Course Syllabus

Syllabus - Mobile and Ubiquitous Computing (MUC) Georgia Tech: CS7470-001 OMSCS

Alexander Adams

This document provides general guidelines and an overview of the Georgia Tech OMSCS MUC class. Use this as a reference throughout the semester. Mentors, TAs, and instructors will assist you in case there are any questions or concerns.

General Course Information

Mobile and Ubiquitous Computing are often referred to as the third generation of computing, in which users continuously interact with not just one but many computing devices. The latter are thereby embedded in their users' everyday environment in such a way that users—ultimately—will not even be aware of their interaction with computers. In this class, students will explore the third generation of computing (and beyond) that enables continuous, especially ubiquitous, computing. Students will learn the technical foundations of sensing and computing that are prerequisites for continuous, seamless interactions. Based on these foundations, students will work on practical projects that address cutting-edge real-world problems and develop innovative solutions through mobile and ubiquitous computing. Beyond providing a solid technical foundation for mobile and ubiquitous computing, the course will focus on aspects of how to actually make, that is, build and deploy, mobile and ubiquitous computing systems.

Mandatory Requirement:

Before students start working on their projects, they will need to provide documentation regarding successful completion of CITI IRB Training — specifically, the following courses need to be completed (or refreshed):

- Responsible Conduct of Research (1 — Basic Course)
- Human Research (Group 2 Social / Behavioral Investigators and Key Personnel — 1 Basic Course)

Students will have three weeks (at the beginning of the semester) to complete the IRB training and submit their certificates (PDF) through Canvas (see below).

The CITI IRB online training can be accessed through:

- http://researchintegrity.gatech.edu/about-irb/irb-required-trainingLinks to an external site.

and should not take longer than two hours to complete. Students who already have valid, that is not expired, certificates for the aforementioned courses can submit their certificates directly.

Important: Without valid CITI certification students cannot work on their projects and as such will not be able to fulfill the requirements of all project-related assignments!

Recommendations

Students shall have a general interest in the subject area of mobile, ubiquitous, pervasive, and wearable computing. Curiosity and eagerness to not only learn about (and understand) the field of mobile and ubiquitous computing, but also to make and experiment in practical, hands-on sessions, are of benefit for enjoying the course.

Existing programming skills are beneficial (for mobile platforms and/or lower-level device control; for web platforms). For some projects, experience with data analysis frameworks such as Python, R, or MATLAB is beneficial. Other projects will build on the foundations of electrical engineering and manufacturing.

Time and Location

This course is asynchronous and online.

Final Schedule and Assignment Details

The schedule and course details related to assignments, quizzes, deliverables will be posted on Canvas. Adjustments may become necessary once enrollment details are settled.

Learning Management System (LMS) — Canvas, Ed

Course updates, reading assignments, calendar, and any other official information are distributed through the course CANVAS website. Please visit this site frequently as all formal communication will go through it. Students who have not used Canvas before are asked to familiarize themselves with the system. On Canvas, the course can be found under:

Mobile and Ubiquitous Computing

We will also use Ed Discussions as the central discussion platform for this class. Students will automatically be enrolled and Ed is accessible through Canvas.

Course Objectives and Outcomes

This course aims to provide students with an overview and the foundations of the research field of third-generation computing (and beyond). Through active, practical explorations the course aims to provide an appreciation of the practical potential the field offers for researchers and practitioners.

Course Outline

- Overview of the field and past, present, and future of Ubiquitous Computing
- Prototyping mobile and ubiquitous computing technology
- Sensors and sensor data analysis including applied machine learning
- Eye and gesture-based interaction
- Evaluation of mobile and ubiquitous computing systems
- Smart homes and Infrastructure Mediated Sensing
- Overview of wearable computing: Challenges and design processes
- Head mounted displays
- Location technologies and how to use them
- Privacy in mobile and ubiquitous computing
- Context aware computing
- Real world applications: implications and challenges

Intended Outcomes

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

- Build on the foundations of mobile and ubiquitous computing to develop practical applications;
- Discern the capabilities of different components of mobile and ubiquitous computing, which allows for informed decisions on the usefulness and usability of resulting interface and potential technical challenges;
- Exploit the potential of mobile and ubiquitous computing techniques for real-world applications.

