IPRO 333: Fab Lab

Creating Design-Prototype Learning Modules at the Museum of Science and Industry

Fall 2008

Final Report

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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 projects for more advanced and knowledgeable users of the equipment specific to the Fab Lab: the students enrolled in the Science Achievers program and museum members; the second team will be responsible for designing and implementing projects for less advanced users with more constrained timeframes: the Open Access users and school groups.

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I. Background

Fabrication Laboratories were developed by The Massachusetts Institute of Technology's Center for Bits and Atoms. The program allows easy access to rapid prototyping capabilities for communities. The concept began as a collaboration between MIT and the Grassroots Invention Group exploring how technology could bring a sense of power to a community. It also grew out of MIT's Open Courseware program and the course "How to Make Almost Anything" Currently there are thirty-four Fab Labs in ten countries around the world. These labs focus on the use of digital fabrication technologies linking tools with computers to create a faster, safer process. They act as outreach programs catering to the fabrication needs of the community and allowing for inventors and entrepreneurs from all backgrounds the opportunity to realize their ideas. The Fab Lab Community is based in Open Source communication where users of the lab share their efforts and benefit from the experiences of other users.

The Fabrication Lab at MSI currently runs as an education component developed for the Science Achievers program. This program allows high school students with an increased interest in science to actively engage in special projects and volunteer at the museum. The students spend ten weeks in this program learning how to use the various tools in the lab. Once they complete their program, they help the Lab by running Open Access sessions where visitors to the museum are allowed into the lab as part of a museum exhibit. The session is ninety minutes long; the guests are given a brief description of the mission of the lab, and then fabricate a small keepsake. The MSI Fab Lab wishes to expand the use of the lab by increasing the number of Open Access Sessions and opening the Lab to Members and school groups.

Fab Lab generally contains a large assortment of fabrication tools. They range from additive and subtractive tools, Welding tools, circuitry stations and the software to run the tools. MSI's Fab Lab is a smaller lab with only a few fabrication tools. It currently has:

Two Epsilon Mini Laser Cutters
Two Vinyl Cutters
Two Modela Milling Machines
One Shop Bot CNC Router
A Circuitry Station

All of the cutting tools are subtractive tools. The Laser cutters are the most used tools and can precisely cut a variety of materials up to one quarter inch thick. The Vinyl Cutters are primarily used for creating stickers, signs and screen printing masks. Modela Milling Machines are small mills that can be used to cut wax molds and custom circuit boards. The Shop Bot is not currently used often, but has the potential to be used to fabricate larger scale objects. The Fab Lab used Corel Draw to run its Laser Cutters and Vinyl Cutters, and Art CAM to run the Modela and Shop Bot.

The Lab is currently underutilized. IPRO 333 is working with MSI to define its goals for the Fab Lab and develop a path for its future use.

II. Objectives

This semester the objectives of IPRO 333 were 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 projects 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 aspired 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 projects 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 was that the Fab Lab was under developed and underutilized. We worked with the MSI Fab Lab to develop a 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 made weekly visits to the Fab Lab. In the first half of this semester these visits allowed us to meet with the Fab Lab staff and work with them in develop their goals.
- We offered the expertise of the IPRO team to increase the knowledge of the Fab Lab Staff about the tools. On Thursday October 9th we also brought IIT professors, TJ Mc Leish and Brett Balogh, who are experienced in working with and teaching students about these tools, to the lab.
- Research was conducted for the projects that were developed. This research included
    - Surveying the potential users of the Fab Lab to determine their needs. Surveys were given to the Science Achievers, and members of the team went to schools to survey science teachers and students.
    - 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 aided us in gauging the educational content and difficulty level of projects for different age groups. They were 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 was dedicated to writing projects for the Fab Lab users. To accomplish this we divided the group into two teams. The first developed materials for Open Access, and student groups, fourth grade and older; the second developed materials for museum members and the Science Achievers. Each of the teams utilized the research conducted to brainstorm possible projects.
- The two groups chose projects to develop for each of its respective users.

