IPRO 333: Fab Lab
Fall 2008

PROJECT PLAN

Instructor David Gatchell

Collaborators Steve Willis - Director, Fabrication Laboratory,
The Museum of Science and Industry

IPRO Team
Michael Brassil
Regina Lamonica
Joseph Luciani
Christine Ly
Jessica Martinez
Michael Martinez
Patricia Murman
Treyson Ptak
Ivan Reyes
Jacqueline Villa

Illinois Institute of Technology
September 19, 2008

Abstract

Fabrication Laboratories (Fab Labs) were started as a community outreach program by the Massachusetts Institute of Technology to provide digital fabrication tools for rapid prototyping to the general public. The Museum of Science and Industry in Chicago (MSI) has partnered with this IPRO to further develop their existing Fab Lab. IPRO 333 has been assigned the task of working with the Fab Lab administrators to design methodologies for furthering the use of the laboratory and determining its end goals for both the museum and the community. Once these goals are established, we will support them with a list of projects that we will create and execute. By working with the lab directors to broaden the possible uses of the lab, we hope to encourage hands-on learning in local schools. This will promote membership at MSI and involve the community in science and technology programs and education. To accomplish this, we have broken into two teams, each of which will focus on a different audience. The first team will be responsible for designing and creating programs for more advanced and knowledgeable users of the equipment specific to the Fab Lab, such as the students enrolled in the Science Achievers program as well as museum members; the second team will be responsible for designing and implementing programs for less advanced users with more constrained timeframes, such as visiting families or groups of school children.

Table of Contents

I. Background

Currently there are thirty-four Fabrication Labs (Fab Labs) spread across nine countries. What began as a rapid prototyping platform developed by the *Center for Bits and Atoms* at Massachusetts Institute of Technology (MIT) in August 2007, has quickly emerged as the future of small scale industry. As such, Fab Labs are meant to encourage local entrepreneurs to take their own ideas from the drawing board to prototypes to starting local micro businesses. More importantly, Fab Labs also teach users critical skills in computing, electronics, programming, and CAD/CAM fabrication techniques, all of which remain a set of internationally recognized skills. A lab typically contains groups of off-the-shelf, industrial-grade fabrication and electronics tools, wrapped in open source software and programs. What IPRO 333 does is take the knowledge and fresh ideas of young engineers, architects, and scientists of IIT and pairs that up with the resources of the Museum of Science and Industry in Chicago (MSI). This partnership hopes to utilize the current Fab Lab at MSI to its fullest potential by designing future projects for museum visitors. While past Fab Lab programs were primarily designed to solve critical issues within the local community, IPRO 333 will concentrate on the education of four client groups: members of the Science Achievers Program (i.e., high school students who volunteer at the museum and are also enrolled in a special science education program), visiting school children ages eight and up, museum guests, and museum members. By reaching out to these four groups we will introduce people of all ages to the process of design, and in some cases stimulate the minds of future scientists, architects, and engineers.

II. Objectives

This semester the objectives of IPRO 333 are to:

- assess the needs of potential Fab Lab users by conducting surveys of potential users and the designated stakeholders previously mentioned;
- educate the Fab Lab employees on the capabilities of the lab by introducing local expertise and potentially IIT lab managers;
- define potential programs for the various user groups of the lab to include:
    - pre-lab exercises to introduce users to the lab tools, software, and relevant safety measures;
    - user tutorials to facilitate more independence among the users;
    - quick reference cards that provide visual cues to guide a project;
    - predefined projects to fit into a specific time frame which are age appropriate according to the standards set forth by the National Science Foundation;
- catalogue all ideas regarding potential projects for the Fab Lab so that future IPRO 333 teams may draw upon them.

In addition this IPRO aspires to:

- create a safe workshop in which children can operate the machinery under the supervision of the museum staff;
- establish communication with other Fab Labs to facilitate the sharing of ideas, past experiences, successes, and failures;
- develop programs that are larger in scope and require time windows longer than those currently used by the Fab Lab (i.e., greater than 90 minutes in length).

