

Spring - 2019
AET361C: Physical Computing – Unique #: 20770
Michael McKellar
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Office Hours: By Appointment

Monday & Wednesday 12:00 – 1:30 pm
PAC 3.204

REQUIRED assets for Class:
A notebook & pen

Recommend assets for Class:
A personal Arduino Uno & breadboard

OVERVIEW

Lab based hybrid class:

Focuses on the design fundamentals, correct usage and implementation with embedded micro-controllers such as Arduino/Raspberry-Pi.

This class will develop practical knowledge for driving motors, building sensors and other electric micro-units for use in both prototyping and permanent sculpture/experience uses.

Safe handling, wiring and implementation will cover the correct terminology and practise for voltage, current and resistance as well as ability to both design and calculate the above for real world developments.

This studio will involve hands on experience in computing/electronics hardware as well as correct software programmatic methods.

This class is scheduled to overlap with **AET 339 – digital fabrication** course for complex group project realization.

COURSE DESCRIPTION

This class will take students through the design, development and implementation of micro-controller based sensor systems. Using Arduino (Arduino.cc) as a foundation students will learn the fundamentals of human computer interaction methods ranging from correct circuitry design and voltage/current calculations through to engaging and automatic computer driven mechanics (motors, buttons, lasers etc.).

Initial weeks within the class will develop foundation knowledge for safe practise and implementation while offering students as much hands on time as possible with the range of sensors, inputs and outputs offered in the physical computing realm.

Pass/fail technical challenges will assess and compound student learning from class and offer the ability to begin building and prototyping unique installations/experiences.

Project 1 will explore students to explore the ideas of automation and possibilities within the physical computing realms by implementing an action or event from their everyday life in a computer controlled way. One example being using a range of moving motors and a smart phone stylus to send a text automatically.

Project 2 will activate the cross over section of this class. Combining with AET 339 – Digital Fabrication - students will form project groups and develop an interactive, kinetic sculpture within the loose scope and boundary set in class. Student groups will be responsible for the design, prototyping and final implementation of a unique interactive sculpture. The works from all groups will be shown in an exhibitions style format celebrating the work from AET students and the SDCT. The exhibition will form part of the student's grade.

LEARNING OUTCOMES

By the end of the semester, students will be able to:

- Develop critical understanding of the current state of physical computing trends and the processing in creation

- Developed an understanding in real-world physical computing implementations
- Utilised multiple Industry standard hardware and software tools to realise finished products
- Worked in groups to develop, build and implement a real-world showcase of interactive/reactive work

COURSE REQUIREMENTS

- Participation (15%): Students should be prepared to raise ideas, critique designs and add to class discussions, this is expected weekly.
- Attendance (5%): Attendance is taken during every class
- Technical Challenges (25% total) – technical challenges are graded on a pass/fail basis (for 4 points) if they meet the scope set out in the specific challenge, some challenges will have an additional grade point available allowing for creative or other adaptive implementation by students.
- Project 1 (25%) – Automate your life. Students will design, develop and implement an iterative prototype product that automatically performs a single task.
- Project 2 (30%) – Interactive sculpture exhibition. Working in collaboration, student groups will design, develop and implement an interactive and reactive kinetic sculpture for exhibition at an out of classroom space.

CLASS POLICIES

UT ELECTRONIC MAIL NOTIFICATION POLICY

Electronic mail (e-mail) is a mechanism for official University and instructor communication to students. Students are expected to check e-mail on a frequent and regular basis in order to stay current with University- and course-related communications, recognizing that certain communications may be time-critical. It is recommended that e-mail be checked daily, but at a minimum, twice per week.

It is the responsibility of every student to keep the University and instructor informed of changes in his or her official e-mail address (do so at https://utdirect.utexas.edu/utdirect/bio/address_change.WBX). Consequently, e-mail returned to the University with "User Unknown" is not an acceptable excuse for missed communication. Similarly, undeliverable messages returned because of a full inbox or use of a spam filter will be considered delivered without further action required of the University or instructor.

(see <http://www.utexas.edu/cio/policies/university-electronic-mail-student-notification-policy>)

ATTENDANCE

Attendance and punctuality are professional attributes. This class is designed to provide students skills for a more practical and professional future career.

You are allowed three absences for illness or personal reasons; however, you will likely miss points for in-class assignments or activities as a result, and these generally cannot be made up.

However, if a serious medical or personal crisis (hospitalization, death in the family, etc.) impacts your attendance, please inform me as soon as possible. In addition, see the exception below for religious holy days.

Arriving more than ten minutes late at the beginning of class or after a break, leaving class without permission, and leaving class prior to dismissal for the day all count as being absent.

Unexplained absences beyond the three outlined above will result in a penalty to your final grade. Normally a single grade drop per unexplained absence. (E.g. A, becomes A-, C+ becomes C etc.)

