# Sensor Based Embedded Systems Design

## Overview

Wireless and sensor systems represent a new paradigm for information gathering and processing in our daily life. It is expected that in the near future people will be surrounded by embedded and wirelessly networked systems to provide easy access to information from physical environment, to enrich daily life and to increase productivity at work. New smart sensing and embedded applications in space and other extreme environments are fuelling the need for innovative wireless sensing systems. These systems contain a mixture of hardware and software; their scope may be as simple as a sensor, or as complex as an embedded device, or even an entire building or city. The specific nature of these systems require them to be open, scalable, adaptable and dependable, while integrating heterogeneous devices ranging from tiny sensors to larger computers. These challenging environments are typically characterized by highly dynamic and unpredictable operating conditions, requiring new solutions based upon autonomous operation and embedded intelligence. There is a huge opportunity of research in this hot area.

The proposed course will help UG/PG/PhD students, academicians, engineers, researchers, and professionals to stay abreast of the latest developments in these technologies. The course will provide an excellent opportunity for participants to learn about both the basics of sensor systems and embedded technologies and recent breakthroughs in the area.

Following are the key objectives of the course:
1. To provide knowledge and the concepts of the emerging wireless sensor technologies to the participants.
2. An exposure to hardware and software tools in mobile, ad hoc, sensor and embedded technologies.
3. To provide technical know-how and manpower development in wireless sensor networks and embedded systems.

**Knowledge and Comprehension Goals**

Participants will
1. Use area accessibility to decide whether to deploy sensors randomly or in a regular pattern
2. Use sensor coverage area to determine needed number of sensors
3. Determine location of base station, cluster heads and investing mobile base station/cluster heads
4. Understand the need for data aggregation
5. Determine location of sensors
6. Understand need for synchronization among sensors
7. Interfacing with simple operating system to investigate "proof of the concept"

**Application Goals**

Participants will utilize probability theory and mathematical methods as a means to embedded system design problems, including
1. Translation between given coverage and connectivity to number of sensors needed
2. Using geometrical distance to determine location of the base station for data collection
3. Defining routing methods for random and regular sensor topology
4. Using basic geometry to determine locations of sensors
5. Doing evaluation of both random and regular deployments
6. Evaluating final design with respect to a given application

| Modules | Duration of the Course | June 20 – July 01, 2016 |
|---|---|---|
| | **Venue** | Department of Computer Science & Engineering<br>National Institute of Technology Hamirpur<br>Hamirpur (HP) – 177 005   India |
| | **Brief About Modules** | |
| | 1. Introduction to Wireless Systems | June 20, 2016 |
| | 2. Applications of Sensor Networks | June 21, 2016 |
| | 3. Sensor Modeling, synchronization, and sleep-awake cycle | June 22-23, 2016 |
| | 4. Coverage, Connectivity, clustering, and  aggregation in random and regular topologies | June 24-29, 2016 |
| | 5. Body-area networks and authentication | June 30-July 01, 2016 |
| | **Number of participants for the Course will be limited to FIFTY.** | |
| **You May Consider Attending If…** | ▪ Academicians/researchers/engineers working in the area of mobile computing, wireless systems, embedded systems<br>▪ UG/PG/PhD students from engineering | |
| **Fees** | The participation fees for taking the course is as follows: | |
| | ▪ Participants from Abroad | US$ 500 |
| | ▪ Participant from Educational/Research Organizations | Rs. 1000 |
| | ▪ UG Students | Rs. 500 |
| | ▪ PG/PhD Students | Rs. 1000 |
| | ▪ Participants from Industry | Rs. 4000 |
| | The above fees include all instructional materials, tutorials and assignments, laboratory equipment usage charges and internet facility. The participants will be provided accommodation on payment basis, subject to availability. | |

# The Faculty

 **Prof. Dharma P. Agrawal** has been the OBR Distinguished Professor at the University of Cincinnati, since August 1998. He is co-author of textbooks Introduction to Wireless and Mobile System, and Ad hoc and Sensor Networks and co-edited Encyclopaedia on Ad Hoc and Ubiquitous Computing. He is the Fellow of IEEE, ACM, AAAS, NAI, IACSIT, and WIF. He is a Golden Core member of the IEEE-CS and recipient of the IEEE Third Millennium Medal. He has published over 650 articles, 29 keynote speeches, 42 intensive courses, 7 patents and 25 invention disclosures, supervised 70 PhD dissertations and led UCBT Bluetooth package. He has been on the editorial boards of IEEE Transactions on Computers, IEEE Computer, Journal of High Speed Computing, JPDC, and is serving IJCN, JECE, IJSIA, IJDSN, IJAHUC, IJAHSWN, JDSN, and IJWMC and founding EIC of the Central European Journal of Computer Science. His research interests include applications of sensor networks in monitoring Parkinson's disease patients and neurosis, applications of sensor networks in monitoring fitness of athletes' personnel wellness, applications of sensor networks in monitoring firefighters physical condition in action, efficient secured communication in Sensor networks, secured group communication in Vehicular Networks, use of Femto cells in LTE technology and interference issues, heterogeneous wireless networks, and resource allocation and security in mesh networks for 4G technology. G-Index: 63, H-Index: 61. Home: http://www.cs.uc.edu/~dpa/

**Dr. Narottam Chand** received his PhD degree from IIT Roorkee in Computer Science and Engineering. Previously he received MTech and BTech degrees in Computer Science and Engineering from IIT Delhi and NIT Hamirpur, respectively. Presently he is working as Head, Department of Computer Science and Engineering, NIT Hamirpur. Previously also he has served as Head, Department of Computer Science and Engineering, during Feb 2008 to Jan 2011 and Head, Institute Computer Centre, for two terms during 2008-2009, and 2014-2015. He is also working as Coordinator, Accreditation at NIT Hamirpur. In the recent past, he has coordinated different key assignments at NIT Hamirpur like Campus Wide Networking, Institute Web Site and Institute Office Automation. Dr. Narottam is an active industry consultant for entities like BHEL and Kangra Central

Cooperative Bank. His current research areas of interest include mobile computing, mobile ad hoc networks and wireless sensor networks. He has published more than 150 research papers in International/National journals & conferences, guided six PhDs and guiding few more in these areas. He is member of IEEE, ISTE, CSI, International Association of Engineers and Internet Society.

**Dr. Naveen Chauhan** has received M.E. degree from Punjab University, Chandigarh, India and received his PhD degree from National Institute of Technology Hamirpur, India in 2012.  He is currently working as Assistant Professor in Computer Science and Engineering at National Institute of Technology, Hamirpur. His research interest includes wireless networks, distributed systems, and mobile computing, with a focus on mobile ad hoc networks. He has published more than 50 research papers in these areas and guiding four PhD dissertations. He is also working as Nodal Officer IIIT Una. He is member of ACM, Computer Society of India and ISTE.

# Course Coordinators

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