III. Methodology

A. The Problem

The Problem presented to this IPRO is that the Fab Lab is under developed and underutilized. We will be working with the MSI Fab Lab to develop plan to improve the lab and expand its usage. We started this semester by beginning to familiarize ourselves with the problem. We researched examples of Fab Labs worldwide, the MIT Media Lab and its Open Courseware, and defined potential user groups of the Fab Lab. We brainstormed, as a team, the potential directions this IPRO could take this semester and in the future. Our first visit to The Fab Lab was conducted on September 9, and this allowed the group to become familiar with the lab and to better define the scope of our project for this semester. In this first visit, we determined that the staff of the Fab Lab could benefit from the expertise, on the capabilities of labs, offered by IIT.

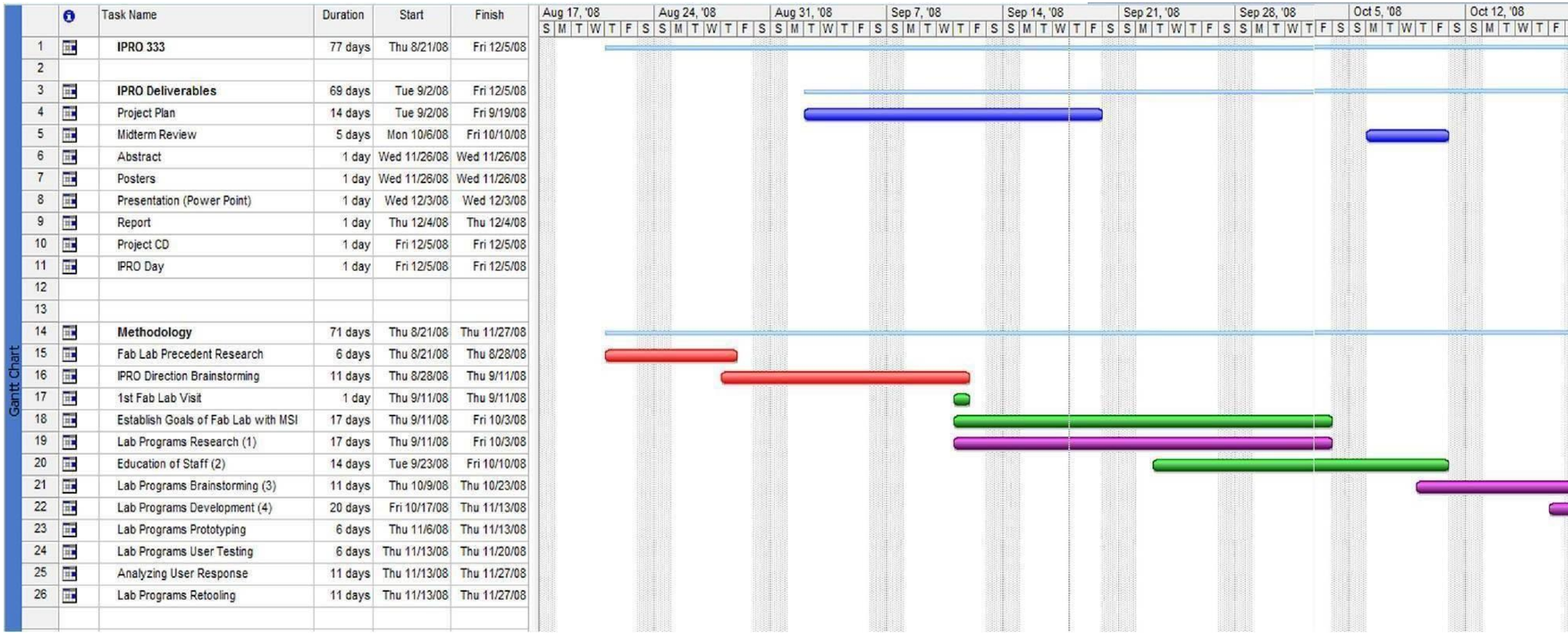
B. Plan of Action

- We will make weekly visits to the Fab Lab. In the first half of this semester these visits will allow us to meet with the Fab Lab staff and work with them in develop their goals.
- During the first half of the semester, we will offer the staff of the Fab Lab the experience of this group to increase their understanding of the capabilities of the Fab Lab tools. We will also bring IIT professors, experienced in working with and teaching students about these tools, to the lab. As part of this process we will ensure that the tools are in proper working order.
- Research will be conducted for the programs that will be developed. This research will include
    - Surveying the potential users of the Fab Lab to determine their needs. Surveys will be developed to be given to visitors entering the museum, and sent to Members, Science Achievers, and the science teachers.
    - Becoming familiar with the education standards of the National Science Foundation and other sources, such as the Benchmarks for Science Literacy, the Atlas of Science Literacy and the National Science Education (and curriculum) Standards. These standards will aid us in gauging the educational content and difficulty level of projects for different age groups. These will be utilized to guide the writing of the projects in the second half of the semester.
    - Finding examples of projects to determine what kinds of projects can be built using the lab tools and in what time frames.
- The second half of the semester will be dedicated to writing programs for the Fab Lab users. To accomplish this we have divided the group into two teams. The first will develop materials for museum members and Science Achievers, a group of about 30 high school students; the second will develop materials for general visitors to the museum, and student groups, second grade and older. Each of the teams will utilize the research conducted to brainstorm possible programs.
