Course Information

- **Course number and title:** ECE 69500 - Advanced Internet of Things Design and Applications
- **CRN:** 29607
- **Lecture Time**
  - **Lecture session:** Tuesday 3:00 pm - 4:15 pm
  - **Paper presentation session:** Thursday 3:00 pm - 4:15 pm
- **Lecture Room:** Max W & Maileen Brown Hall (EE Building) 226
- **Online Lectures**
  - **https://purdue-edu.zoom.us/my/lusuroom**
  - **Either synchronous or asynchronous**
  - **Will be recorded**
- **Instructional Modality:** Hybrid/Hy-Flex
- **Course credit hours:** 3 credits
- **Prerequisites:**
  - There are no prerequisite courses, but the students should have some basic knowledge of computer networks, embedded systems, and system programming.
  - Knowing data mining/machine learning/deep learning would be helpful, but not required.

Instructor(s) Contact Information

- **Name of the instructor(s):** Lu Su
- **Office Location:** EE 331B
- **Office Phone Number:** 765-496-5301
- **Purdue Email Address:** lusu@purdue.edu

- **Student consultation hours, times, and location:**
  - **Platform for QA:** https://piazza.com/purdue/spring2023/ece69500iot
  - **Announcement:** Brightspace and/or Piazza.
  - **Office hour:** 3:30PM-4:30PM Friday in my Zoom room: https://purdue-edu.zoom.us/my/lusuroom
  - **Email:** Please include “ECE 695” in the subject line.

Course Description

Recent years have witnessed the rise of the Internet of Things (IoT), a newly emerged networking paradigm that connects humans and the physical world through ubiquitous sensing, computing, and communicating devices. With billions of such connected devices that pervade every corner of the world, IoT is able to benefit a whole spectrum of civilian and military applications with enormous societal and economic impacts, such as smart cities and transportation, healthcare and assisted living, activity and gesture recognition, smart homes and buildings, and environmental monitoring. This course provides the students with a deep and comprehensive understanding of IoT systems by introducing the key IoT technologies from the ground up, including IoT devices programming, wireless network design and optimization, edge-cloud IoT platforms, deep/machine learning, as well as security and privacy preserving mechanisms. In this course, we will also survey recently published algorithms, systems, and applications of Internet of Things, and explore key opportunities as well as challenges emerging in the research of this area.

Learning Resources, Technology & Texts

- **Textbooks:** There are no designated textbooks. The students are encouraged to refer to the textbooks on computer networks, embedded systems, and machine learning.
- **Class websites:**
  - **Brightspace:** Lecture slides, assignments, and grades.
  - **Piazza:** Discussions & Question answering.

Learning Outcomes

At the end of this course, students are expected to:

- Understand the basic concepts and major components of IoT systems.
- Grasp state-of-the-art IoT techniques.
- Know representative IoT enabled applications.
- Be able to survey and criticize research papers in IoT area.
- Be able to identify and formulate real-world IoT problems, and design or apply appropriate data and/or system approaches to solve the problems.

Assignments

Your learning will be assessed through a combination of

paper presentation and review, as well as a course project spread throughout the semester. Details on these assignments, including a schedule of due dates and rubrics to guide evaluation will be posted on Brightspace or Piazza.

- **Course project:** In this course, each student is required to complete either a research project or a survey. Students are free to choose the topic of the project/survey, as long as it is related to IoT. Each team is required to submit a written proposal and give a proposal presentation in Week 6 (tentative) of the semester presenting the topic to be studied/surveyed and a final presentation in the final week presenting the results of the project/survey. In addition, a final report needs to be submitted by the end the semester.
- **Paper presentation:** Throughout the semester, each student is required to present one or two papers in the class. The papers are selected by the instructor from recent publications in top IoT conferences and journals. The presentation is similar to a conference presentation, which typically lasts for about 20 minutes, followed by 5 minutes discussion and question answering.
- **Paper review:** Throughout the semester, each student is required to write reviews for several papers presented in the class. The review format is similar to that of a research paper submitted to a conference or journal. The reviewer also needs to prepare two questions to be asked to the presenter of the paper in the class.
- **Peer evaluation on paper presentation:** Each student is required to evaluate a subset of paper presentations conducted by the other students by filling out an evaluation form.
- **No exam!**

Grading Scale

The final grade reflects your cumulative achievements throughout the semester. You will receive grade points on each of the aforementioned assignments. At the end of the semester, a final score will be calculated by conducting a weighted combination of the points as follows:

- **Course Project (60%)**
- **Paper presentations (20%)**
- **Paper reviews (10%)**
- **Peer evaluations (10%)**

There is no predefined numerical range for each letter grade. The final grade will be curved based on the relative performance of the students.