Skills

Through active course participation the students will gain:

- The ability to appreciate and analyze the foundations of the third generation of computing (Mobile and Ubiquitous Computing)
- The ability to use methods of mobile and ubiquitous computing in innovative, real-world practical applications.

Course Logistics

Class Sessions

Class sessions will cover a mix of lectures, interactive exercises, discussions, team exercises, and presentations. Attendance is mandatory for all graded exercises (see below). We strive for a highly interactive, discussion based learning experience for which we require to come prepared for each session. Dedicated reading homeworks will be assigned and classes are based on these and on the assumption that students have done those assignments prior to coming to class.

Class Participation & In-Class Exercises

As mentioned above this class lives from active student participation. As such, students need to be well prepared when coming to class. Do not expect to simply "catch up" on things in class. We will use class time for active, detailed discussions, activities, and exercises that shall deepen the students' understanding of the material and provide a forum for questions.

Class material is structured into 13 topic blocks, each of which will be covered (roughly) by one week, i.e., two class sessions, each. Students will need to prepare for classes through provided readings. For most topic blocks we will have practical in-class exercises that students will work on either individually or, more commonly, in teams. TAs and instructors will guide and support those activities.

AI Policy

With the availability of powerful AI tools such as ChatGPT exploring a new subject area and learning new material can be accelerated and much deeper. I encourage the use of AI tools for exploration and initializing the learning process. However, all assignments are individual / team assignments and students will be assessed on their knowledge of the subject matter and not on how to use AI tools. As such, these tools are meant to be starting points and not end points of the learning journey. Directly submitting AI generated outputs explicitly violates the individual / team assessment policy and will lead to OSI (Office of Student Integrity) investigations with potential drastic consequences.

Some tips on how to constructively use AI tools:

- Minimum effort will result in poor outcomes. Good prompts require work and a decent understanding of the subject matter – which students will acquire through learning! So, ChatGPT will not do the learning but will structure the learning.
- AI generated output can be wrong! A good student uses AI tools for an exploration and draws their own conclusions based on what they have learned by following up on what the AI has suggested.

- Students who actually read–the assignments and what generative AI tools produce / “reference”--will see when (not if!) AI generated output is wrong.

All submissions require proper referencing of the tools that have been used: References to cited papers / blog posts / software etc. If a student chooses to use AI as a starting point for their assignment(s), then this needs to be clearly indicated including how the AI was used. If generative models were used, the prompts used along with the AI generated output (e.g., chat history in ChatGPT) need to be attached as appendices.

Again, using AI to structure / facilitate / support learning is allowed. Yet, all submitted content needs to come from the student such that the student is assessed and not the AI.

“If you choose to use generative AI, you must do so responsibly. Please consider the following risks:

- Reduced learning. The purpose of academic writing assignments is to help you learn the material. You should be aware that using generative AI typically lessens the amount you learn from the assignment. This includes both reduced content learning, and reduced learning about how to write independently. This reduced learning may diminish what you get from the course, and may impact your grade later in your performance on exams.
- Factual errors. AI may introduce factual errors. If your work contains factual errors, we will deduct points for each error (typically 5 or 10 points per error) or may give a zero on the assignment, at the instructor’s discretion.
- Bias. AI may introduce unfair biases, for example against certain groups. You are responsible for any biases in work you submit.
- Fake references. AI may provide fake references. Citing a paper is asserting that it exists, you have read part or all of it, and that it supports the point being made. If you have a reference for a paper that does not exist in your bibliography, you will receive a zero on the assignment and be reported for a violation of academic integrity.
- Poor style. AI sometimes writes in an awkward or clichéd style. The quality of your writing is part of your grade, and we will deduct points for poor writing style.”

[with permission; adopted from Prof Amy Bruckman: https://asbruckman.medium.com/a-draft-new-ai-policy-for-my-college-class-29cd971e89c1Links to an external site.]

