ID 4863 Syllabus

Introduction to Arduino Circuits and Programming, ARD, 2 Credits

Summer 2025

Instructor Information

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Teaching Assistant (TA) Information

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General Course Information

Description

Arduino is cheap, modular, open-sourced, and well-supported by a plethora of resources that keep being updated by global communities. For a designer, engineer, or someone who is interested in making interactive artifacts such as Internet of Things (IoT), Arduino can be a great tool to help you quickly prototype your design vision, especially in the age of Generative AI (GenAI). In this course, you will learn:

- The basic concepts and computational thinking skills for Arduino prototyping;
- How to design and develop Arduino circuits;
- How to read and write Arduino code;
- How to do Arduino prototyping for a novel circuit (or project) together with Large Language Models (LLMs).

Pre-Requisites

This is an introductory course in Arduino prototyping, and no prior experience in electronics or programming is required. Basic knowledge of C++ (e.g., "if" statements, "while" loops, and "for" loops) may be helpful for understanding the course material more easily.

Course Learning Outcomes

Upon completion of the course, students are expected to demonstrate knowledge, skill, and abilities in the following areas:

- Acquiring a solid knowledge foundation in Arduino circuits and programming;
- Practice the Arduino skills through which novel Arduino projects can be created.
- Practice the skills of working together with LLMs for Arduino prototyping.

Course Format

- **Asynchronous** video lectures: introducing basic Arduino prototyping knowledge; live coding demo and circuit crafting through simulation platforms.
- **Asynchronous** Q&A sessions: Questions from students will be collected weekly through online surveys, based on which videos will be created to answer the questions.

Required Course Materials

There are no required texts for this course. Whenever possible references and reading materials will be provided in digital format via the class website (on Canvas). However, we do have two books you can look into for reference:

- Banzi, Massimo, and Michael Shiloh. Getting started with Arduino. Maker Media, Inc., 2022.
- Ulrich, Karl T., and Steven D. Eppinger. Product design and development. McGraw-hill, 2016.

Grading Policy:

Your final grade will be assigned as a letter grade. Grading for this course consists of two components:

Participation (10%): Each week, each student needs to submit **at least two lecture-related questions** through the unique Qualtrics survey links, which will be provided through Canvas during the course period.

- Week 1 Qualtrics Survey, 2% of the final grade
- Week 2 Qualtrics Survey, 2% of the final grade

- Week 3 Qualtrics Survey, 2% of the final grade
- Week 4 Qualtrics Survey, 2% of the final grade
- Week 5 Qualtrics Survey, 2% of the final grade

Assignments (in total 90%): Five assignments regarding Arduino circuit and programming.

- Assignment 1, 18% of the final grade
- Assignment 2, 18% of the final grade
- Assignment 3, 18% of the final grade
- Assignment 4, 18% of the final grade
- Assignment 5, 18% of the final grade

Since this summer course has five weeks, there will be one assignment for each week, focusing on the practice of the key Arduino programming and circuit skills introduced in that week. Each assignment will be submitted through Canvas. The specific format of the submissions will be specified in the assignment sheets.

Scores for individual submissions, assignments, or any other components will be given based on the general guidelines below. Any additional grading criteria in the assignment sheet need to conform to the guidelines below:

- ***A:*** ***90.00-100%*** *Excels in quality and understanding beyond requirements*
- ***B:*** ***80.00-89.99%*** *Meets all requirements and no outstanding lack in quality*
- ***C:*** ***70.00-79.99%*** *Minor lack in quality or some requirements missing*
- ***D:*** ***60.00-69.99%*** *A small part of requirements is delivered but effort is evident*
- ***F:*** ***0-59.99%*** *Low effort or major lack in quality or no submission*

Description of Graded Components

For the participation grade, please note that questions submitted through the Qualtrics links must be **related to** or **based on** the online **lecture video content for each week**. Questions not related to that week's video lectures will **not** earn participation points.

Since the deliverables for all the assignments will focus on Arduino circuits and programming, students should pay attention to the following categories of submission qualities:

- ***Functionality and Requirement Fulfillment:*** *Circuit fully functional – incorporate all components and functionality as specified in the requirements of this assignment sheet.*
- ***Organized Layout:*** *Well-organized layout of components on the breadboard in your TinkerCAD simulations. Avoid the intersection of wires as much as possible, and follow the*

color-coding conventions (black for ground, red for power, yellow for signal, and different colors for different functions).

