IPRO 333: Fab Lab

Fall 2009

PROJECT PLAN

Instructors Blake Davis
David Gatchell

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

IPRO Team Andrew Bonesz
Howard Clark
Carlie Douglas
Michael Gajdorus
Keenan Gottschall
Rachel Hendricks
Clayton Kimball
Jered Linares
Paul Marks
James Mellom
Cindy Oblenida
Sabina Pop
Carl Stelcel
Jeremy Young
Raymond Zhou

Illinois Institute of Technology

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Abstract

Fabrication Laboratories, or Fab Labs, were started as a community outreach program by the Massachusetts Institute of Technology and provide digital fabrication tools for rapid prototyping to the general public. The Museum of Science and Industry has partnered with this IPRO to further develop the Fab Lab at their site. IPRO 333 currently works with the administration in the Fab lab of MSI to design materials and activities for increasing the use of the laboratory. IPRO 333 aims to broaden the possible uses of the lab, promote membership at the museum, and increasing participation by the community in science and technology programs at the museum.

In order to accomplish our goals IPRO 333 has been divided into two teams, each of which will focus on different, but not necessarily independent, aspects of the lab. The project creation team will be responsible for designing and creating new projects, tutorials, and activities for users of the Fab Lab, principally 4^{th} – 12^{th} grade students. The lab preparation and organization group will be responsible for the following: networking within the museum; marketing the Fab Lab; disseminating information about the lab to employees within and volunteers/community members outside of the museum; promoting the lab's presence within the community. The second group will also be responsible for continuing to develop the lab's website.

Contents

I. Team Charter

1. Team Information

A. Team Member Roster

Team Member Name	Email Address
Andrew Bonesz	abonesz@iit.edu
Howard Clark	hclark@iit.edu
Carlie Douglas	cdougla2@iit.edu
Michael Gajdorus	mgajdoru@iit.edu
Keenan Gottschall	kgottsch@iit.edu
Rachel Hendricks	rhendri2@iit.edu
Clayton Kimball	kimbcla@iit.edu
Jered Linares	jlinares@iit.edu
Paul Marks	pmarks@iit.edu
James Mellom	jmellom@iit.edu
Cindy Oblenida	coblenid@iit.edu
Sabina Pop	spop@iit.edu
Carl Stelcel	cstelcel@iit.edu
Jeremy Young	jyoung14@iit.edu
Raymond Zhou	rzhou1@iit.edu

B. Team Member Strengths, Interests, Experience, and Expectations

Name	Major	Skills/Interests	Experience	Expectations	Group
Andrew Bonesz	Architecture (5th Year)	Graphics and web design, CAD, Adobe products, video editing	Fabrication, leadership, architectural intern	Develop problem solving experience	1
Howard Clark	Architecture (5th Year)	CAD, BIM, design/build, modeling, Microsoft Excel & Word, graphics, construction & PR	Modeling, construction, presentation, IIT's laser cutter, wood-working	To assist MSI in promoting & utilizing its Fab Lab. To create a sustainable program in which it can be run in the future.	1
Carlie Douglas	Architecture (5th Year)	Proficient in AutoCAD, 3D Studio MAX, Microsoft Office Suite, Adobe Creative Suite time management, and communication	Model and full-scale construction experience. digital modeling, laser-cutter certified, leadership and teamwork experience	Learn Fab Lab capabilities, connect Fab Lab with MSI; leave Lab with better organization; improve employee knowledge of Lab	1
Michael Gajdorus	Architecture (5th Year)	Proficient in CorelDraw, Microsoft Office Suite, and Photoshop	Shop and digital fabrication experience	Get Fab Lab running safely; provide education to users	1, 2