Projects

Students will work in groups on one practical project (per group) throughout the whole semester. Each project will be overseen by a mentor. Students will have to organize themselves into groups of at least four and define the specifics of their project. Project ideas will be provided by mentors, but can also be defined by the students. A pool of mentors (more senior students, PhD students, staff, and faculty members) and project ideas will be available. **Every project team needs to find a mentor and define their project in collaboration with this mentor.** Teaching assistants will support students during the project definition phase to ensure all students can work on a project they want, find interesting, and that leads to achievable results. All projects need to be discussed with and approved by TAs or the instructor. Part of these discussions is an adjustment of complexity (by the TAs in discussion with project teams) that will aim at class appropriate projects — that are neither trivial nor unachievable. Examples of successful projects from previous semesters will be shared with the students.

Process

Students will form project teams of at least four — as soon as the semester starts. Based on the initial readings, the example projects from previous years, and on research areas of and suggestions from mentors, teams will start exploring the wider area of mobile and ubiquitous computing in order to get an understanding of what interests them and what direction their project could go. TAs will play an active role in this process and will help students find their passion. TAs will also give feedback on the intended complexity of a project — ideally it should be challenging to push students out of their comfort zone and thus to enable learning, whilst at the same time not being unrealistically over-ambitious. This process will be iterative and requires substantial work, but —if done well— it will pay off with a project the team will be passionate about, which will lead to mastery of the field of mobile and ubiquitous computing.

A project fair will be held on January 16 (in class) in which project ideas will be discussed and students can ask questions about projects as well as discuss amongst themselves to form teams.

Students should not wait until the project fair but start exploring potential project ideas and teams as the semester starts (January 6).

Project Teams

Students are responsible for forming teams of at least four members. Students are encouraged to enter some basic information about their background, experience, and motivation / interests into a class-public spreadsheet, which will make the project forming process easier. The link to the document is given on Canvas.

All members of a project team will fill a team contract in which they formulate their goals and objectives, their anticipated roles within the project, and their overall ambitions. This contract is a required deliverable (pass / fail grade) and will be used throughout the project to keep track of project progress and especially the individual contributions of all team members. See grading guidelines below.

Project Deliverables

Projects have the following deliverables that will be graded (totalling to up to 60% of the overall grade):

- Team contract — has to be signed by all team members and is binding — will be used for progress evaluation throughout the semester
- Project proposal
- Project teaser video
- Halftime project update (presentation / discussion / critique – details to be specified)
- Project demo (end of project)
- Project report

Guidelines for writing proposals, report, demo, slide and video presentations are available on Canvas (Files section).

Grading (Group Components)

For group assignments and project deliverables, every team will submit one copy of the assignment / deliverable to Canvas. Every group assignment must include a statement of each team member's contributions to the assignment. TAs and instructors will regularly discuss group participation with every team. All members of a project team will receive the same grade for the main portion of a deliverable. This is a general rule unless in extreme, well justified cases that will need to be discussed with TAs, mentor, and instructor. In case of unequal contributions to a group assignment, the grading team will reduce grades on a case-by-case basis. TAs will grade the project components using a rubric that corresponds to the guidelines for students as mentioned above.

Two team evaluation surveys will be conducted throughout the semester (at about half-time and at the end of the semester), in which each team member assesses their own contributions and those of all their team members.

- For each evaluation total of four stars can be given to each team member.
- This peer evaluation will affect up to 10% of your Final Project grade (6 points of Total Grade)

Underperforming team members (determined as outlined above) may have their project grades reduced by up to 10%. Overperforming team members may have their project grades increased by up to 5%.

The expectation is that each team member contributes such that the workload is equally shared in a fair way. This has been true for the vast (!) majority of projects in previous semesters and down-scaling individual grades has been the rare exception. Yet, this instrument of team evaluation and scaling of grades has proved to be very effective to ensure fair sharing of workload.

Plagiarism Quiz

Students will have to take a quiz on plagiarism in order to demonstrate that they have understood the academic code of conduct and are able to work on the class assignments and project components according to good academic practice. Details of the academic honor code and pointers to background information are given below.

The plagiarism quiz is available online on Canvas. Students will have an infinite number of attempts but will have to answer all questions correctly in order to be able to proceed with the class (pass / fail). Deadline for successful completion of the plagiarism quiz:

IRB

Students can only start working on their project after providing evidence of successful completion of relevant IRB (Institutional Review Board) training (CITI certificate(s) as outlined above).