Attendance Policy

This course is designed in a hybrid model, with face-to-face meetings for on-campus students and online lectures for online students. According to university policy, on-campus students are expected to be present for every meeting of the classes in which they are enrolled, unless you are ill or need to be absent for one of four “excused” reasons: grief/bereavement, military service, jury duty, or parenting leave (go to the Office of the Dean of Students website for details on how to submit those requests).

For online students, attending lectures remotely is encouraged but not required. The lectures and presentations will be recorded and made available to both on-campus and online students.

Guidance on class attendance related to COVID-19 are outlined in the Protect Purdue Pledge on the Protect Purdue website.

Academic Guidance in the Event a Student is Quarantined/Isolated

If you must miss class at any point in time during the semester, please reach out to me via Purdue email so that we can communicate about how you can maintain your academic progress. If you find yourself too sick to progress in the course, notify your adviser and notify me via email. We will make arrangements based on your particular situation.

Course Schedule

Number of Weeks	Topic
3 Weeks	**IoT Networking:** Internet, Data Dissemination, Medium Access Control
2 Weeks	**IoT Edge:** Embedded and Mobile Sensing devices
2 Weeks	**IoT Wireless:** WiFi, Bluetooth, mmWave, Cellular Network
1 Week	**IoT Cloud:** Edge-Cloud Architecture, Load Balancing, Energy Management
2 Weeks	**IoT AI:** Deep/Federated/Distributed Learning, Data Distillation and Aggregation
2 Weeks	**IoT Security:** Authentication, Privacy, Adversarial Learning
2 Weeks	**IoT Applications:** Smart home, Health care, Smart city

*** Schedule is tentative and subject to change.**

Classroom Guidance Regarding Protect Purdue

Any student who has substantial reason to believe that another person is threatening the safety of others by not complying with Protect Purdue protocols is encouraged to report the behavior to and discuss the next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also Purdue University Bill of Student Rights and the Violent Behavior Policy under University Resources in Brightspace.

Academic Integrity

Incidents of academic misconduct in this course will be addressed by the course instructor and referred to the Office of Student Rights and Responsibilities (OSRR) for review at the university level. Any violation of course policies as it relates to academic integrity will result minimally in a failing or zero grade for that particular assignment, and at the instructor's discretion may result in a failing grade for the course. In addition, all incidents of academic misconduct will be forwarded to OSRR, where university penalties, including removal from the university, may be considered.

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information is submitted the greater the opportunity for the university to investigate the concern. More details are available on our course Brightspace table of contents, under University Policies.

Nondiscrimination Statement

Purdue University is committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the

institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. A hyperlink to Purdue's full Nondiscrimination Policy Statement is included in our course Brightspace under University Policies.

Accessibility

Purdue University is committed to making learning experiences accessible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

Mental Health/Wellness Statement

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack**.** Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the Office of the Dean of Students. Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc., sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office on the second floor of the Purdue University Student Health Center (PUSH) during business hours.

CAPS also offers resources specific to COVID-19 on its website. Topics range from "Adjusting to the New Normal" to "How to Talk with Professors about Personal Matters."

Basic Needs Security

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8 a.m.-5 p.m. Monday through Friday. Considering the significant disruptions caused by the current global crisis as it relates to COVID-19, students may submit requests for emergency assistance from the Critical Need Fund

Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructor. You are expected to read your @purdue.edu email on a frequent basis.

Disclaimer: This syllabus is subject to change. You will be notified of any changes as far in advance as possible via an announcement on Brightspace or Piazza. Monitor your Purdue email daily for updates.