CS 59200 - Mobile and Ubiquitous Computing

(for PhD and MS)

Spring 2026 Syllabus

Course Description:

This course will introduce students to mobile and ubiquitous computing, which are often described as the third generation of computing, where users can interact with computing anytime, anywhere. The course begins with a broad overview of the field and explores key subareas such as wearable computing, gesture interaction, and mobile health. Through the discussion of two research papers per class, students will gain exposure to state-of-the-art research and develop critical reading and analytical skills. The course will cover methods for mobile sensing, system design, real-world deployment, and understanding and modeling sensor data. Students will work on hands-on projects that tackle real-world problems, applying technical foundations to develop innovative and practical mobile and ubiquitous computing solutions.

Learning Outcomes:

Upon successful completion of the course, students will be able to:

- Have a solid understanding of the foundations of mobile and ubiquitous computing, including its role in shaping the next generation of computing systems.
- Understand the state-of-the-art developments in the field and identify opportunities for initiating research.
- Design and implement mobile and ubiquitous systems for real-world applications.

Course Info:

- 3 credit hours
- Instructional Modality: Face-to-Face (virtual or Zoom may be made available)
- Prerequisites: Basic programming skills required. Backgrounds in human-computer interaction and mobile systems are encouraged but not required. And prototyping experience may be helpful for completing a course project.
- Textbooks: No textbook is required for this course.

Instructor Info:

- Name: Qiuyue (Shirley) Xue
- Email: qiuyue@purdue.edu
- Office: DSAI 3034
- Office hours: By appointment

Grading:

- Paper presentation: 20%
- Paper discussion: 20% (online written discussion before class: 10%, in-class discussion: 10%)
- Midterm exam: 25%
- Class project: 35% (proposal: 5%, final presentation: 15%, final report: 15%)

Paper Presentation:

Typically in one class, we will have 2 required papers to read on one topic, and 2 students will be assigned as the leading presenters on this topic. Every student will be assigned at least once as the leading presenter on a paper in the semester. Leading presenters of the class are required to 1) read all required papers for that class, 2) give a presentation (15 to 20 minutes) on that paper, 3) prepare 2 to 3 discussion and brainstorming questions, 4) lead the discussion on the paper in class.

Paper Discussion:

All students are required to read the required papers for every class, and are encouraged to read the optional papers as well. Students are required to post a written discussion (one paragraph) before the class, and participate in the discussion sessions in class.

Midterm Exam:

The midterm will be a take-home exam. Students may reference their lecture notes; however, discussions with other students and the use of the internet or AI are prohibited. The scope of the midterm exam will be from the lectures and class materials before the exam.

Class Project:

The class project is a great opportunity for students to get hands-on experience in mobile and ubiquitous computing. Students can work independently or with a partner on the project. The components of the project are:

- **Project proposal (5%):** You will be required to present your project idea in class for early feedback, which should be around 2 minutes. The project proposal is a one page maximum description of your project with: 1) project title, 2) project idea and application (why do we care?), 3) implementation plan, including the software/hardware you will use or make, resources you'll need, 4) milestones and timelines (what will you complete by the end of the class?), 5) Related papers if applicable, 6) whether you will have a teammate?

- **Final presentation (15%)**: You will be asked to present your project in class. The presentation will be graded on 1) project motivation and objectives, 2) technical implementation and system integration, 3) results and key findings (accuracy, performance, etc.), 4) live demo or demo video, 5) presentation quality (a well-organized presentation with high-quality slides), 6) Q&A with instructor and students in the class
- **Final report (15%)**: The final report is an eight page maximum report on your project, including: 1) introduction (problem space and motivation), 2) related prior work and background on the problem you are addressing, 3) details on your design decisions and the implementation itself, 4) test and evaluation results to prove your design/implementation works (highlight any regulatory considerations), 5) discussion on limitation, future direction, and/or societal/ethical consideration of this work. You are also welcome to use ACM templates if you prefer.

Course Schedule:

	Topic	**Readings**	**Assignments**
Week 1	**Lecture:** 1) Introduction and logistics 2) Overview and history of mobile and ubiquitous computing	1. The Computer for the 21st Century 2. Charting Past, Present, and Future Research in Ubiquitous Computing	
Week 2	**Lecture:** 1) Sensing principles 2) Sensor data analysis, including applied machine learning	1.Making Sense of Sensing Systems 2. ViBand	Project proposal due
Week 3	**Paper discussion:** 1) Indoor and outdoor localization 2) Activity recognition	1.SpotFi 2. See Through Walls with Wi-Fi!	
Week 4:	**Paper discussion:** 1) Gesture interaction 2) Haptic feedback	1. Soli 2. Haptic Source-Effector 3. FingerPing (optional)	
Week 5	**Paper discussion:** 1) Wearable computing: modern technologies 2) Wearable computing: design challenges and what's next	1. The challenges of wearable computing 2. PPG Earring 3. Wearable computing: a first step toward personal imaging	

		(optional)	
Week 6	**Paper discussion:** 1) Mobile health 2) Wellbeing and mental health	1. HemaApp 2. WiStress	
Week 7	**Lecture:** 1) Tutorial on designing an end-to-end working mobile and ubiquitous system 2) Guided working session	N/A	
Week 8	**Paper discussion:** 1) Smart home 2) IoT and environmental sensing	1. Wall++ 2. FarmBeats	Midterm report due
Week 9	**Paper discussion:** 1) Integration with AI and LLM 2) On-device computing, resource-constrained ML	1. IMUGPT 2.0 2. Edge Assisted Real-time Object Detection	
Week 10	Spring break		
Week 11	**Paper discussion:** 1)Self-powered/low-power system 2) Sustainability	1.Battery-free Game Boy 2. Recyclable circuitboards 3. Battery-Free Cellphone (optional)	
Week 12	**Paper discussion:** 1) Minimized system 2) Mobile robots	1. Millimobile 2. ShapeBots	
Week 13	**Paper discussion:** 1) Fabrication 2) Longitudinal sensing and monitoring	1. KnitUI 2. GLOBEM 3. Material Mechanism (optional)	
Week 14	Final presentation	N/A	Final report due