    Science Achievers: Personal Power Plant; Micro TV Transmitter - chosen to allow the Science Achievers to become familiar with the Circuitry Station.

    Members: Sliding Puzzle; Hexagram Puzzle; Japanese Puzzle Box – chosen for the longer time frame of completion and the added mental capabilities needed to use the objects.

    Open Access: Wine Rack; Yo-Yo – chosen for the short completion time and variety of interests addressed.

    Student Groups: Rubber Band Train – Chosen to fit into the 4th grade forces and motion curriculum.

    The projects were written so that they complied with the education standards researched. All the Projects contained a step-by step tutorial for the user and a Lesson Plan cover page for the lab. The student project also included a teacher Lesson Plan Page and a student Lab Worksheet.
- We did not reach the user testing phase with our projects. All projects were prototyped.

C. Documentation

Throughout the semester, a project notebook was used to record the results of our research. The materials produced for our projects were also being provided, and were placed on templates designed by the team. These templates can be used by future semesters to provide a uniform look to the projects given to the lab.

D. Work Breakdown Schedule

ID	Task Name	Duration	Start	Finish
1	IPRO 333	90 days	Thu 8/21/08	Fri 12/5/08
2				
3	IPRO Deliverables	82 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	1 day	Thu 10/9/08	Thu 10/9/08
6	Abstract	1 day	Mon 12/1/08	Mon 12/1/08
7	Posters	1 day	Mon 12/1/08	Mon 12/1/08
8	Presentation (Power Point)	4 days	Mon 12/1/08	Thu 12/4/08
9	Final 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	81 days	Thu 8/21/08	Tue 11/25/08
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				
18	Establish Goals of Fab Lab with MSI	16 days	Thu 9/11/08	Thu 10/2/08
30	Fab Lab Visits	66 days	Thu 9/11/08	Tue 11/25/08
21	9/11/08	1 day	Thu 9/11/08	Thu 9/11/08
22	9/25/08	1 day	Thu 9/25/08	Thu 9/25/08
23	10/2/08	1 day	Thu 10/2/08	Thu 10/2/08
24	10/9/08	1 day	Thu 10/9/08	Thu 10/9/08
25	10/23/08	1 day	Thu 10/23/08	Thu 10/23/08
26	10/30/08	1 day	Thu 10/30/08	Thu 10/30/08
27	11/6/08	1 day	Thu 11/6/08	Thu 11/6/08
28	11/13/08	1 day	Thu 11/13/08	Thu 11/13/08
29	11/20/08	1 day	Thu 11/20/08	Thu 11/20/08
30	11/25/08	1 day	Tue 11/25/08	Tue 11/25/08
31	Science Achievers	47 days	Sat 10/4/08	Sat 11/22/08
32	10/04/08	1 day	Sat 10/4/08	Sat 10/4/08
33	10/18/08	1 day	Sat 10/18/08	Sat 10/18/08
34	10/25/08	1 day	Sat 10/25/08	Sat 10/25/08
35	11/08/08	1 day	Sat 11/8/08	Sat 11/8/08
60	11/15/08	1 day	Sat 11/15/08	Sat 11/15/08
37	11/22/08	1 day	Sat 11/22/08	Sat 11/22/08
38	School Visits	28 days	Sat 10/4/08	Sat 11/1/08
39	Mark Sheridan School	3 days	Wed 10/15/08	Fri 10/17/08
61	Healy School	1 day	Fri 10/31/08	Fri 10/31/08
40				
42	Curriculum Research	69 days	Thu 9/4/08	Sat 11/22/08
60				
45	Education of Staff	12 days	Thu 9/25/08	Thu 10/9/08
36	Bert and T.J. Visit	1 day	Thu 10/9/08	Thu 10/9/08
79				
46	CHC Enclosure	43 days	Sun 10/12/08	Tue 11/25/08
47				
48	Lab Programs Brainstorming	15 days	Thu 10/9/08	Thu 10/23/08
49				
50	Project Development and Prototyping	47 days	Tue 10/7/08	Tue 11/25/08
51	Musical Instrument	37 days	Tue 10/7/08	Thu 11/13/08
52	Train	30 days	Fri 10/24/08	Tue 11/25/08
53	Development	28 days	Fri 10/24/08	Thu 11/20/08