All projects are—by definition—classroom (educational) projects and, as such—if adhering to good academic practice as attested through a successful IRB training—are exempt from IRB approval. However, without proper IRB approval (if required by a project) the results of a project can NOT be published as such. Publication (for example, in the form of a scientific article) typically requires IRB approval (depending on the project). Teams aiming to publish their project results should discuss their plans with their mentors / the professor to seek advice.

Schedule

See calendar. Note that the schedule is subject to (minor) changes. So, please check the site frequently.

Final Exam

The final exam will contribute 20% of the overall grade**.** All covered materials incl. lectures, readings (!), activities, and project components are relevant for the exam. This is an individualized assessment and no cooperation is allowed. Strict plagiarism / cheating checking will be implemented.

The final exam will be a be completed on Canvas **in class during the exam period**. Late submissions will not be accepted.

Grading & Evaluation

Grading Scheme

Overall course grading is based on the Georgia Tech letter grading system (A through F, as defined at https://registrar.gatech.edu/info/grading-systemLinks to an external site.). The various components of the course contribute to the overall grade as follows:

Contributions to Overall Grade

Grade Component	**Max. grade contribution**
3 graded group exercises – best two count but all must be successfully attempted (at least 70%): • Sensor data analysis • Prototyping • Indoor Localization	10%
4 Graded Individual Exercises - Best 3 count but all must be attempted (at least 70%) • Gesture Music Player • Eyetyping • Head Worn Displays • Smartphone Development	10%

Project deliverables: • Individual Mini Proposal/Survey [5%] • Teasesr Video [5%] • Proposal [10%] • Halftime update [10%] • Final Demo/Poster [10%] • Final Report [20%])	60%
Final exam	20%
Total	100%

TAs will use detailed grading schemes for each component, which ensures fair and objective grading.

Calculating Final Grades

Each component (as described above) will be graded separately accumulating points towards the overall course grade. The final, overall course grade is then calculated as follows:

Accumulated percentage	**grade**
90-100%	A
80-89%	B
70-79%	C
60-69%	D
<60%	Not passing

Attendance & Class Participation

Students have to attend all sessions.

Learning Resources

Textbook

We will make use of the following textbook:

Krumm, J. (2009). Ubiquitous Computing Fundamentals (1st ed.). Chapman & Hall/CRC. http://www.amazon.com/Ubiquitous-Computing-Fundamentals-John-Krumm/dp/1420093606Links to an external site.

This semester we will put more focus on scientific articles rather than on a single textbook. The majority of the readings will be provided through the course website. For some assignments — and of course for the project work — students are expected to conduct their own, independent literature research (and reading).

Hardware Kit

For the prototyping exercise, as well as for general prototyping activities, we will use the following kit, which students are asked to purchase at the beginning of the class (one kit per project team is sufficient):

Name	ELEGOO UNO Project Super Starter Kit with Tutorial and UNO R3 Compatible with Arduino IDE
Description	Starter kit for Arduino-like prototyping containing breadboard, jumper cables, selection of sensors and actuators, power supply, tutorial etc. Compatible with Arduino UNO R3, MEGA 2560 R3, NANO.
Purchasing option	https://tinyurl.com/MUChardwareLinks to an external site. (Amazon; likely to be available elsewhere as well)
Approximate cost	$45
Note	If students already have access to similar hardware, then there is no need to purchase. Yet, in-class activities and potentially project work is based on access to hardware like this.

Readings

Students are expected to read the required readings prior to the session when they are due. Class exercises and discussions and any examinations will assume familiarity with

any reading material as distributed through the course website. All the readings and when they are due will be posted on the Canvas.

Rapid Prototyping (Lab)

A selection of electronics and hardware rapid prototyping equipment and tools will be provided to teams on a first come first served basis. Students will have access to both the GVU Prototyping Lab as well as the GT Invention Studio where maker equipment such as laser cutter and 3D printer can be used.

Important: For some of the facilities students must attend an orientation session prior to using the equipment within these labs. Please visit the websites and schedule orientation sessions independently, if required.

