CDE514
Engineering Technologies for Designers

Syllabus

Responsible lecturer
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Not decided

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Creative Design Engineering
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1. Course contents and the relevance to ID education Structure

The students in this course will learn basic engineering skills, specifically comprising physical computing skills for the implementation of their interactive product ideas, and programming skills to control the prototypes. This course will be a fundamental course on learning programming and physical computing for the non-engineering background students. By learning the technical implementation knowledges during the course, the students might learn at least a way to implement the design concepts by themselves and communicate with engineering background students. The knowledge and skills that they have learned during the course could be applied to the IDP I & II, Interaction Design course of CDE or other courses that might require design and implementation of interactive prototypes.

Week 1 ~ 8: Students will learn electronics and programming basics. The programming phase will consist of variables, functions, arrays, string and operators that are fundamental knowledge that are need to be delivered to the students. Along with this, the electronic basics, which might be the basis of physical computing will be taught with the contents that comprise of breadboard, resistors, diodes, LEDs, transistors, and so on. After learning those basics, the students will learn ways to control basic sensors and actuators through Arduino. This phase will be divided into four sections within two weeks. Lastly, they will learn ways to connect and implement various electronic parts with connecting Arduino and Processing. By doing three different phases of Arduino + Processing exercises, they will present a simple interactive prototype demo at the Midterm period.

Week 9 ~16: After the midterm period, students will conduct co-project within all 1st year CDE (conditional) required courses that they are taking at the semester. They will investigate appropriate technologies for their design concepts and learn advanced programming & physical computing skills by implementing the concepts. During this period, each student will creative a design concept and implement an outcome that integrates the lessons and skills learned from the courses. In addition, they will learn how to select and apply technologies on their design concept, and practice integrating the technologies on their concepts from the perspective of design.

2. Study goals

The major goals of this course are:

1. Learning and practicing fundamental engineering knowledges for enhancing technical implementation skills of the design concepts
    a. Programming
    b. Physical computing
2. Investigate and apply the engineering knowledge and skills on implementing their design concepts
    a. Derive a creative interactive product design concept
    b. Investigate appropriate technologies of their concept, and integrate the lessons and skills learned from the design and engineering backboard courses.
    c. Understand the technologies on the aspect of design and apply to represent the core concept of their design.

3. Education method

Week 1 ~ 8: Students will learn electronics and programming basics by conducting step-by-step exercises during the course and through the assignments. The major tools that the students will be using are Arduino and Processing. During the course, the basics of programming and physical computing will be delivered through the lectures and student will practice them by using the Arduino, Processing software and electronic kits. At one lecture time, 2-3 phases of lecture & practice will be provided to the students, and through the weekly assignments, they will integrate all the lessons learned during the week and implement a specific item that would require the knowledge and skills of the week.

Week 9 ~16: After the midterm period, students will conduct co-project within all 1st year CDE (conditional) required courses that they are taking at the semester. This period will be more like learning-by-doing by investigating appropriate technologies for their design concepts and learning programming & physical computing skills by implementing the concepts. During this period, each student will creative a design concept and implement an outcome that integrates the lessons and skills learned from the courses.

4. Deliverables

Week 1 ~ 8: Programming, Physical Computing (Arduino), Sensors and Actuator Control (Arduino+Processing) homework. A simple interactive prototype demo at the Midterm period.

Final Outcome: Design concept and working prototype of interactive product/systems that integrates the knowledges and skills learned during the design-based and engineering-based conditionally required CDE courses.

5. Assessment

Attendance and Participation: 15%
Assignments: 30% (Homework until midterm: 20%, Work-in-progress presentation until Final: 10%)
Midterm Outcome Presentation & Demo: 25% (Programming: 10%, Physical Computing: 10%, Representation: 5%)
Final Co-Project: 30% (Concept: 10%, Prototype: 10%, Video: 5%, Document: 5%)

6. Schedule and organisation

Week	Date	Teaching contents/teaching method	Homework / Project
1	*1st class*	Course Introduction / Lecture	
	2nd class	Programming Basics 1 (Processing) / Lecture + Practice	
2	*1st class*	Programming Basics 2 (Processing) / Lecture + Practice	
	2nd class	Programming Basics 3 (Processing) / Lecture + Practice	Programming homework
3	*1st class*	Electronics Basics 1 / Lecture + Practice	
	2nd class	Electronics Basics 2 / Lecture + Practice	
4	*1st class*	Step by Step Arduino Exercise 1 / Lecture + Practice	
	2nd class	Step by Step Arduino Exercise 2 / Lecture + Practice	Arduino homework
5	*1st class*	Step by Step Arduino Exercise 3 / Lecture + Practice	
	2nd class	Step by Step Arduino Exercise 4 / Lecture + Practice	Arduino homework
6	*1st class*	Communication between Arduino and Processing (I/O) / Lecture + Practice	
	2nd class	Arduino+Processing 1 / Lecture + Practice	Arduino+Processing homework
7	*1st class*	Arduino+Processing 2 / Lecture + Practice	
	2nd class	Arduino+Processing 3 / Lecture + Practice	Arduino+Processing homework
8	*1st class*	Midterm : Summary & integration of lessons learned through a simple interactive prototype / Outcome Presentation & Demo	
	2nd class		Presentation & Demo
9	*1st class*	Review of Lessons Learned / Lecture	
	2nd class	Concept Generation / Practice	Brainstorming with a Probe kit
10	*1st class*	Concept Presentation & Selection / Practice	Presentation & Critics
	2nd class	Electronic Parts & Sensors & Actuators (Selection & Purchasing) / Practice	
11	*1st class*	Hardware Design and Electronic Parts Connection 1 / Practice	
	2nd class	Hardware Design and Electronic Parts Connection 2 / Practice	Work-in-progress presentation & Critics
12	*1st class*	Physical Computing / Practice	
	2nd class	Programming (Arduino+Processing) / Practice	Work-in-progress presentation & Critics
13	*1st class*	Programming (Arduino+Processing) / Practice	Work-in-progress presentation & Critics
	2nd class		
14	*1st class*	Implementation and Integration (SW + HW) / Practice	Work-in-progress presentation & Critics
	2nd class		
15	*1st class*	Implementation and Integration (SW + HW) / Practice	Work-in-progress presentation & Critics
	2nd class		
16	*1st class*	Final Working Prototype Demo Presentation	Final presentation & Demo (Open)
	2nd class		

- *Week 9 ~ 15: Co-project period (The schedule can be slightly modified considering the students' progresses)*

7. Literature and study materials

Major References

- Margolis, M. (2011). Arduino cookbook. O'Reilly Media, Inc.
- Noble, J. (2009). Programming Interactivity: A Designer's Guide to Processing, Arduino, and Openframeworks. O'Reilly Media, Inc.

Other References

- McRoberts, M. (2010). Beginning Arduino. New York. Apress.
- O'Sullivan, D., & Igoe, T. (2004). Physical computing: sensing and controlling the physical world with computers. Course Technology Press.
- Greenberg, I. (2007). Processing: creative coding and computational art. Apress.