- ***Completeness and Accessibility:*** *All the required deliverables are complete and submitted, with files easily accessible by the instructor (e.g., I can open the TinkerCAD link, Wokwi link, mp4 video file, or any other required files easily,* ***without error messages****).*
- ***Clarity of Communication:*** *Code includes clear and sufficient comments to explain the operations. Text-based submissions (e.g., paragraphs or pages of texts), if any, should clearly communicate the required key points as specified in the assignment sheets.*

Course Schedules

	Structure	**Content**	**Date**
Week 1	Digital Input & Output	Introducing basic Arduino coding structures and circuit creation process through buttons and LEDs.	June 29 to July 5
Week 2	Analog Input & Output	Introducing various sensors as analog input and RGD LEDs as analog output.	July 6 to 12
Week 3	Libraries & Functions	Introducing how to use functions from existing libraries and how to self-define functions through servo and DC motor controls.	July 13 to 19
Week 4	Communication Protocols	Introducing the I2C communication protocol through OLED screens and RFID sensors.	July 20 to 26
Week 5	Programming with Large Language Models (LLMs)	Introducing examples of how to design and develop novel Arduino circuits and programs together with Large Language Models (LLMs).	July 27 to 31

Course Policies

Attendance and/or Participation

Attendance: Given that all the classes are in an asynchronous online format, there is no requirement for attendance in this course.

Participation: You are expected to actively engage in asking questions regarding each week's lecture videos. **Each week, each student needs to ask at least two lecture-related questions through the unique Qualtrics survey links, which will be provided through Canvas.**

Academic Integrity

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 Georgia Tech's Honor Code and the student Code of Conduct.

Any student suspected of cheating or plagiarism 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.

Grade Dispute Policies and Procedures

The grade for each released assignment will be released on Canvas. Students should contact the instructor **through the instructor's GA Tech email** (**ywang4372@gatech.edu**) within 4 days of the grades being posted if they have any concerns about the assigned grade or questions about the grading reasons. A regrading process can be initiated based on student requests. However, please note that the regrading process may result in higher or lower grades depending on the quality of the deliverables requested for regrading.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) 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.

Student-Faculty Expectations Agreement

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 Student-Faculty Expectations articulate 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.

Extra Credit Opportunities

There are no extra credit assignments or opportunities for this course.

Collaboration

Please be aware that all the assignments in this course are individual assignments. There is no group assignment. For collaboration among students, it is encouraged for students to discuss with each other about the basic logic of programming and circuits for the

assignments. However, students are not allowed to look through each other's circuit diagrams or Arduino codes for the assignments, and certainly not to copy each other's work.

Use of Generative AI

Regarding the recent rise of LLMs such as ChatGPT or Copilot, **this course allows the use of LLMs for the purpose of programming ONLY for the final assignment (the Week 5 Assignment).** You should not use LLMs for assignments from Week 1 to Week 4. **However, it is acceptable and encouraged to use LLMs as a source of learning programming syntax and logic.** In other words, students can discuss with LLMs about how to write a specific command in the right syntax and how to approach a programming issue with the right coding logic; however, students should NOT ask LLMs to write Arduino code for their assignments.

This course does NOT allow students to use LLMs for writing lecture-related questions.

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

All assignments must be turned in on time, or alternative arrangements must be made with the instructors prior to the due date. Failure to hand in assignments on time may result in a late penalty assessment for that assignment. Extensions may be assessed in consultation with the instructors. Institute-mandated exceptions will be honored, as explained in this document: http://www.catalog.gatech.edu/rules/4/

Course Website and Other Classroom Management Tools

The course will utilize Canvas for the distribution of class materials, such as lecture videos or supplemental readings, survey links for submitting lecture-related questions, announcements, and for turning in assignments. However, for grade-dispute matters, please email the instructor for prompt responses. Please do NOT use Canvas to communicate with the instructor or the TA for grade dispute matters since Canvas may delay the responses.

Campus Resources for Students

Undergraduate Student Academic Success Resources:

Academic Support: Academic Success and Advising (a unit in the Office of Undergraduate Education & Student Success) provides free support for your courses. Students can attend scheduled supplemental review (PLUS) sessions, stop by Drop-In Tutoring, or schedule a one-on-one appointment through Knack. To explore what options work best for you, please

visit us online at success.gatech.edu/tutoring, email us at tutoring@gatech.edu, or come see us at Clough Undergraduate Learning Commons, Suite 283.

Graduate Student Academic and Professional Success Resources:

A list of resources for graduate students is given on the Office of Graduate and Postdoctoral Education website. Specific information for current graduate students includes

- Academic Resources such as the Communications Center, Language Institute, Library, Catalog, Registrar, resources for conducting research, Advocacy and Conflict Resolution resources, and how to manage unexpected situations that may impact your academic performance;
- Student Resources such as Campus Services, Child Care/Family programs, Health & Wellness, Career Services, and the Student Resource Guide; and
- *Professional Development such as the programming from the Career Center and other professional development resources and events"*

Student Well-Being:

At Georgia Tech, we are concerned about your overall physical, social, and mental well-being. A comprehensive list of wellness related resources has been compiled and maintained by the Office of the Vice President for Student Engagement and Well-being (student-resource-guide (gatech.edu)