Course Policies

Anti-Harassment Policy

We will implement a strict anti-harassment, zero tolerance policy in line with the institution's general anti harassment policy as it is defined here:

http://titleix.gatech.edu/anti-harassment-policyLinks to an external site.

Honor Code

Students are expected to follow the Georgia Tech Honor Code, available at https://policylibrary.gatech.edu/student-life/academic-honor-codeLinks to an external site., including but not limited to the section on plagiarism (see below).

Group Work

Group work is explicitly encouraged for the project students will be working on throughout the course. Project reports will be written in groups (all members of a team submit the same report and receive the same grade). Group discussions in the classroom will be fostered — at appropriate times — throughout the course.

Academic Misconduct: Plagiarism & Cheating

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit

ttp://www.catalog.gatech.edu/policies/honor-code/Links to an external site. or http:// www.catalog.gatech.edu/rules/18/Links to an external site..
Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations. Instructor(s) and TAs will implement a zero-tolerance policy on plagiarism & cheating. This policy is based on the Code of Conduct as cited by

the Georgia Tech Honor Code. As per the Georgia Tech honor code, plagiarism is defined as “Submission of material that is wholly or substantially identical to that created or published by another person, without adequate credit notations indicating authorship (plagiarism);“ [https://osi.gatech.edu/students/honor-codeLinks to an external site.] Plagiarism or any other kind of cheating as defined by the Georgia Tech Code of Conduct will result in failing the course. As a reminder it is worth noting that class exercises will be treated the same way as any other material that shall be submitted by students. Signing up for anyone else other than oneself is considered forgery and counts as cheating for both parties involved.

Submission Policy

All work needs to be submitted through Canvas using the Assignments feature. For group assignments only one submission per team has to be made. We will use the group feature in Canvas as soon as project teams are finalized. TAs will assist students with submissions.

Acceptable format for written reports is PDF (only). Unless stated otherwise all reports / assignments are required to use the ACM, double column conference format (which will be linked in the assignment descriptions). Page limits apply as specified for each assignment.

Acceptable format for slides submission (not presentation) is PDF (only). Use your favorite presentation software for the presentation in class but please export slides to PDF for submission to Canvas. Alternatively, students may submit links to online resources (such as Google Slides) that can be used for in-class presentations.

When submitting videos, please use standard codecs that can be played on either Mac or Windows machines (test before). However, it is strongly encouraged to rather provide links to online resources (such as youtube) where the videos have been uploaded.

Extensions, Late Assignments, & Re-Scheduled / Missed Exams

Late assignments will not be accepted without a suitable excuse (doctor’s note, police report, etc.). Note that extenuating circumstances have to be brought to the instructor’s attention **before the fact** — through the regular channels, that is *do not send doctor’s notes to the instructor or TAs* but rather send them to student services who will get in touch with the instructor. Late submission without evidence of extenuating circumstances will result in zero marks for the particular component. In case of a planned absence (e.g., for interviews) students are required to communicate this well in advance such that the team and instructor can discuss options. In case of unplanned yet excused absences (illness etc.) instructor and team will discuss options on how a student can make up for what has been missed. Missing an assignment — without evidence of extenuating circumstances as defined before — will result in failing the quiz and thus zero marks for this component.

However, in case of extenuating circumstances as defined before quizzes / exams may be rescheduled or other accommodations discussed— according to the official Gatech policy and procedure. In any case it is strongly advised to consult with the instructor well in

advance (at least one week notice) should extenuating circumstances result in extraordinary difficulties with the schedule. Within the constraints of fair treatment and within reason we will always aim for finding a satisfying solution.

Academic and Research Honesty/Integrity Statement

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review the Student Code of Conduct and the Academic Honor Code, especially Appendix A: Graduate Addendum to the Academic Honor Code.

Students are expected to perform research in an ethical and responsible manner. All Doctoral and Master's Thesis students are required to take the Responsible Conduct of Research training, and it is expected that students abide by the principles taught in that training while performing research for this thesis course.

Allegations of scientific or scholarly misconduct are handled in accordance with the procedures outlined by the Policy for Responding to Allegations of Scientific or Other Scholarly Misconduct.

Core IMPACTS

Not applicable.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Expectations of Advisors and Advisees

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Expectations of Advisors and Advisees articulates some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.