



AME 494/598 : Programming the Internet-of-Things

T Th 12:00 PM - 1:15 PM

Stauffer B 123

<https://github.com/tejaswigowda/ame494-598Fall2021>

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Office hours: T Th 10:15 - 11:15 or by appointment.

Course Description

With the proliferation of cheap and powerful microcontrollers and System-on-Chips (SoC), it is becoming easier to deploy intelligence (sensors and actuators) in the real world. There are a plethora of stand alone devices (such as a pH sensor, moisture/light sensors) already on the market, but for the vision of IoT to be realized these devices must be able to communicate and be controlled over the Internet. This class focuses on the full stack needed to make any IoT device cloud compatible. At the end of this class students will be able to design IoT devices of intermediate complexity that can log information to a cloud server.

Enrollment Requirements

Programming experience required. AME 220, AME 294 or equivalent.

Course Objectives

Develop a conceptual understanding of the *Internet, Client-server model, IoT software* via developing minimum-viable clones of IoT products like bulbs, sockets, thermostats, sensors etc.

Student Learning Outcomes

By the end of this course students will be able to:

- *Program Clients and Servers on Microcontrollers.*
- *Deploy and scale IoT software using IaaS providers (AWS, GCP, Azure)*
- *Understand no-SQL databases.*
- *Develop IoT APIs.*
- *Understand scaling and security issues.*



Course Access

Your ASU courses can be accessed by both my.asu.edu and myasucourses.asu.edu; bookmark both in the event that one site is down.

Additional Requirements

This course requires the following technologies

- Computer with Webcam, microphone, headset/earbuds, and speaker.
- Web browsers ([Chrome](https://www.google.com/chrome/), [Mozilla Firefox](https://www.mozilla.org/en-US/firefox/), or [Safari](https://www.safari.com/))
- Reliable broadband internet connection (DSL or cable).
- Simple Text Editor (eg: TextMate on Mac, Notepad on Windows, VI on Unix)
- GitHub account (Free account)
- Minimal hardware requirement: Mac, Linux Box or Windows PC
- TTGO Watch kit: <https://www.aliexpress.com/item/4000170737186.html> (will be provided).
- Other required software will be specified in class.

Classroom Technology (Your specific Technology Usage policy)

- It is encouraged that you bring technology (cell phones, tablets and laptops) to class to help you take notes and do research, however please turn off cell phone ringers and do not use your phone to make personal calls in class or use any technology to use social media in class. Do not answer your phone in class. If you believe you are receiving an emergency call, please step outside to take it.



Required Primary and Secondary Materials

This course does not have a text-book. Appropriate reading material and tutorials will be assigned. Please follow along with the course on the class repo: <https://github.com/tejaswigowda/ame494-598Fall2021>.

You will need a simple Text Editor (eg: Atom on Mac, Notepad++ on Windows, VI on Unix) and a GitHub account (free account).



Anti-Discrimination Statement

The Herberger Institute of Design and the Arts at Arizona State University upholds, values, and cherishes student and faculty diversity, no matter the circumstance. As members of the ASU community, we are charged with challenging injustices and social inequities of any kind through education. These values are an integral part of our standing as an institution and must be upheld by all members of the ASU community, including but not limited to all Herberger Institute of Design and the Arts staff, faculty and students. The call is clear and present at ASU for every member of our community to do their part in fostering a culture of Inclusive Excellence that contributes meaningfully to lasting equity for all. For students and faculty alike, this culture of Inclusive Excellence creates role models, broadens perspectives, combats negative stereotyping and enables artists, designers and makers of the 21st century to think creatively, critically and, above all, compassionately about our impact on the world at large.

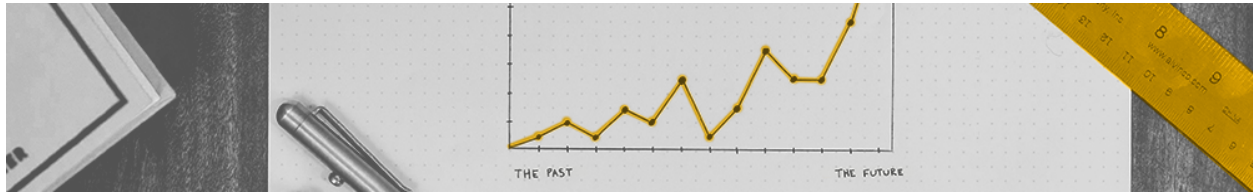
This course and Arizona State University welcomes all students regardless of race/ethnicity, gender identities, gender expressions, sexual orientation, socio-economic status, age, disabilities, religion, regional background, Veteran status, citizenship status, nationality and other diverse identities that we each bring to class. Each of us bear intersectional perspectives that are born out of our backgrounds and identities, and each of us has a contribution to make towards our culture of Inclusive Excellence. As your instructor, I expect that all of my students abide by the following community agreements:

- to bring a willingness to deeply inspect your own assumptions about the world, identifying areas in which you may need to unlearn implicit biases and behaviors

- to help others learn by respectfully voicing your thoughts and reactions, acknowledging that they are partial to and shaped by the way you make sense of the world
- to demonstrate a curious and eager inquiry into how others make sense of the world

Diversity of experiences, backgrounds and opinions are essential to cultivating a rich academic environment which in turn strengthens our capacity to be ethical and empathetic creative-thinkers. I aim for students of all backgrounds to be well served by this course and that the diversity students bring to this class be viewed as a resource, strength and benefit. The materials of this course, including readings and assignments, will reflect this commitment to diverse and inclusive knowledge. If a student feels that there has been a discrepancy between my teaching practices and the university's commitment to Inclusive Excellence, you are encouraged to discuss your concerns directly with me. I value your learning experience and welcome all opportunities to enrich the efficacy of this course for all student groups. Here are resources available to all students to report incidents of bias, harassment, and other forms of discrimination inside and outside the classroom:

- Unsure of whether the concern you experience or witness falls under the criteria of bias, harassment, and other forms of discrimination? You can fill out the Herberger Institute Community of Care form at herbergerinstitute.asu.edu/caring describing the situation. One of the members of the Herberger Institute Behavioral Response Team will connect with you.
- Anyone who believes that they have been subjected to discrimination, harassment, or retaliation in violation of this policy, or who believes that this policy has been violated, should report the matter immediately to the Office of University Rights and Responsibilities or the Dean of Students office or directly fill out an incident report.
- Unless a person is restricted by law from doing so, any employee who is informed of or has a reasonable basis to believe that sexual harassment has occurred, shall immediately report all information regarding the occurrence(s) to the Office of University Rights and Responsibilities or the Title IX Coordinator or the Dean of Students office.
- More reporting pathways are available to students on the University's Prohibition Against Discrimination, Harassment, and Retaliation policy page.



Assignments

All assignments will be turned in on GitHub. More details for each assignment will be introduced in class. There are 8 assignments in total and a final exam.

Grading, including grade scale

Assignments 1-7 are worth 12% of your grade and Assignment 8 is worth 16% of your grade. The final exam will be an opportunity for 10% extra credit. You will be given a one and a half hour task similar to one a prospective employer would give you to test your skill in coding. This brings the total amount of points in the class to 110 points and gives you the possibility of getting ten points extra credit.

This course uses +/- grading

98+	A+
93-97	A
90-92	A-
88-89	B+
83-87	B
80-82	B-
78-79	C+
70-77	C
60-69	D
0-59	E

Incomplete Policy

The incomplete is not a routine process for successful completion of coursework. Rather, it is a limited academic exception intended to address situations where a student who has been doing acceptable work experiences exceptional extenuating circumstances beyond the student's control preventing their timely completion of the course. In evaluating requests for incompletes, I not only assess the nature of the extenuating circumstances and whether such circumstances were beyond the student's control, but also whether the student's record of performance in the class demonstrates the likelihood for successful completion of the remaining coursework. All incomplete contracts must also be approved from the academic unit leads. Finally, while policy dictates the maximum time for contract completion, I take into account what materials are outstanding and consider the appropriate extension. Statistically at ASU, the shorter the contract length the more likely students will be able to successfully complete their classroom obligations. You can read more about the incomplete policy at <https://www.asu.edu/aad/manuals/ssm/ssm203-09.html>

Subject to change

The Instructor reserves the right to change portions of this syllabus (assignments, deadlines etc.) by verbal instructions during scheduled class time. The student is responsible for noting changes and acting accordingly. Grading and absence policies are not subject to change.



Policies and Procedures

Attendance Policy (see: <https://provost.asu.edu/fall-2021-learning-expectations>)

The class is offered in-person and uses University space and resources to enhance learning. The expectation is that all students attend every class. However, absences can be excused based on individual circumstances. Faculty will provide accommodations that may include participation in classes remotely, access to recordings of class activities to the degree it is possible. Absences do not relieve students from responsibility for any part of the course work required during the period of absence.