Keenan Gottschall	Political Science (4th Year)	Proficient in AutoCAD, Microsoft Office Suite, and Quicken accounting software	Shop experience, laser-cutter certified, student organization leadership, previous IPRO experience	To take a step towards opening the doors to a self-sustaining Fab Lab	2
Rachel Hendricks	Biochemistry (4th Year)	Proficient in Microsoft Office, Sequencer, time and organizational skills. First aid and CPR	Safety training, administrative and leadership experience	To have defined lab safety rules and procedures for using in the Fab Lab	2
Clayton Kimball	Architecture (5th Year)	Proficient in AutoCAD, Adobe Creative Suite, filming and editing	Shop, laser cutter, film, graphic design	Learn new machines, work with students, practice teamwork	2
Jered Linares	Biomedical Engineering/ Computer Science (5^{th} Year)	Proficient in JAVA and C++ programming as well as website design	Medical device design, translational research, and leadership	Positively impact the community	1
Paul Marks	Biology (4th Year)	Solid communication skills, problem solving mindset, and adept at acquiring new skills quickly	Electrical, landscaping, and mechanical construction experience	To have the Fab Lab be a functional learning asset to MSI	1
James Mellom	Architecture (5^{th} Year)	CAD, Rhino, 3D max, Pro E., Microsoft Office Suite, Micro-station CAD, Adobe Creative Suite, design/build	Modeling, construction management, digital modeling, shop experience	Help to improve use and overall function of the Fab Lab, build teamwork skills	2
Cindy Oblenida	Architecture (5^{th} Year)	Proficient in AutoCAD drafting, Adobe Creative Suite, Microsoft Office	Experience with laser cutter, interest in graphic arts and education	To integrate the Fab Lab into an MSI exhibit and encourage creativity	2
Sabina Pop	Business Administration (5^{th} Year)	Develop business plans, marketing, surveys	IPRO experience, entrepreneurial project in previous classes	To learn team building and teamwork skills, communicate better, learn leadership skills	2
Carl Stelcel	Biomedical Engineering (4^{th} Year)	Proficient in MS Office, MatLab, C++, Java, Adobe Creative Suite, some AutoCAD	Construction experience, IPRO experience, team work skills	Work to get the Lab open to the public and make it user accessible	2
Jeremy Young	Biomedical Engineering (4th Year)	Proficient in MATLAB, Microsoft Office Suite, Adobe Creative Suite, First Aid, CPR, and enjoys construction	Working with small children, teaching, electric car construction, leadership and teamwork through Boy Scouts and student organizations	To learn what the Fab Lab is capable of and to help make it fully functional	1
Raymond Zhou	Electrical Engineering (4^{th} Year)	Proficient in Microsoft Office, JAVA, MATLAB, Adobe Creative Suite, PSPICE	Shop, electrical, construction, web design experience	To have projects for K-12 students	1

- Group One: Education and Projects
- Group Two: Organization of Fabrication Laboratory

C. Team Identity

Dream IIT, Design IIT, Fabricate IIT

MSI-entists

2. Team Purpose and Objectives

This semester the objectives of IPRO 333 are to:

IPRO Team Goals:

- Educate the Fab Lab employees on the capabilities of the lab and each machine by introducing local expertise in the form of IIT professors and advanced students and identifying user manuals for each machine.
- Organize the Fab Lab by creating labels and places for everything.
- Define potential programs for the user groups of the lab to include:
    - Pre-lab exercises to introduce users to the lab tools, software, and its safety measures.
    - User tutorials to facilitate more independence among the users.
    - Quick reference cards that provide visual cues to guide a project.
    - Pre-defined projects to fit into a specific time frame which are age appropriate according to the standards of the National Science Foundation.
- Increase awareness of the Fab Lab by creating and implementing new marketing strategies for the Fab Lab.
- Integrate the Fab Lab into the current working exhibits as well as future exhibitions
- Record a catalogue of all ideas regarding the possibilities of the Fab Lab for future semesters of this IPRO to draw upon.