- The two groups will chose one program to develop for each of its respective users. The programs will be written so that they comply with the education standards researched. Depending on the user, the program may include pre-lab worksheets, an interactive tutorial, quick reference cards, or a step-by-step project. Projects which are chosen will be prototyped before user testing.
- The programs developed will be user tested at the MSI Fab Lab. The success of the tests will be determined by surveys given to the users after completion of the program. The surveys and observations from the testing will be analyzed, so the results may be implemented in writing future programs.

C. Documentation

Throughout the semester, an engineering notebook will be used to record the results of our research. The materials produced for our programs (for example: surveys, pre-lab worksheets, step by step instructions and photos of finished projects) will also be provided, as well as the results of our program testing. The team members will also contribute, in the notebook, to a compendium of ideas for possible implementation in the Fab Lab for future semesters of this IPRO to draw upon.

D. Work Breakdown Schedule



	Task Name	Duration	Start	Finish
1	**IPRO 333**	77 days	Thu 8/21/08	Fri 12/5/08
2				
3	**IPRO Deliverables**	69 days	Tue 9/2/08	Fri 12/5/08
4	Project Plan	14 days	Tue 9/2/08	Fri 9/19/08
5	Midterm Review	5 days	Mon 10/6/08	Fri 10/10/08
6	Abstract	1 day	Wed 11/26/08	Wed 11/26/08
7	Posters	1 day	Wed 11/26/08	Wed 11/26/08
8	Presentation (Power Point)	1 day	Wed 12/3/08	Wed 12/3/08
9	Report	1 day	Thu 12/4/08	Thu 12/4/08
10	Project CD	1 day	Fri 12/5/08	Fri 12/5/08
11	IPRO Day	1 day	Fri 12/5/08	Fri 12/5/08
12				
13				
14	**Methodology**	71 days	Thu 8/21/08	Thu 11/27/08
15	Fab Lab Precedent Research	6 days	Thu 8/21/08	Thu 8/28/08
16	IPRO Direction Brainstorming	11 days	Thu 8/28/08	Thu 9/11/08
17	1st Fab Lab Visit	1 day	Thu 9/11/08	Thu 9/11/08
18	Establish Goals of Fab Lab with MSI	17 days	Thu 9/11/08	Fri 10/3/08
19	Lab Programs Research (1)	17 days	Thu 9/11/08	Fri 10/3/08
20	Education of Staff (2)	14 days	Tue 9/23/08	Fri 10/10/08
21	Lab Programs Brainstorming (3)	11 days	Thu 10/9/08	Thu 10/23/08
22	Lab Programs Development (4)	20 days	Fri 10/17/08	Thu 11/13/08
23	Lab Programs Prototyping	6 days	Thu 11/6/08	Thu 11/13/08
24	Lab Programs User Testing	6 days	Thu 11/13/08	Thu 11/20/08
25	Analyzing User Response	11 days	Thu 11/13/08	Thu 11/27/08
26	Lab Programs Retooling	11 days	Thu 11/13/08	Thu 11/27/08