Excused absences related to religious observances/practices in accord with [ACD 304-04](#), "Accommodation for Religious Practices." Students may be excused for the observance of religious holidays. Students should notify the instructor at the beginning of the semester about the need to be absent from class due to religious observances. Students will be responsible for materials covered during their absence and should consult with the instructor to arrange reasonable accommodation for missed exams or other required assignments.

Excused absences related to university sanctioned activities in accord with [ACD 304-02](#), "Missed Classes Due to University-Sanctioned Activities." Students required to miss classes due to university sanctioned activities will not be counted absent. However, absence from class or examinations due to university-sanctioned activities does not relieve students from responsibility for any part of the course work required during the period of the absence. Students should inform the instructor early in the semester of upcoming scheduled absences and immediately upon learning of unscheduled required class absences. Reasonable accommodation to make up missed exams or other required assignments will be made. Consult the instructor BEFORE the absence to arrange for this accommodation.

Line-of-duty absence and missed assignment policy

A student who is a member of the National Guard, Reserve, or other U.S. Armed Forces branch who misses classes, assignments or examinations due to line-of-duty responsibilities shall have the opportunity to make up the coursework in accordance with [SSM 201-18 Accommodating Active Duty Military Personnel](#). This accommodation also applies to spouses who are the guardian of minor children during line-of-duty activities. This policy does not excuse students from course responsibilities during their absence. Students should first notify the Pat Tillman Veterans Center of their activation and then the instructor to discuss options.

Instructor Absence Policy

Students should wait for an absent instructor 15 minutes in class sessions of 90 minutes or less, and 30 minutes for those lasting more than 90 minutes, unless directed otherwise by someone from the academic unit.

Academic Integrity and Student Honor Code

The ASU student honor code affirms the commitment of ASU to uphold the values, principles, and ethics of academic integrity. All students are expected follow the code which states,

"We, the students of Arizona State University, have adopted this code as an affirmation of our commitment to academic integrity and our participation in ethical education. We embrace the duty to uphold ASU's Honor Code, and in light of that duty, We promise to refrain from academic dishonesty. We pledge to act with integrity and honesty to promote these values among our peers. We agree to always abide by the Sun Devil Way and uphold the values of the New American University."

Every student is expected to produce his/her original, independent work. Any student whose work indicates a violation of the ASU Academic Integrity Policy including cheating, plagiarism, and dishonesty will be subject to disciplinary action. Plagiarism is defined as deliberately passing off someone else's words or ideas as your own. All necessary and appropriate sanctions will be issued to all parties involved with plagiarizing any and all course work. Plagiarism and any other form of academic dishonesty that is in violation with the Student Code of Conduct will not be tolerated. Arizona State University and the Herberger Institute for Design and the Arts expect the highest standards of academic integrity from all students. Failure to meet these standards may result in suspension or expulsion from the university or other sanctions as specified in the ASU Student Academic Integrity Policy (<http://provost.asu.edu/academicintegrity>), "[e]ach student must act with honesty and integrity, and must respect the rights of others in carrying out all academic assignments." This policy also defines academic dishonesty and sets a process for faculty members and colleges to sanction dishonesty. Violations of this policy fall into five broad areas that include but are not limited to:

- Cheating on an academic evaluation or assignments
- Plagiarizing
- Academic deceit, such as fabricating data or information
- Aiding Academic Integrity Policy violations and inappropriately collaborating
- Falsifying academic records

I sanction any incidents of academic dishonesty in my courses using University and HIDA guidelines. Should you have any question about whether or not something falls subject to this clause, feel free to contact me or review the university policy on academic integrity at the above link. Per ASU policy, a student may not avoid the consequences of academic dishonesty by withdrawing from a course, and may be placed back in the course in order to face sanctions resulting from academic integrity violations. You are responsible for abiding by this policy.

Student Learning Community Conduct

ASU adheres to a university-wide Student Code of Conduct. The philosophy behind this policy states, The aim of education is the intellectual, personal, social, and ethical development of the individual. The educational process is ideally conducted in an environment that encourages reasoned discourse, intellectual honesty, openness to constructive change and respect for the rights of all individuals. Self-discipline and a respect for the rights of others in the university community are necessary for the fulfillment of such goals. The Student Code of Conduct is designed to promote this environment at each of the state universities. You are expected to treat your instructor and your fellow classmates with respect and kindness. In all correspondence and in Discussion Board postings, you should show

respect for the viewpoints of others who may disagree with you or see things from a different perspective. Criticizing, ridiculing, insulting, or belittling others will not be accepted. Keep in mind that electronic communications do not have the advantage of nonverbal cues that are so much a part of interpersonal communication. Humor or satire can sometimes be misinterpreted in strictly electronic communication forums. In addition, all students should be aware of their [Rights and Responsibilities](#) at Arizona State University.