IV. Team Structure

A. Team Structure Chart

Name	Major / Year	Skills / Strengths	Experience and Academic Interest	Team[a]
Michael Brassil	Architecture / 5th Master of Business Administration	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	A

			archeology, and eventually get a PHD	
Treyson Ptak	Architecture / 5th	Various Shop and computer skills. Photography, Drawing, and Music.	16 years of Job experience including military, and various corporate duties, even as a professional stunt man. Interested 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 Open Access; Team B: Developing projects for museum members and Science Achievers

B. Team Tasks

- Before midterm the group worked as a whole, making sure the Fab Lab was in 100% working condition, in terms of equipment, software, and education for those running it.
- After midterm the group separated into the A and B teams. The A team concentrated on designing and testing projects for Open Access and student groups. The B team concentrated on designing and testing projects for the Science Achievers and members of the museum.
- Regina Lamonica, and Jacqueline Villa were 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 were in charge of setting meetings, some project design, and keeping everyone on track.
- Individual member task breakdown:

Before Midterm:

Joseph Luciani: Furthered the training of Steven Wills (our contact at the M.S. I. Who runs the Fabrication Laboratory) on the laser cutter. Also began working on a Material Reference Library for the Laser cutter.
Ivan Reyes: Researched the Modela.
Jacqueline Villa: Coordinated the team's research on the tools and software. Authored team Deliverables
Michael Brassil: Research possible software acquisitions for the Fabrication Laboratory. Researched ArtCAM.
Christine Ly: Surveyed the Science Achievers
Treyson Ptak: Researched the Vinyl Cutter,
Regina Lamonica: Coordinate visits to the Lab by Professors McLeish and Balogh. Wrote introductory letters to administrators and teachers. Wrote survey for teachers.
Michael Martinez: Researched tutorials
Jessica Martinez: Wrote surveys for teachers and students.
Patricia Murman: Wrote the survey for the Science Achievers. Researched NSF and education standards and methodology.

After Midterm:

Group A:
As a whole, the group worked on developing and testing projects for Open Access and student groups.

Regina Lamonica: Coordinated the team's tasks. Wrote the template for the tutorials. Helped design, draw, and prototype all the team's projects. Wrote the Step-by-Step for the team's tutorials.
Treyson Ptak: Researched and proposed a safety barrier for the Shop Bot in the Lab.
Patricia Murman: Continued Research on education standards. Worked on the Train Project - Designing and Writing the Teacher and Student Pages. Began writing Lesson Plan pages for all projects.
Michael Martinez: Worked on the Train Project - Designing
Jessica Martinez: Worked on the Wine Rack and Yo-Yo Projects – Designing and drawing

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

Jacqueline Villa: Coordinated the team's tasks. Wrote guidelines for tutorials. Wrote an Executive Summary for the Fab Lab.
Ivan Reyes: Worked on the Micro TV Transmitter – Prototyping and writing steps.
Joseph Luciani: Worked on the Personal Power Plant – Prototyping and writing steps.
Christine Ly: Worked on the Sliding Puzzle – Prototyping and writing steps.
Michael Brassil: Worked on the Hexagon Puzzle and Japanese Puzzle Box – Prototyping and writing steps.