Gantt Chart

Aug 17, '08 | Aug 24, '08 | Aug 31, '08 | Sep 7, '08 | Sep 14, '08 | Sep 21, '08 | Sep 28, '08 | Oct 5, '08 | Oct 12, '08

S M T W T F S

Color Code:
Blue – IPRO Deliverables
Red – Reaearch
Green – Tasks involving Fab Lab staff
Purple – Project Tasks
Cyan – Task involving Fab Lab users

IV. Budget

Item	Estimated Cost ($)
Zip car	$6/hour $0.30/mile 15 trips : $225
Printing for presentation meetings, and engineering binders	$40
Prototyping Materials	$150
Public Relations (for food etc. if meeting with representatives from M.S.I)	$50
Miscellaneous	$50
Total	$515

V. Team Structure

A. Team Structure Chart

Name	Major / Year	Skills / Strengths	Experience and Academic Interest	Team[a]
Michael Brassil	Architecture / 5th	Experienced in various design and digital fabrication software. (Sketch-up, Illustrator) Microsoft office, laser cutter, wood shop tools	5th year architecture student and 1st year MBA. Worked 4 years as an arch intern, drafting, construction, graphic design.	B
Jacqueline Villa	Architecture / 5th	Experienced in various software platforms used in design and digital fabrication. (Including: Digital Project, Rhino, 3D max, InDesign, Revit) Shop work: laser cutter, wood tools and welding.	Worked in several different firms, with construction drawings, marketing and web page design. Focused and experienced in digital fabrication. Interested in the fabrication lab as a whole and designing the advanced projects they can use to promote the museum and use of the materials laboratory	B
Joseph Luciani	Architecture / 4th	Experienced in various software platforms used in design and digital fabrication. (Including: Digital Project, Sketch-up) Microsoft Office, Hand drafting and rendering, Free-hand sketching, Model-making, Field measuring, Digital Cameras, Welding, and Custom carpentry.	Design/Build, CAD development and Digital media, and conceptual design & fabrication experience. Intern for Heffernan Holland Morgan Architecture, growing interest in digital fabrication and design.	B
Regina Lamonica	Architecture / 5th	Experienced in various software platforms used in design and digital fabrication. (including: 3D Max, Flash) Shop skills: wood working, metal working, and laser cutters.	T.A for model shop in Architecture Department at IIT Interest in fabrication technology, and materials science.	A
Jessica Martinez	Biology/ 3rd	Microsoft word, excel, access, power point. Research	REU summer intern at IIT, office assistant in provost and BME office, laboratory research	A
Patricia Murman	Psychology, criminal justice / 3rd	Mechanical skills: engines and wiring Basic wood working, Microsoft office, Excel; Photography, Painting.	Worked for a contractor in construction, painting and simple demolition. NJROTC: Leadership and skill development. Academic interest: Forensic Profiling, the technical aspects of a lab and educational methods.	A

