FABLAB O SHANGHAI “FABO ACADEMY X CHINA”

Fablab O Shanghai “Fabo Academy X China”, is a digital manufacturing and rapid prototyping course based on MIT’s “How To Make (Almost) Anything” class (MAS.863/4.140/6.943) and Fab Foundation’s “Fab Academy” global. The course is an overview of the tools and practices commonly used in any Fablab, with a focus on design, project development and documentation.

COURSE CONTENTS

The course focus is on learning the skills to design and prototype a product/service that solve the problem of a group of users. Design Thinking techniques are used alongside fabrication skill. Student will learn the tools and workflows of the Fablab: 3D scanning, electronic design and programming, basics of 2D sketching and 3D Modeling software, training on laser cutting and 3D printing. These skills are important to learn the constraints and best practices to design objects for digital fabrication tools. Get used to move from design to prototype and back for improvements. Understand how the machines work, what they are used for and what are the materials available, how to adapt the design process to the machine or technique used. Also, production and programming techniques for electronics will be introduced.

DESIGN THINKING

Throughout the class, students will be introduced to Design Thinking techniques. First, they will conduct a research about the field their product will live in, collect data and informations, interpret the research material through visual storytelling and ideate a final project proposal. At this point they will experience how rapid prototyping works, by moving many times back and forth in both the design and fabrication stage.

The prototyping phase make use of project development and documentation tools, to record and publish the processes, experiment results, designs, code and all the material related to the project. In the end, each student presents the final project to the class.

MODULAR STRUCTURE

1. Introduction: what is a Fablab? Design challenge
2. Laser Cut practice, 2D design software, empathy interview
3. 3D Printing practice, 3D modeling software, interpretation
4. 3D Scanning, brainstorming
5. Physical Computing, quick prototyping
6. Project Development
7. Project Development
8. Project Development

- Final Presentation Event

DESIGN CHALLENGE BRIEF: “LIFE AT THE TIME OF AN EPIDEMIC”.

The COVID-19 epidemic has hit our planet and the lives of all human beings. Never in its recent history, human kind has been so fragile but at the same time so united to fight a common enemy. How did the epidemic affected the lives of the people living in Shanghai Tech's campus during this special time? What problems emerged in daily life? How can we design and prototype a solution to one of these problems?

COURSE STRUCTURE

The principal for teaching is hands-on learning: keeping the theory short but dense before continuing on practical applications. Each student is required to bring his own laptop, in good working order, **with a mouse** and basic software installed.

Course Length: 1 day/week, 7 days in total + 1 day for presentation of the final projects.
On Class Hours: 3 classes (50 min) each day.
Off Class Exercise Hours: 3+.

CLASS SCHEDULE

15 min - Review: Review of past week's assignments.
35 min - Theory Lecture: Video/Slide Presentation.
10 min - Break.
50 min + 35 min (+10 min Break) - Practical Lecture: Machine Training, Practical Application, Software Demonstration.
15 min - Assignment: Overview of the weekly assignment.

CLASS 1. 2D CAD SOFTWARE, DESIGN AND LASER PRACTICE.

Introduction to the Fablab Network and personal fabrication concepts. Introduction to Design Thinking concept and practice. Design Challenge presentation. Finding a problem: Dreams and Complaints. Skills Market and group Formation.

Assignment:

1. Make a group of 3 people.
2. Make a list of the group's dreams and complaints.
3. Make a list of dreams and complaint of as many people as possible in the campus.
4. Create a repository on an online platform (github) to share material for the course.

Learning outcomes:

- Learn how to find problems within a design challenge.

CLASS 2. 2D CAD SOFTWARE, DESIGN AND LASER PRACTICE.

Introduction to the basic commands of 2D CAD sketching. Learning key concepts of designing 2D objects and understand the possibilities and limitations of laser cutting. Design Thinking 2: empathy interview.