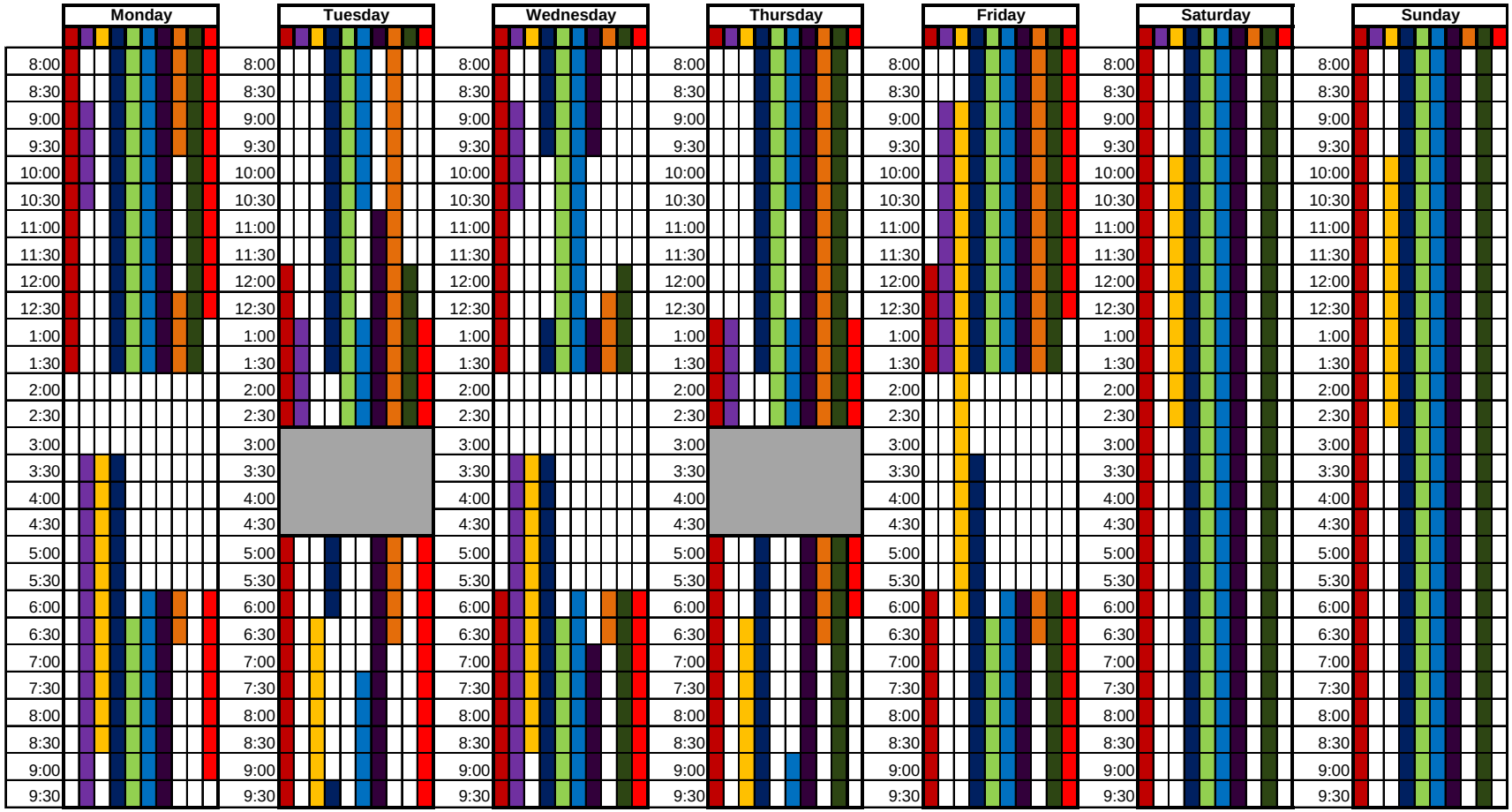
C. Project Monitoring Roles

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

D. IPRO Deliverables

- Abstract: Jackie Villa
- Posters: Regina Lamonica, and Jacqueline Villa
- Props: Christine Ly
- Writing Presentation: Treyson Ptak, Jessica Martinez
- Giving Presentation: Treyson Ptak, Patricia Murman, Michael Brassil
- Ethics Code: Michael Brassil
- Project Report: Regina Lamonica
- Notebook: Joseph Luciani
- CD: Regina Lamonica

