Ch. 00: Course Logistics

CS 244p: Internet-of-Things. Software and Systems

Fall Quarter 2024

ABOUT THE INSTRUCTOR

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- Research Interests:
  Pervasive Computing
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COURSE ORGANIZATION

- Course Website on Canvas

  Syllabus

  Course Schedule & Logistics

  Grading Rubric

  Notes and assignments

  ED Discussion integration

  Weekly quizzes based on lecture material.

- Final hands-on project and project report

ASSESSMENT AND GRADING

- Students will be assessed based on three criteria:

A. Weekly Exercises Hands-on (labs): **40%**

Students will perform weekly practical hands-on small projects in the lab and demonstrate them to the teacher or the TA

B. Weekly Quizzes: **10%**

Students will be evaluated on provided materials in lectures every week.

C. Course Project (Reports, demos, presentations): **50%**

Students will do an in-depth Hands-on IoT system design and programming project that will span the whole quarter

D. Extra-Credit: 3%

3% Final Course Evaluation

QUIZZES AND READINGS

- **Quizzes**
  - Weekly starting in Week 2 based on lecture slides.

- **Readings/Resources:**
  - Internet-of-Things - From Hype to Reality, by *A. Rayes, and S. Salam* Springer 2017.
  - Fog Computing in the Internet of Things, by A. *Rahmani, P. Liljeberg, J. Preden, A. Jantsch* - Springer 2017
  - 6LoWPAN: The Wireless Embedded Internet, by Z. Shelby, C. Bormann, 2009
  - IEEE Internet of Things: https://iot.ieee.org/
  - IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, by D. Hanes et al., Cisco Press, 2017.

PROJECT SCHEDULE

- On **Week 3**: presenting guidelines on project proposal
- On **Week 4**: Project proposal due
- On **Week 7:** Progress Report/presentation due
- Final project report and in-person demonstration on **Week 10**.

LAB ORGANIZATION

- Exercises Hands-on /Lab Sessions
  - Buy list of components asap (expect shipping delays)
  - Desktop/laptop required
  - Soldering required
  - Lab 0 due in week 2.
  - About 7~10 days to complete each lab.
  - 5 Lab assignments in 7 weeks

WEEKLY LAB EXERCISES

- **Lab 0:** Working with I/Os on ESP32
  - Serial communication, timing, digital I/O, and analog read
  - Building a Light Meter Gage
- **Lab 1:** Getting familiar with SPI, UART, I2C, and wired communication with sensors and actuators
  - Working with sensors and actuators.
- **Lab 2:** Building a Highway Traffic Light using touch buttons, buzzers, and LEDs
- **Lab 3:** Connecting your sensors via ESP32(Bluetooth) to a smart phone (using nrfConnect):
  - Building a step counter by reading from 3D Accelerometer and send it to the smart phone using Bluetooth
- **Lab 4:** Transferring sensory data to a cloud server
  - Working with Microsoft Azure/Amazon AWS clouds/Self-hosted.

COURSE OUTLINE I

- **IoT Trends, Applications, Concepts**
  - Definitions, components, financial trends, ubiquity, application domains (e.g., healthcare, smart spaces, environmental monitoring, etc.)
- **Introduction to IoT Programing**
- **Embedded IoT Development Kits and Serial Communication**
  - Sparkfun Thing, ST SensorTile kit, TI SENSORTAG, NORDIC SEMICONDUCTO, EspressIf etc.
  - UART, SPI, I2C, etc.
- **The Things: Sensors and Actuators**
  - Inertial Sensors, Tachometer Sensor, Proximity Sensor, Wearable Sensors, etc.
- **IoT Requirements for Networking Protocols**
  - Introduction to OSI and TCP/IP protocol stacks
  - Interoperability, Scalability, Determinism, Security, etc.

COURSE OUTLINE II (TENTATIVE)

- **IoT Protocol Stack: Link Layer and Industrial Open Standard Solutions**
  IEEE 802.15.4, Bluetooth, BLE, WiFi, IEEE 802.11AH, TSN, nRF, LoRA, etc.
- **IoT Protocol Stack: Internet Layer and Industrial Open Standard Solutions**
  - 6LoWPAN, RPL, etc.
- **IoT Protocol Stack: Application Protocol Layer and Industrial Open Standard Solutions**
  - RESTful Constraints, CoAP, Web-of-Things, XMPP, MQTT, AMQP, SIP, etc.
- **IoT Protocol Stack: Application Services Layer and Industrial Open Standard Solutions**
  - ETSI M2M, ONEM2M, etc.
- **IoT Security and Privacy**
  - Cloud layer attacks, Edge/Fog layer attacks, sensor layer attacks