Southern University of Science & Technology
电子与电气工程系 Department of Electrical and Electronics and Engineering
物联网工程基础 Internet of Things (IoT) Technology EE344
春季 **Spring 2020**

Lectures: 4:00 – 6:00 PM Monday, Wednesday

Instructor: 教授 Rabi N. Mahapatra, rabi at tamu.edu,
Office: Bldg#, Room# *Online for now*
Office Hours: by appointment.

TAs: 1. Haoqiu Xiong (Contact: TBA) 2. Yulong Liu (Contact: TBA)

URL: https://codes.engr.tamu.edu/teaching/ (site change TBA)

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1. **Course Objectives:**

The primary objective of the course is to make the students get introduced with Internet-of-Things (IoT), its architecture, components and various issues such as security, privacy, energy preservation etc. Through the course the students will also become aware of how various other important domains such as Computer Network Communication Protocols, Artificial Intelligence, Machine Learning, Data Analytics etc. are applied together to bring efficient collaboration among "Things" despite massive size and inherent heterogeneity issues in IoT.

本课程的主要目的是让学生对物联网的架构、组成以及与之相关的安全、隐私、能量供应等问题有基本的了解。通过教学，学生也将了解有关计算机网络通信协议、人工智能、机器学习、数据分析等领域在物联网方面的应用，以及他们是如何协同工作使得大量不同的物品能够进行有效的沟通和协作。

2. **Pre-requisites**: EE201-17 模拟电路, EE202-17 数字电路, EE204 半导体器件导论, EE304 集成电路设计

3. **教材及其它参考资料 Textbook and Supplementary Readings**

Suggested Books: These books would not provide entire coverage of the syllabus.
1. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" (1st Edition); by David Hanes et. al; Cisco Press, 2017; ISBN-10: 1587144565.
2. "Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security"; By Perry Lea, ISBN- 10: 1788470591; Wiley Publication, 2018.
3. Supplemental: Important for the course as good text books are not available now.
   - Technical manuscripts from journals and conference proceedings will be selected by the instructor for various topics for class discussion and their details will be shared to the class.

4. **Detailed Course Description:**

a. Introduction: Introductions to IoT; various IoT Systems and challenges; IoT trends;
b. IoT Architecture and Components: System architecture; hardware; operating systems;

Sensors; scope of device drivers; edge computing; cloud-computing supports;

c. IoT Frameworks: ARTIK platform and usages; IFTTT platform and usages

d. Networks and Protocols for IoT: Sensor networks for IoT, energy conserving MAC and network layer protocols, device discovery protocols.

e. Emerging attributes of IoT: Artificial Intelligence for IoT; Cognitive IoT; multi-modal modelling; programmability; tools and platforms;

f. IoT Data analytics: understanding IoT data; IoT data collection and integration: machine leaning techniques for data analysis; advanced analytics; IoT analytics tools;

g. IoT Security and Privacy: Authentications, biometric authentications; software/applications with dynamic authentication; privacy along with security; Fluid media; privacy and security with VANET;

h. Case Studies: IoT wearable and healthcare; industrial IoTs; Low-power considerations in IoT; and voice user interactions.

5. Tentative Teaching Schedule (the schedule may change based on the pace of the course coverage)

Lecture#	Topic Details (Each lecture is of 2 hours duration)
1	Introductions to IoT; 物联网介绍
2	IoT systems and challenges; IoT trends; 不同的物联网系统：挑战、趋势
3	IoT Architecture and Components: System architecture; hardware; 物联网架构和组成：系统架构、硬件
4	IoT Operating systems; 物联网操作系统
5	Sensors; scope of device drivers, 传感器与驱动设备
6	Edge computing; cloud-computing supports; 边缘计算与云端支持
7	IoT Frameworks:ARTIK platform and usages 物联网框架 ARTIK 平台和应用
8	IoT Frameworks: IFTTT platform and usages 物联网框架 IFTTT 平台和应用
9	Mini Project: Slides on Design Steps and deliverables
10	Networks and Protocols for IoT. 物联网网络和协议
11	Sensor networks for IoT, 物联网与传感网络
12	Energy conserving MAC and network layer protocols, device discovery protocols. 能量采集接口及网络层协议，设备发现协议
13	Emerging attributes of IoT: Artificial intelligence for IoT; Cognitive IoT; multi-modal modelling; 物联网新兴属性：人工智能、认知物联网与多模式建模
14	Programmability; tools and platforms; 编程：工具与平台
15	IoT Data analytics: Understanding IoT data; IoT data collection and integration; 物联网数据分析：理解、收集及集成
16	Machine learning techniques for data analysis; 机器学习数据分析
17	Advanced analytics 高级分析方法
18	IoT analytics tools; 物联网分析工具
19	IoT Security and Privacy: Authentications 物联网安全与隐私：授权认证
20	Biometric authentications; software / applications with dynamic authentication; 生物识别认证，动态认证软件/应用
21	Privacy along with security, Fluid media; privacy and security with VANET; 安全与隐私，流媒体，VANET 安全隐私

22	Case studies: IoT wearable and healthcare; industrial IoTs; 范例：可穿戴物联网与健康，工业物联网
23	Low-power considerations in IoT; 范例：低功耗物联网
24	Voice user interactions; 范例：语音用户交互

6. Grading Policy (Letter Grade)

The final grade you will receive in the class will be based on points accumulated during the semester.

Exams (60%): There will be midterm and final exams during the semester with 25% and 35% weightage respectively. The tests are designed to evaluate students comprehending the course objectives and based on the materials covered in the lectures.

Assignments (20%): There are regular assignments following the lectures to ensure student's understanding of the materials. The assignments are due after one week. You will be instructed on the details of each assignment. Also, quiz can be held with advance notice for reading assignments.

Mini-Projects, Attendance and Final Presentations (20%): There will be one mini-project to demonstrate students' hands-on skill in building IoT products based on their learning. This is a team project with 3-4 students in a team. The students will be involved in designing and implement an open project in team environment that can be accomplished only in 7 weeks. After 4-5 weeks from semester start, the students will form teams and work on project proposals to be approved by the instructor. Most of the time, the students reach out to materials available online and discuss with instructor to select a project. They must understand the constraints related to time, budget, and technical limitations to accomplish their goal. A final grade will be assigned to your project based on the completion of all the objectives stated in the proposal, project report, and on a live presentation/demonstration in front of the class. The complexity of your project and the size of your team will be factored in.

Each team will perhaps meet project hardware costs. If your project is sponsored by a lab in the department or by someone else including you, that is welcome.

7. Document preparation

All major documents (Class Assignments, Lab Reports, Project Proposal and Project Report) should be submitted in a professional format and should contain a title page, an outline, as well as clear section and subsection headings, etc. Template can be provided.

8. Attendance Policy

Class attendances are required. Lateness or absence can be excused if there is a valid reason. Illness, job interviews out of town, death in the family, inclement weather or accidents for commuters, etc., are valid reasons. Oversleeping, a term paper due, an exam to cram for, etc., are not valid reasons. Ultimately, the instructor reserves the right to determine what constitutes a "valid reason" on a case-by-case basis.

9. Scholastic Dishonesty

Be aware of the issues of *plagiarism* and *fabrication of information*. The use of existing software implementations or hardware designs should be discussed with the instructor prior to being incorporated into the project. Proper credit must be given to the original source of concepts, designs, software, technical documents, scientific literature, etc.