DEPARTMENT OF COMPUTER SCIENCE COURSE SYLLABUS

CS 4/5/73303 Internet of Things 3 credit hours

Instructor’s Name: _________________________ Gokarna Sharma____________________________


Course Content:
This course will provide a comprehensive understanding of Internet of Things by looking into a variety of real-world application scenarios, existing and new technologies and architectures, communication protocols and standardization efforts, societal and behavioral changes, and how to apply these technologies to tackle real-world problems.

Prerequisites or co-requisites: Graduate standing OR CS 4/55231 (Internet Engineering) and 3XXXX (Embedded System Programming)

Topics to be Covered: Total 45 hours

1. **Internet of Things:** introduction, characteristics, architecture, evolution, application scenarios, vision, scalability, current solutions, issues, players, research and future challenges, IoC to IoT (3 hours)
2. **Enabling technologies:** RFID, Cellular networks, WLAN, Wireless (ZigBee, NFC, Wireless Hart), WiMAX, Sensor Networks, Mobile and smart phones, robotics, Energy Harvesting, big data and cloud (3 hours)
3. **IoT Architectures:** Layered Architecture, SOA (Service Oriented Architecture), middlewares (4 hours)
4. **IPv6:** introduction, features, packet structure and processing, address architecture, unicast, multicast, and anycast, deployment, IPv6 vs IPv4, interoperability with IPv4 (4 hours)
5. **ICMPv6:** introduction, functionalities, neighbor discovery protocol, address autoconfiguration, ICMPv6 vs ICMPv4 (4 hours)
6. **IP for smart objects:** motivation and main challenges, smart object architectural considerations (1 hours)
7. Low power and lossy networks (LLN), IEEE 802.15.4 (2 hours)
8. **6LoWPAN:** introduction, architecture, issues, IPv6 addressing in 6LoWPAN, 6LoWPAN forwarding: route-over and mesh-under approaches, neighbor discovery (4 hours)
9. **RPL** (the IPv6 Routing Protocol for LLNs): introduction, routing metrics and constraints, topology maintenance, DODAG formation, the trickle algorithm, loop detection and avoidance (2 hours)
10. **CoAP** (the Constrained Application Protocol): introduction, features, packet format, proxying, service and resource discovery. MQTT protocol for machine-to-machine communications (2 hours)

11. Contiki (the open source OS for IoT) and Cooja (the contiki network simulator), TinyOS for IoT, Interoperable data encoding, XML, XML Schema, JSON (2 hours)

12. **Web services**: SOAP (Simple Object Access Protocol) and WSDL (Web Service Definition Language), RESTful web services and applications for networked embedded systems (3 hours)

13. **Standardization efforts**: M2M, ROLL, GRIFS, EPCglobal, 6LoWPAN (1.5 hours)

14. **IoT standards**: the oneM2M standard, OMA LightWeight M2M (LWM2M). Building the environment for the Things-as-a-service (1.5 hours)

15. Security/Privacy Issues (4 hours)

16. IoT Societal Impact, persuasive technologies and behavioral change, Business cases, concepts, issues, and models for IoT (4 hours)

**Learning Outcomes:**

1. Articulate the organization of the Internet. [Familiarity]
2. List and define the appropriate network terminology. [Familiarity]
3. Describe the layered structure of a typical networked architecture. [Familiarity]
4. Identify the different types of complexity in a network (edges, core, etc.). [Familiarity]
5. Describe the organization of the network layer. [Familiarity]
6. Describe how packets are forwarded in an IP network. [Familiarity]
7. List the scalability benefits of hierarchical addressing. [Familiarity]
8. Describe how frames are forwarded in an Ethernet network. [Familiarity]
9. Describe the differences between IP and Ethernet. [Familiarity]
10. Describe the interrelations between IP and Ethernet. [Familiarity]
11. Describe the steps used in one common approach to the multiple access problem. [Familiarity]
12. Describe the organization of a wireless network. [Familiarity]
13. Describe how wireless networks support mobile users. [Familiarity]

**Assessment of Learning Outcomes:**

1. Project implementation on a topic related to the course, its demonstration, and project report
2. Written reviews and critiques on two to three research articles on topics related to the course
3. Midterm and Final Exams
4. Class presentations on the topic related to the course
5. Homework assignments, quizzes, and case studies