In addition this IPRO aspires to:

- Create a safe workshop in which children can operate the machinery under the supervision of the museum staff.
- Coordinate a program with other Fab Labs that allows for the sharing of ideas, past experiences, successes, and failures.
- Develop a program that allows for the continuation of projects over numerous sessions. This would include museum storage and pertain mainly to museum members.

Group 1 (Education and Projects):

- Conceive, design, and implement educational materials, projects, and activities for 4^{th} – 12^{th} grade 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 will aid us in gauging the educational content and difficulty level of projects for different grade levels, particularly 4-12. These will be utilized to guide the writing of the projects.
    - Searching various sources in order to find examples of projects that can be used or modified in order to fit the education requirements dictated by the standards, and the capabilities of the MSI Fab Lab.
    - Organizing the projects into workable programs made specifically for a grade level.
    - The programs developed will be user tested at the MSI Fab Lab. The success of the tests will determine the validity of the program.

Group 2 (Organization of Fabrication Laboratory):

- Research what has already been done by other Fab Labs
- Take an inventory of all tools and materials, label them, and organize them
- Create Fab Lab safety guidelines and post them throughout the Lab
- Make sure all Fab Lab equipment is fully functional
- Create user-friendly software and machine manuals in hard copy, digital, and video formats
- Create informational videos about the Fab Lab for users to watch and to use as marketing media
- Have training and certification for all machinery to register individuals who can operate each machine
- Create a marketing plan that starts with identifying Lab users and issues, as well as working closely with MSI to market internally and externally

3. Background

Currently there are 34 Fabrication Laboratories (Fab Labs) spread across nine countries. What began as a rapid prototyping platform developed by the *Center for Bits and Atoms* at the 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; 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.

This IPRO 333 is a continuation of an ongoing project. Last semester, the students were able to organize two student events and one teacher workshop. They succeeded in getting all machinery working, beginning to market through the internet, and creating projects catered to existing museum exhibits and school science guidelines. One big breakdown was their inability to establish a clear line of communication with the museum administrators.

What this IPRO 333 aims to do is take the knowledge, education, and fresh ideas of young engineers, architects, and scientists of IIT and pair that up with the resources of the Fab Lab at 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 and increasing awareness of the capabilities of machines. While past Fab Lab programs were primarily designed to solve critical issues within the local community, IPRO 333 will concentrate on the education of client groups such as; high-school science achievers, museum guests (children and adults), and members. We will also focus on organizing the Lab to make it more user-friendly, furthering the creation of the website to increase awareness, and integrating the Fab Lab into the Museum. In doing so, we are sure to introduce people of all ages in the greater Chicago-land area to the MSI and its Fab Lab so that we may stimulate the minds of future generations of scientists, architects, and engineers.

One ethical dilemma that we may face is the sharing of information. What belongs to the museum and what needs to be shared? Another issue we may face is attempting to educate our clients at the Museum of Science and Industry without undermining their authority.

4. Team Values Statement

In order to achieve all individual and group goals, all group members participating in IPRO 333 acknowledge and agree to adhere to the following principles of professional, ethical conduct:

- To complete their assigned tasks in a timely and earnest manner, and trust in their teammates to do likewise, in order to maintain a sense of individual and team accountability.
- To maintain professional organizational standards with regards to setting goals, scheduling, and agenda creation.
- To seek help and/or clarification when needed to understand what is required of them.
- To remain informed of all topics and important issues addressed by the group.
- To communicate clearly and effectively when sharing information with the group, and for those reviewing material to do so constructively and in a positive manner.
- To maintain an atmosphere of open communication built on cooperation, collaboration, and open-mindedness.
- To be present, attentive, and open-minded during group meetings so as to achieve maximal participation and comprehension.
- To work passionately and enthusiastically in every endeavor of the team or individual, and to put forth the best effort possible in every endeavor.
- To have a strong commitment to achieving this team's goals, and to being an effective team.
- To resolve any grievances among group members quickly and peacefully, thereby maintaining focus on their primary objective.
- To treat each of the group members with courtesy and respect as dictated by professional standards, and to also respect their investments into the team and projects.