E. Schedule of Availability (listed by person)



V. Results

The Team sent the first half of the semester doing research. The Research done on the tools and software allowed us to better inform the personnel working in the Fab Lab about the capabilities of the Lab. The Research on educational standards is also invaluable for the projects developed now and in the future. We gained a better understanding of how the science curriculum is laid out and some of the information gathered will make it easy to find projects for specific grade levels. We also contacted several professors, including Professors Mc Leish and Balogh, who can be used as resources for future semesters. Next semester the research on the Modela and Shop Bot will continue. Also, more schools will be involved in surveys.

For the Fab Lab itself, we researched and proposed a safety partition for the Shop Bot. The partition would protect the rest of the lab from debris and broken drill bits. It would also dampen the noise from the machine allowing the rest of the lab to be used while the Shop Bot is running. We also started a Material Reference will have sample pieces of the cuttable material cut at the ideal settings for the material.

We wrote and prototyped projects for all the user groups we defined. All our projects and possible future projects are documented on designed templates that will allow for a uniform look for all future projects developed by this IPRO. While we created several iterations of each of the projects ourselves, we did not reach the user testing phase with the projects, so that will need to be conducted next semester. Each of the projects needs to be buildable by its intended audience. The teacher Lesson Plan page and student Lab Worksheet page of the Rubber Band Train project will also need to be reviewed by Teachers.

We established a good working relationship with MSI and the Fab Lab staff. They have been very pleased with the results of our work this semester. The Fab Lab staff has asked our team to present our project to the Museum administrators.

VI. Obstacles

As this was the first semester for this IPRO, we encountered several obstacles that resulted from not being aware of what our role should be.

- Understanding the goals: The team encountered initial problems of figuring out the expectations that MSI had for us as well as what was achievable during the course of one semester and the future of the IPRO. It wasn't until the second half of the semester that it was made clear to us what the Fab Lab wanted. The team brainstormed our own end goals based on what information was gathered from the Fab Lab staff. We then presented those goals to the Fab Lab staff and determine what accomplishments were desired by the end of our semester.
- Establishing contact at MSI: It was difficult for the team to establish solid contacts at the museum. It took Several weeks until we were able to visit the lab itself, and it wasn't until then that we were able to clarify the scope of this project. It was also difficult to contact the Lab staff outside of our visits. We returned every week to the Lab; this was very useful in keeping contact with the staff to ask them questions and update them on our progress.
- Expertise of the Fab Lab staff: The Fab Lab was equipped with a good range of tools, but the staff in the lab did not have the expertise to use the tools to their greatest potential. The team used its own expertise with the tools to better inform the staff. We also brought in Professors Mc Leish and Balogh, who are very experience, not only with the tools, but also teaching the tools. The lab will continue to nee experienced people to come in to help teach the staff.
- Technical background of team members: Seven of the ten team members this semester were Architecture students with backgrounds in design and fabrication. As this was the first Ipro, the first half of the semester had a focus on planning the course of the IPRO and writing surveys. Not all of the Architecture majors had experience with this kind of task, but the non-architecture majors excelled in the research. The remaining part of the semester dealt with designing & fabricating in the lab. The non-architecture majors did not have the experience to complete their tasks and relied heavily on the other students. This could be solved by training all the students on the tools in the first part of the semester.

VII. Recommendations

- The team learned that establishing contacts and setting up a Lab visit as early as possible would be beneficial to the process. This will familiarize the team with the fabrication techniques as well as what is possible with the tools in the lab. It will also allow the team to clarify the Fab Lab's needs early on.
- While our semester contained a large group of students who were familiar with fabrication, tooling, and safety procedures this will not always be the case. The future team should take and pass the Shop Safety course at IIT School of Architecture Model Shop as and be certified to use the school's laser cutters. This will allow the team to act safely in the Fab Lab and ease the prototyping process.