Michael Martinez	History With a minor in Biology / 5th	Microsoft word, excel, access, power point, research	Interest in Meso-America History and Ancient Civilizations. Plans on attending grad school to study either history or branch into archeology, and eventually get a PHD	A
Treyson Patek	Architecture / 5th	Various Shop and computer skills. Photography, Drawing, and Music.	16 years of Job experience including military, and various cooperate duties, even as a professional stunt man. Interested in in light weight building technologies, architecture in general, and philosophy.	A
Ivan Reyes	Architecture / 4th	Experienced in various software platforms used in design and digital fabrication. (including: Revit Architecture 2008, Pro-Steel 3D V16.3) Power Point, Microsoft Word and Excel	9 years of job experience in architecture / engineering, and drafting abilities. A Master's of Architecture in Landscape.	B
Christine Ly	Architecture /4th	Experienced in various software platforms used in design and digital fabrication. Basic shop and laser cutter skills	Architecture and the advanced and innovative technologies involved.	B

[a]Team A: Developing projects for student groups and museum visitors; Team B: Developing projects for museum members and Science Acheivers

B. Team Tasks

- Before midterm the group will work as a whole. Making sure the Fabrication Laboratory is in 100% working condition, in terms of equipment, software, and education for those running it.
- After midterm the group will separate into the A and B teams. The A team with concentrate on designing and testing projects for general visitors to the museum and younger student groups. The B team will concentrate on designing and testing projects for the Science Achievers and members of the museum.
- Regina Lamonica, and Jacqueline Villa will be the respective sub team leaders of team A and B. Being both T.A's in the Architecture Shop, they have experience with many shop tools and teaching. They will be in charge of setting meetings, some project design, and keeping everyone on track.
- Individual member task breakdown:

Before Midterm:

Joseph Luciani: Working with Ivan, bring the laser cutter in the M.S. I. up to its full potential, in working order, and training Steven Wills (our contact at the M.S. I. Who runs the Fabrication Laboratory) in any topics he may not be aware of.

Ivan Reyes: Work with Joseph on the laser cutters, focusing on potential programming for different materials to cut.

Jacqueline Villa: Work on CNC tutorial for Steven Wills. Have a comprehensive copy to hand to Steven Wills, and be certain the machine is being used to its full potential.

Michael Brassil: Working with Christine, research possible software acquisitions for the Fabrication Laboratory, to ameliorate the functionality of its hardware.

Christine Ly: Work with Michael B. on software, focusing on financial availability, licensing and contacts concerning such.
Treyson Patek: Research Vinyl cutter, brainstorm a possible wider variety of projects for the machine. Define, how far we can take such machinery, for example: Can we use it to make circuit boards?.
Regina Lamonica: Corroborate with certain voluntary professors; coordinate their visits to the fabrication laboratory and define their exact role in training Steven Wills and getting all machinery in prime running condition.
Michael Martinez: Brainstorm Projects, while keeping in mind the research and development of the other team members work. Finalize a list of restriction for the design of projects after midterm.
Jessica Martinez: Write and organize surveys to help define the goals of the M.S.I. Materials library.
Patricia Murman: Help write and organize surveys, as well as finalize research on NSF and education standards and methodology.

After Midterm:

Group A:
As a whole, the group will be working on developing and testing projects for general visitors and younger student groups

Regina Lamonica: with a focus on procedure
Treyson Patek: with a focus on procedure (final display)
Patricia Murmon: with a focus on format and method (final presentation)
Michael Martinez: with a focus on project topics (final presentation)
Jessica Martinez: with a focus on project topics

Group B:
As a whole, the group will be working on developing and testing projects Science Achievers, and M.S.I. members.

Jacqueline Villa: with a focus on writing procedure (final poster)
Ivan Reyes: with a focus on project topics
Joseph Luciani: with a focus on project topics (final poster)
Christine Ly: with a focus on formatting, and time limitations
Michael Brassil: With a focus on formatting, and procedure. (final abstract)

C. Project Monitoring Roles

- Minute Taker: Christine Ly
- Agenda Makers: Regina Lamonica, and Jacqueline Villa
- Time Keepers: Regina Lamonica, and Jacqueline Villa
- Weekly Time sheet Collector/Summarizer: Treyson Patek
- Master Schedule Maker: Regina Lamonica
- Igroups: Treyson Patek

D. Schedule of Availability (listed by person)