Learning, research and development within the class all build on knowledge gained from previous lessons, you are responsible for making up for work missed during any absence. It is your responsibility to obtain any notes or assignments from one of your classmates.

RELIGIOUS HOLIDAYS

Section 51.911 of the Texas Education Code states that a student shall be excused from attending classes or other required activities, including examinations, for the observance of a religious holy day, including travel for that purpose. A student whose absence is excused under this subsection may not be penalized for that absence and shall be allowed to take an examination or complete an assignment from which the student is excused within a reasonable time after the absence. University policy requires students to notify each of their instructors at least fourteen days prior to the date they will be absent from scheduled classes to observe a religious holy day.

(from http://www.utexas.edu/provost/policies/religious_holidays/1555_001.pdf)

SERVICES FOR STUDENTS WITH DISABILITIES (SSD)

The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact Services for Students with Disabilities (512-471-6259, ssd@austin.utexas.edu, <http://ddce.utexas.edu/disability/>, or videophone 512-471-6644). Please provide documentation of your needs during the first week of class, if possible, so that I can make the necessary accommodations promptly.

CLASSROOM ETIQUETTE

1. Be on time at the start of class time and after any breaks
2. This class is a place for artistic discussion and critique, not texting on your phone – please turn them on silent
3. Discussion is good, distraction is bad – I reserve the right to reduce marks for participation for repeat offenders
4. Consider bringing headphones/earphones for any periods of solo work, such as class work sessions – any other time, these are never seen

COURSE COMMUNITATION

The syllabus and assignments will be posted on the course Canvas site. All communications outside class hours will take place via canvas.

This class is designed around discussion and group learning, it will help everyone if you post questions in the discussion area wherever possible. I will post, comment and otherwise add to the discussion wherever relevant, or with topics to help steer general discussion in class.

I will attempt to respond to all private communications within 24 hours on weekdays.

I normally check emails twice per day, once in the afternoon, once in the evening.

- Always ask questions where there is doubt. Do not make assumptions.

ASSIGNMENTS

- All assignments will be given out and discussed during class time and available to view on Canvas.
- Some classes will have specific technical assignments with focus on students learning specific skills in a software or working with a hardware. Additional smaller assignments may be made throughout the semester as the need arises.
- You are responsible for making up for any class work missed – specifically technical challenges completed during class time as these, and the homework assignment contribute heavily to the final grade.
- It is your responsibility to ask and inquire if you are unclear about what is required or when.
- A number of assignments will make use of lab accessible technology. You are responsible for making sure you leave appropriate time to access all the required technology for a given assignment.

ASSIGNMENTS DEADLINES

- It is vital that you do not get behind in this class as all work builds upon previous work.
- As a general rule all projects, reading, research and homework assignments must be completed before the beginning of each class period. However, many class assignments have a due date and time in the evening before class. This allows time for review and feedback, as well as discussion based upon the submitted work during the next lesson. Any work not submitted on time will still receive feedback but will not benefit from peer review in class time.
- All work is due as specified in the assignment listed on canvas. Work not completed before the canvas deadline will be considered late.
- Any work turned in late, without prior consent and valid reason, will be accepted for a week past the original due date penalized with a full grade drop from the deserved reward (an A submission will reward a B etc).
- Technical challenges are given out week 2 onwards
- Project 1 is given in week 7 due in week 10
- Project 2 is given in week 10, due in week 15. An exhibition external to class may result in a requirement to present outside of class hours.
- You will be shown your estimated class participate grade during mid-term week (normally week 7) based on current engagement. Use this as a chance to evaluate your engagement and participation in discussions and critiques and whether a change on your part is required.

CLASS SCHEDULE

Due to holidays, university breaks and other external factors some dates from the below table may change slightly from semester to semester.