Copyright

Students must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's original work, unless the students first comply with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement. The course content, including lectures and other handouts, is copyrighted material. Students may not share outside the class, upload, sell, or distribute course content or notes taken during the conduct of the course (see [ACD 304-06](#), "Commercial Note Taking Services" for more information). THIS CONTENT IS PROTECTED AND MAY NOT BE SHARED, UPLOADED, SOLD, OR DISTRIBUTED.

Statement on ASU's Community of Care standards

The Herberger Institute for Design and the Arts complies with the spirit and the letter of ASU's community of care standards with regard to social distancing, masking, and student, faculty, and staff safety and well being. <https://eoss.asu.edu/communityofcare>

Threatening or disruptive behavior

Self-discipline and a respect for the rights of others in the classroom or studio and university community are necessary for a conducive learning and teaching environment. Threatening or violent behavior will result in the administrative withdrawal of the student from the class. Disruptive behavior may result in the removal of the student from the class. Threatening, violent, or disruptive behavior will not be tolerated in this class, and will be handled in accordance with ASU policy (SSM 104-02). For more information please visit:

<https://eoss.asu.edu/dos/srr/PoliciesAndProcedures> and
<https://eoss.asu.edu/dos/safety/ThreateningBehavior>.

Withdrawal

If you are unable to complete the course, it is your responsibility to arrange for withdrawal from the class. You will not be automatically withdrawn and unless you are officially withdrawn from the course you will receive a final grade based upon the total points you have earned for the semester. Students are required to pay all tuition and fees for any registered course unless enrollment is officially cancelled during the 100% refund period. Please visit the Academic Calendar to review the withdrawal deadlines for this semester. For more information on Drop/Add and Withdrawal visit <https://students.asu.edu/drop-add>

Special Accommodations

Your instructor will make any reasonable adaptations for limitations due to any disability documented with the Student Accessibility and Inclusive Learning Services (SAILS), including learning disabilities. Please contact the instructor during office hours or by appointment to discuss any special needs you may have. You must contact the SAILS to process the paperwork for special course accommodations. To request academic accommodations due to a disability, please contact the SAILS (<https://eoss.asu.edu/drc>); Phone (480) 965-1234; TDD (480) 965-9000). Students who feel they will need disability accommodations in this class but have not registered SAILS should contact SAILS immediately. Students should contact the Center on the campus that your class is being held. Campus-specific [location and contact information](#) can be found on the SAILS website. SAILS offices are open 8 a.m. to 5 p.m. Monday – Friday. Check the [above](#) website for eligibility and documentation policies (<https://eoss.asu.edu/drc>). This is a very important step as accommodations may be difficult to make retroactively. If you have a letter from their office indicating that you have a disability which

requires academic accommodations, in order to assure that you receive your accommodations in a timely manner, please present this documentation to me as soon as possible so that your needs can be addressed effectively.

Title IX and Mandated Reporter Policy

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at <https://sexualviolenceprevention.asu.edu/faqs>.

As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, <https://eoss.asu.edu/counseling>, is available if you wish to discuss any concerns confidentially and privately.

Policy on Sexual Discrimination

Policy on sexual discrimination as described in [ACD 401](#), "Prohibition Against Discrimination, Harassment, and Retaliation", including the fact that the instructor is a mandated reporter and therefore obligated to report any information regarding alleged acts of sexual discrimination. Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information.

Student Services & Resources

You will find a list of student resources at <https://eoss.asu.edu/resources>

Resources included are advisement, registration, financial aid, disability services, counseling, tutoring, library, and more.

Novel Coronavirus Information and Updates

You will find information and Frequently Asked Questions here
<https://eoss.asu.edu/communityofcare>

You will find Novel Coronavirus updates and announcements here
<https://eoss.asu.edu/health/announcements/coronavirus>

Non-emergency Student Care process

If you are concerned for a your own or a fellow student's well-being, please review the information and complete the form at herbergerinstitute.asu.edu/caring and the HIDA Care Team will reach out. FOR EMERGENCIES CALL 911. (Be prepared with the physical address of the location.)

Academic Calendar and Important Dates

The academic calendar can be found here <https://students.asu.edu/academic-calendar>