Assignment:

5. Design a modular (parametric) "Totem" with engraved and scored element.
6. Cut 2 modules and analyze them. Modify the design, cut an improved version.
7. Laser cut all the modules and assemble them without using glue.
8. Perform an "empathy interview" to find a problem in the form of an anecdote.

Learning outcomes:

- Learn the basic commands of 2D CAD software.
- Know what kerf is and how to compensate for it in the design.
- Learn how to safely and efficiently use the Laser Cutter and the stock material.

Software: Fusion 360
Device: Laser Cutter

CLASS 3. 3D MODELING SOFTWARE, DESIGN AND 3D PRINT STORYTELLING ELEMENTS.

An introduction to the basic commands of a 3D modeling software and to the different 3D printing technologies. Learn the limitations of what can be printed and the workflow going from design to print. Analyze and debug printer errors. Design thinking, quickly going from idea to design to 3D printed prototype and then back to design. Design Thinking 3: interpretation of a problem and storytelling.

Assignment:

1. Design a small 3D model and use it for testing the printer and its design rules.
2. Design 3D elements to use in the storytelling.
3. Print one of the 3D element you designed, analyze, modify, print an improved version.
4. Create a visual storytelling making use of the 3D models designed.

Learning outcomes:

- Learn the basic operations of 3D Modeling software.
- Learn the toolchain and workflow for 3D printing.
- Identify and solve printer errors.
- Use rapid prototyping in design thinking storytelling.

Software: Fusion 360, Slicer software
Device: 3D Printer

CLASS 4. PROGRAMMING MICROCONTROLLERS WITH INPUT & OUTPUT.

Learning how analog and digital ports work and how to add Input and Output (I/O) devices to a microcontroller. Make a prototype circuit using the Arduino platform and I/O devices, write or modify a program and test it.

Assignment:

1. Test and use many different electronic components.
2. Use the Arduino IDE to write or modify a program with I/O devices.
3. Assemble your circuit on a breadboard and test it.

Learning outcomes:

- Analyze a question and prototype a solution.
- Conduct simultaneous hardware and software development.
- Work with electronic components on the breadboard.

Software: Arduino IDE
Devices: Arduino, electronic components.

CLASS 5. PHYSICAL COMPUTING AND QUICK PROTOTYPING.

Learning how to use and program an Arduino board to interact with the physical world. Use an input device to control an output device (actuator). Make a quick prototype with I/O and simple materials like cardboard and paper to illustrate the functions of the solution you are working on.

Assignment:

1. Assemble an electronic circuit using Arduino board and I/O devices.
2. Program the board to control an output device with an input device.
3. Make a quick prototype of the solution you are working on using simple materials.

Learning outcomes:

- Familiarize with Arduino board and its components.
- Learn how to create, upload, interpret and modify an interactive code.
- Integrate the physical world with the computing world to describe an idea.

Software: Arduino IDE
Devices: Arduino board, I/O devices

CLASS 6/7/8. PROJECT DEVELOPMENT.

Introduction to Project Development, Spiral Development, documentation and dissemination. Design and fabricate a working prototype of the solution to your problem. Is your solution a product? Make it. Is your solution a service? Describe how it works with a model. The final project integrates electronics, functions and shapes and use as many techniques learnt: 3d printing, 3D scanning, laser cutting, electronics, programming.

Assignment:

1. Design and fabricate all the parts of your project.
2. Assemble your project, test it, modify, improve (use spiral development).

Learning outcomes:

- Understand system integration, materials and processes needed.
- Manage time, break down development in simple tasks, iterate, add features.
- Solve problems and deliver solutions in a short amount of time.

FINAL DOCUMENTATION & PRESENTATION.

Finish the final project and upload the documentation online. Make a slide to present your project to a broad audience. Include a photo of the project, a few photos of details, the title, a brief description and the name of the class and of the members of the group. Review your work and present your website and your project to the class.

Assignment:

1. Create a 1920x1080 PNG slide to present your project.

2. Upload all the material to the repository.
3. Present your work to the class.

Learning outcomes:

- Be able to talk in public and make an effective exposition of the work.