W/C Date	Week	Lecture (Monday)	Lab (Wednesday)	Assignment Given	Assignment Due	Other
Jan 21	1	No class	<ul style="list-style-type: none"> Course Overview Introduction to Arduino Uno The IDE & Breadboard My first Program 			Meet and greet AET 339 1:00PM
Jan 28	2	<ul style="list-style-type: none"> Not making fires Wiring, Serial, Parallel HIGH & LOW 	<ul style="list-style-type: none"> Lights (LED, LED Serial, LED Parallel) Accessing different LEDs LED pattern generation 	Technical 1		
Feb 4	3	<ul style="list-style-type: none"> Input (buttons, dials, Gyroscope, etc...) 	<ul style="list-style-type: none"> Developing with various inputs Making interaction happen 	Technical 2	Technical 1	
Feb 11	4	<ul style="list-style-type: none"> Advanced Input (Light/Heat/Accelerometer/IR sensor/) 	<ul style="list-style-type: none"> Oven time/ security light/ Speedometer 	Technical 3	Technical 2	
Feb 18	5	<ul style="list-style-type: none"> Movement (motors, servos, dynos, gears & ratios) 	<ul style="list-style-type: none"> Working with motors, gears & movement 	Technical 4	Technical 3	
Feb 25	6	<ul style="list-style-type: none"> Output (Screens, more LEDs, noise etc...) 	<ul style="list-style-type: none"> Motion detection alarm 	Technical 5	Technical 4	
Mar 4	7	<ul style="list-style-type: none"> External devices & the outside world (OSC / Serial/ protocols and languages) 	<ul style="list-style-type: none"> Implementing your physical computing into another project 	Project 1	Technical 5	Current Participation grade shown
Mar 11	8	Project 1 pitch	<ul style="list-style-type: none"> Project 1 Support Teams meet – Potential skype guest 			Team Intros
Mar 18		Spring break				
Mar 25	9	Project 1 Support	Group elevator pitches			Group elevator pitches
Apr 1	10	Project 1 – Reviewed Project 2 – group work kick off	Group focused work	Project 2 – Kick off	Project 1	
Apr 8	11	Group focused work	Group focused work			
Apr 15	12	Group focused work	Group focused work			Project 2 Prototype
Apr 22	13	Group focused work	Group focused work			
Apr 29	14	Group focused work	Group focused work			MAKER FAIRE – 4th
May 6	15	Project 2 tidy up	Project 2 – Final submission – Blog & Portfolio submission		Project 2 – portfolio	
May 13	16	No class days				

EVALUATION & GRADING

GENERAL

Neatness, scholarship and presentation will all count towards your final grade. When designing being able to visually communicate ideas is part of the process, this does not mean that artistic merit is awarded.

TECHNICAL CHALLENGES

Technical challenges for this class are graded on a **pass/fail** criteria. Every technical challenge will present a number of bullet point objectives to achieve for submission.

Unless all points marked required are present the assignment will be graded fail.

Some challenges will include 'optional' additional points that are not included in the grading criteria but offer advanced skill or creative challenge.

Some challenges may indicate they award an additional point for creativity.

PROJECT WORK

Each assignment will be given a specific grading rubric covering exactly how students will earn points. A rubric section is normally **assigned a grade from 0-5**:

0 – **Null**, not covered in submission

2 – **Okay**, attempts to answer brief but fall short of minimum requirements

3 – **Good or great**, answers the brief

4 – **Excellent**, goes above and beyond the brief

5 – **Exceptional**, a perfect professional piece of work

Some rubric points may have double (or higher) weighting that will result in your award being multiplied by weighting.

Example:

Grading Section	Award	Weighting	Total
1	3	2	6/10 (60%)
2	4	1	4/5 (80%)
		Total	10/15 (66.67%)

YOU WILL BE GRADED ON

- Reading, discussion, Participation (15%);
- Attendance (5%)
- Technical Challenges (1-5) (25%)
- Project 1 – augment your life (25%)
- Project 2 – AET 339 cross over work & exhibition (30%)

This course does not have a final exam, but student exhibition will make part of the assigned grade.

GRADING SCHEME

This class uses a mixture of points and percentages. Assignments will be given in points, but the final grade will be calculated via the percentage of awarded points vs total available points across all assignments.

To ensure fairness, all numbers are absolute, and will not be rounded up or down at any stage. Thus a B- will be inclusive of all scores of 80.000 through 83.999... The University does not recognize the grade of A+. Thus, the conversion from percentage value to letter grade is as follows:

- A = 94+
- A- = 90 – 93.999...
- B+ = 87 – 89.999...
- B = 84 – 86.999...
- B- = 80 – 83.999...
- C+ = 77 – 79.999...
- C = 74 – 76.999...
- C- = 70 – 73.999...
- D+ = 67 – 69.999...

- D = 64 – 66.999...
- D- = 60 – 63.999...
- F = 0 – 59.999...

PRIVACY

This class is designed to be an open space for discussion, critique and learning. What is said about each other's work during this class should remain in the classroom. It will not be published in a blog or any other personal website, tweeted or posted on social networks.

MOBILE DEVICES

Mobile devices of any kind must be silenced and out of sight.

There may be times when using a mobile is appropriate, such as aiding in discussion or during dedicated solo work – these times will be very obviously announced. Usage of a mobile device outside of these terms – with or without warning, will result in severe penalty to your class participation grade.

RESOURCES AND EQUIPMENT

This class will make use of Arduino, a programming development environment based on java (derived from processing).
 Arduino.cc

We will be making notes and diagrams that relate to your safe development while using current, voltage and general electronic devices. While nothing we deal with in class will harm a human - proper usage, documenting and understanding are vital for future learning. **As such as note pad and pen will be required for every class session.**

The lab will supply a variety micro-controllers and associated sensors and devices. **While not a requirement**, it is suggested students acquire their own Arduino board for outside of class development:

<http://a.co/d/4j5iCgG>