac(), radio(), addChannel(ch, output), removeChannel(ch, output), ticksPerSecond().
3. Write a python program which checks the debugging of program by calling dbg mode.

   Use following option of debugging dbg have following
   All, boot, clock, task, sched, sensor, led, crypto, route, am , crc, packet, encode, radio, logger, adc, i2c, uart, prog, sounder, time, sim, queue, simradi o, hardware, simmem, usr1, usr2, usr3, temp
4. Create a counter application that displays binary numbers on the LEDs; the counter is reset to 0 after reaching the maximum, 8. The TinyOS components for Counter should not be used; for practice, the code may be written from scratch.
5. Write a program which enhances counter application by producing a sound when the maximum value is reached.
6. Wrtie a pplication which shows sensor reading on LEDs. This application displays the lowest three bits of the photo sensor reading. The DemoSensorC component available in tos/sensorboards/micasb/ may be used.
7. Write a application for the counter reading is sent on radio frequency, as well as, displayed on LEDs. For RF communication, the GenericComm component at tos/system/ may be used.
8. Write a application for the value received by the radio frequency is displayed on LEDs. Program one mote with CounterReceive and another mote with CounterSend and ensure that the counter value is properly transmitted from one mote to the other one