How to Build a Digital-Physical System Syllabus Outline

Week	Topics (Monday)	Practical (Wednesday)	Reading/Assignment
Module 1: Introduction to Digital Physical Systems			
Week 1 Aug 22	• Introduction to the Course • Questionnaire	• Introduction to Sensing and Control	• Set up Wiki Page • Write a short statement of personal learning goals for the course
Week 2 Aug 29	• Introduction to Machining and Fabrication	• Introduction to Design of Physical Objects • Screening of 'Objectified'	• Based on the discussion in Objectified, outline the major considerations in designing a good physical digital system. •
Module 2: Core Technology Skills			
Week 3 Sept 5	**NOTE: Labour Day - Topics will be covered in first practical** • Introduction to Electronics, Arduino, and microcontroller concepts • Introduction to the Arduino programming language	• Setting up Arduino environment • Working with a breadboard • Blinking Lights Example	• Reading: Basic Electronics Primer • Document First Assignment on Wiki
Week 4 Sept 12	• Types of Physical Digital Systems • Controlling Physical Digital Systems • **Topic 1**: Ambient Systems	• Controlling the light with switches • Soldering	• Document Arduino Practicals • Reading: TBC
Week 5 Sept 19	• Types of Physical Digital Systems • Controlling Physical Digital Systems • **Topic 2**: Wearable & Embedded Systems	• Analogue Input & Pulsing with Modulation • Fading a light • Potentiometer	• Document Arduino Practicals • Reading: Dunne

Week	Topics (Monday)	Practical (Wednesday)	Reading/Assignment
Week 6 **Sept 26**	• Types of Physical Digital Systems • **Topic 3**: Public/Large Scale Systems	• Machining Techniques	• Document Fabrication Practical • Describe pro's and con's of fabrication method • Reading: TBC
Week 7 **Oct 3**	• Functions of Physical Digital Systems • Personal: Motivating behaviour change • In the Home vs. Wider World (awareness & visualisation)	• Laser Cutting	• Document Fabrication Practical • Describe pro's and con's of fabrication method • Reading: Rogers
Week 8 **Oct 10**	Beyond the technical: Physical Digital Systems, Installation & Art	• 3D Printing	• Document Fabrication Practical • Describe pro's and con's of fabrication method • Reading: TBC
Module 2: Designing Physical Digital Systems			
Week 9 **Oct 17**	• Aesthetics & Form of Physical Digital Systems • Considering texture, form, size, weight, height, experience, etc. • Appropriateness - designing for the need, situational context, • Affordances • Introduction to Final Assignment	Continuing from Module 1: Putting it all together: • **Combination Lock *or*** • **Building a Rock-Paper-Scissors Machine** • **TBC** • Code to be provided	• *Readings:* Petrilli, Gaver • Identifying Concept: In Home Observational work / Cultural Probe
Week 10 **Oct 24**	• Ethnography, Observations and Understanding • Material Cultures of Space & Impact on Design	• Student Presentations of Observational Work • Critique Session	• Reading: Harper, Norman • Refinement of Concept: Writeup on Wiki • Create a project summary (what it does, why it does it, who will use it, when, how they will engage with it, etc?)
Week 11 **Oct 31**	• Embodiment & Physicality • Interaction Design for physical digital systems	• Requirements Gathering & Sketching Exercises	• Reading: van Overbeek, Dourish • Illustrate the concept on the Wiki • Continue Final Assignment

Week	Topics (Monday)	Practical (Wednesday)	Reading/Assignment
Module 4: Technical Skills			
Week 12 **Nov 7**	• Sound & Sensing • Connectedness	• Arduino: Simple Theramin - (Light Sensor & Sound) - Code provided	• Document Arduino Practicals • Continue Final Assignment
Week 13 **Nov 14**	• Colour, Light & Ambience • Visual Presentation of information	• Arduino: Nervous/Reactive Lamp (RGB Led) - Code Provided	• Document Arduino Practicals • Continue Final Assignment
Week 15 **Nov 21**	• Motion & Movement	• Arduino: Emotional Barometer (Motor & Online Search) - Code Provided	• Document Arduino Practicals • Continue Final Assignment
Week 16 **Nov 28**	Future of Physical Digital Systems • Examining NUIs • Speculations on where tangible & physical UI's might go over the next 10 years	**Final Presentations** • Groups will present the outcomes of their project	
Week 17 **Dec 6**	**Final Presentations** • Groups will present the outcomes of their project		

Participation & Attendance

Participation and attendance counts for 10% of the overall grade. This will be awarded in part for in-class discussion and students will be expected to engage with and contribute to these discussions and provide constructive advice to other students during critiques. Disruptive behaviour - e.g. talking over other students during presentation - may negatively impact on grades for this components. Laptops should be used appropriately and mobile phones should be set to silent or switched off during class time. All students are expected to arrive to class on time, particularly for practical assignments on a Wednesday. If you're going to be late or absent, please provide advance notice where possible.

Lab & Practical Assignments

Nearly every Wednesday will contain a practical assignment. These will provide simple instructor led tutorials on building physical digital systems. The steps for each assignment will be discussed in class. The steps presented should be completed each week and you should show the working finished version to the instructor to secure your marks for each assignment. Students are encouraged to tinker and try variations of the working system. Doing so, may help the student(s) accrue extra credit. The assignment should also be documented on the WiKi page by each student. This should include photos or videos of the working system, any learnings you had, any problems or difficulties encountered and how you overcame them or any elements you think may be useful to you or others in the future. Clear and instructional (step-by-step) documentation is desirable.

Presentations

All members of the group should be present during the class to showcase and discuss the assignment. All members of the group should contribute to the presentation.

Final Assignment

Develop a conceptual physical digital system for personal use.

Ideate a Concept: Gather requirements through observation, probes and ethnography. Use this to identify a suitable concept for a physical digital system.

Develop a concept: Students should be able to show the development of their concept from simple sketches through to conceptual design. This should be well illustrated and discuss the use of colour, form, textures, size, reasons for the design, expected users, as well as expected use etc.

Produce an System: A high fidelity version of the physical digital system should be produced. Students are not required to implement a working version of the system, however, they are expected to develop their conceptual design to a high standard in some form. This may include: a concept video overviewing its use; the production of an enclosure or fabricated form for the device; the development of a physical prototype; photoshop or 3d model designs overviewing its use. The final outputs should provide a clear understanding of its operation in practice.

All stages of the project should be clearly documented and illustrated. This should include a clear and consise introduction explaining the motivations for this system, its operation, function and goals.

Considerations

- Who is the user and why would they use this? What does it offer them? How will it be perceived by a user?
- What are the constraints on the design? What are its limitations?
- What environments/spaces will it operate in? What opportunities, benefits or challenges does this present?
- Is the form right? Why were the size, texture, dimensions, etc chosen?

- What information does it need and how can it gather it? How often does it capture information?
- How does it provide feedback? Why does it provide feedback in that way? Does it present the right things?
- Is it affective? Will it be critical or encouraging? Will it be enjoyed?

Final Report

Students will be asked to complete a final report on the module. For this they should individually reflect on the concept produced along with the readings provided throughout the course. The student should outline the design process taken in developing the physical digital systems, constraints on the design, design decisions taken, and lessons learned. Finally, the student should consider their own personal learnings from this design exercise.