Proposal for a New Course

Course Number	: CS541P
Course Name	: IoT systems and the Cloud
Credits	: 1-0-3-3 (L-T-P-C)
Prerequisites	: IC161 – Applied Electronics or equivalent IC250 – Programming and Data Structure Practicum or equivalent with Consent of Instructor
Intended for	: B.Tech. (EE. & CSE) /MS/MTech/PhD
Distribution	: Elective for B.Tech. III/IV year, MS, M.Tech., Ph.D.
Semester	: Even/Odd

1. Preamble:

Internet-of-Things is a rapidly expanding domain with applications in both the national and international context. This course is a cross disciplinary 'practicum' course intended to give the students a hands-on experience of end-to-end design and implementation of IoT-based systems. It covers issues related to data acquisition and practical deployment of IoT-based systems, connecting the sensors to the cloud, and analytics on the cloud. The first half of the course will provide hands-on experience to the students in interfacing sensors with common microcontrollers such as Arduino and Raspberry Pi, enabling device-to-device communications, real time data acquisition and hardware control through sensor networks, and connecting the physical systems to a cloud computing platform. The second half will provide hands-on-experience on using different types of storage platforms in the cloud like message queues, distributed file systems and databases, and different computing paradigms such as map reduce. It will also introduce concepts of complex event processing, few algorithms for mining data streams and lambda architecture for combining batch and real-time analytics. The course includes mini-projects and labs in addition to lectures to facilitate and encourage learning by doing.

2. Course Modules with Quantitative lecture hours:

Module 1: Hardware components of IoT systems: Introduction to microcontrollers including PIC, Arduino, Raspberry Pi; interfacing sensors and actuators with microcontrollers, building breadboard circuits, using IoT CAD tools; performance characteristics, drift, measurement techniques, packaging. **[4 lecture hours + 12 lab hours]**

Module 2: Networking of devices: Device-to-device communication; networking protocols and architectures; scheduling and routing; wired and wireless (Bluetooth, Zigbee, NFC) sensor networks; communication technologies like LoRA, SigFox, Cellular IoT; edge analytics and sensor control in networks. **[3 lecture hours + 9 lab hours]**

Module 3: Getting Data Ready for Analytics in the Cloud: Introduction to cloud service models, pre-processing input streams of IoT data, storage in the cloud – message queues, distributed file systems and distributed databases. **[3 lecture hours + 9 lab hours]**

***Module 4: Data Analytics in the Cloud*:** Computing paradigms – map-reduce and its extensions to resilient distributed datasets, concepts in complex event processing (CEP), algorithms for mining data streams, Lambda Architecture. **[4 lecture hours + 12 lab hours]**

3. Text book:

- Donald Norris, "The Internet of Things", McGraw Hill Education, 2015.
- Nathan Marz and James Warren, "Big Data: Principles and best practices of scalable realtime data systems", Manning Publications, April 2015

4. Reference Books:

- Upton and Halfacree, "Raspberry Pi User Guide", Wiley, 2014.
- Robert Faludi, "Building Wireless Sensor Networks" O'Reilly Media, 2011.
- Jure Leskovec, Anand Rajaraman and Jeffrey D. Ullman, Mining of Massive Datasets, v2.1 on-line edition, 2015.
- Research papers on Resilient Distributed Datasets, Kafka, HBase, etc.

5. Similarity Content Declaration with Existing Courses:

S.N	Course Code	Similarity Content	Approx % of content
1	Design of Concurrent Software (CS546) Big Data and Map Reduce (CS561)	Map-reduce computing paradigm	10%
2	Embedded Systems (CS404)	Sensor control using Micro-controllers	20%

6. Justification for new course proposal if cumulative similarity content is > 30%: N.A.

Approvals:

Other Faculty who may be interested in teaching this course: Dr. Siddhartha Sarma, Dr. Shubhajit Roy Chowdhury, Prof. Timothy A. Gonsalves

Proposed by: Dr. Srikant Srinivasan and Dr. Sriram Kailasam School: SCEE

Signature: _____ Date_____

Recommended/Not Recommended, with Comments:

_____ Date:_____

Chairman, CPC

Approved / Not Approved

_____ Date:_____

Chairman, Senate