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http://www.fraps.com/

Research on Learning Standards:
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Surveys:
The teachers, administration, and students of the Mark Sheridan Academy, and Robert Healy Elementary.
The Science Achievers group at the Museum of Science and Industry.
Professor T.J. McLeish, and IIT Shop Technician Bret Balogh.

IX. Resources

A. Budget

Item	Cost ($)
Printing for surveys, and Binder	**$20.17**
Prototyping Materials	**$133.10**
Electronics Goldmine	$18.36
Mouser Electronics	$8.90
Transistors	$0.21
Diodes	$0.32
Solar Cell	$12.00
LED's	$2.00
Terminals	$1.00
Monetary Button	$1.00
Step Motor	$5.00
Acrylic	$84.31
Public Relations (for food etc. if meeting with representatives from M.S.I)	**$0**
Miscellaneous	**$0**
Total	**$153.27**

B. Time

Semester Hours Summary

[Click to Print]

User	12/30 - 1/5	8/17 - 8/23	8/24 - 8/30	8/31 - 9/6	9/7 - 9/13	9/14 - 9/20	9/21 - 9/27	9/28 - 10/4	10/5 - 10/11	10/12 - 10/18	10/19 - 10/25	10/26 - 11/1	11/2 - 11/8	11/9 - 11/15	11/16 - 11/22	11/23 - 11/29	11/30 - 12/6	12/7 - 12/13	Semester Total
Michael Martinez			2.0	8.0	4.0	4.0	2.0	2.3	4.0	7.0	0.5	6.5		9.0	2.0	4.0	9.0		64.3
Michael Brassil			4.0			1.0	4.0	3.0	9.0	1.0	2.5	6.0	4.0	9.5	9.0	6.5	5.0		64.5
Patricia Murman			2.5	5.0	3.8	13.1	4.0	11.3	6.0	3.0	9.5	3.0	5.5	7.0	7.0	7.0	15.5		103.2
Regina Lamonica			2.0	5.5	4.5	15.5	5.8	9.9	5.6	4.7	8.0	8.3	11.3	19.8	15.0	14.0	26.0		155.9
Jessica Martinez		5.0		1.0	3.5	5.5	1.5	6.8	2.7	9.1	4.5	6.0	2.0	9.7	4.0	6.0	19.5		86.8
Christine Ly			7.0		5.0	3.0	1.5	6.0	3.0	9.5	7.5	10.0	21.5	14.0	2.5	4.5	20.0		115.0
Ivan Reyes			6.0		5.5	1.0	3.5	4.3	5.6	3.0	8.6	4.1	4.8	15.1	9.7	15.3	9.0		95.5
Jacqueline Villa	1.5		2.0	1.0	2.5	7.0	2.0	7.5	7.5	8.0	5.0	8.5	1.5	6.5	15.0	9.0	27.5	4.0	116.0
Joseph Luciani		2.0	4.0	1.0	4.0	1.0		8.0	7.8		5.0	19.8	7.0	6.0	5.0	7.0	10.0		87.6
Treyson Patek					2.0	2.5	7.0	4.0	4.0	4.0	4.0	4.5	6.5	5.0	2.0	2.5	31.5		79.5
Week Average	**1.5**	**3.5**	**4.1**	**3.6**	**3.9**	**5.5**	**3.5**	**6.3**	**5.5**	**5.5**	**5.5**	**7.7**	**7.1**	**10.2**	**7.1**	**7.6**	**17.3**	**4**	
Week Total	**1.5**	**7.0**	**33.0**	**21.5**	**34.8**	**54.6**	**31.3**	**63.1**	**55.2**	**49.3**	**55.1**	**76.7**	**64.1**	**101.6**	**71.2**	**75.8**	**173.0**	**4.0**	**972.8**