II. Project Methodology

1. Work Breakdown Structure

a. Problem Solving

- 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 developing their goals as well as our own.
- 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. As part of this process we will ensure that the tools are in proper working order.
- Additional marketing strategies and styles will be developed and implemented for the Fab Lab.
    - Web development (e.g. MSI Website, Fab Lab network)
    - Mailing lists (e.g. members, local schools)
    - Advertising (e.g. newspapers, radio, member events)
- The programs previously developed will be user tested at the MSI Fab Lab. The success of the programs will be determined by surveys given to the users before and after their completion of the program. The surveys and observations from the testing will be analyzed, so the results may be implemented in writing future programs.
    i. Survey results from last semester's events will be used to update and improve the various aspects of the Fab Lab
- The new programs, particularly 4-12 curriculum programs, will be completed and ready to be tested for their designated user groups, whether they are for third-grade students or adult museum members.
- The public introduction of the reinvigorated Fab Lab will begin with a "launching" of the Fab Lab in the form of a members and MSI staff party during which the members will get an inside look at the lab and its possibilities.
- As a team, this IPRO recognizes that there is the potential that all goals may not be completed by the end of the semester, however, per the Team Values Statement we will all have put our best efforts forward in an attempt to complete all of these goals.

b. Team Structure

The initial steps taken in dividing the team involved identifying the major themes requiring the most attention. In that, the classification of task subsets could be established. Ultimately, the first breakdown assessment resulted in following clusters:

<u>Group 1 (Education and Projects)</u>

- Project tutorials for 4-12

<u>Group 2 (Organization)</u>

- Machine manuals
- Website
- Marketing
- All machines functioning
- Rules for lab safety, machine certification
- Open house events
- Tutorials

Group One:

The main function of this group is the production of projects. This is to be dictated by the Illinois Math and Science Standards for the grade levels of 4-12. Multiple project ideas shall be gathered for each learning level. The projects will address mathematical or scientific concepts found within the suggested grade level's curriculum. These ideas will be graded on a set of criteria depicting the estimated skill level, the amount of materials used, which machines are utilized, and its completion time. Upon passing the criteria listed above, projects shall be prototyped and tested. The troubleshooting process shall be done by the members of Group 1, various members Group 2, and by the project's ideal audience.

Paul Marks: **Team Lead**
Andy Bonesz
H. Andrew Clark
Mike Gajdorus
Jered Linares
Raymond Zhou
Jeremy Young

Group Two:

This group aims to prepare the Fab Lab for users; then advertise the Lab. First, machines must be repaired and understood; user-friendly manuals must be written and made available in the lab and online. Safety rules must be determined and posted. Then the Lab can be advertised through the team's website, coordination with the museum staff, and through open house events.

Mike Gajdorus: **Team Lead**
Keenan Gottschall: **Team Lead**
Andy Bonesz
Carlie Douglas
Rachel Hendricks
Clayton Kimball
James Mellom
Cindy Oblenida
Sabina Pop
Carl Stelcel

2. Expected Results

The main results we expect to achieve are for the Fab Lab to become self-sustaining and user-friendly. We will learn how to use each machine, determine safety precautions, and document, in detail, the procedures required to use them. This documentation must be self-explanatory to a typical future user, and will allow the Lab to be useful despite a change in staff. It will be made available both in the Lab and online. We will post prudent warnings in the Lab and create safety guidelines and policies for Lab attendants and users. We will explore ways to staff the Lab, whether by seeking funding for new MSI staff or volunteer groups that would mutually benefit from the Lab.

The Education and Projects team will continue to create tutorials for 4-12 students that demonstrate the Lab's potential while teaching principles related to various levels' curriculums. The result will be clear

instructions to make useful projects that are pertinent to students of any grade. This will require research of typical curriculums of local schools and effective teaching methods.

3. Project Budget

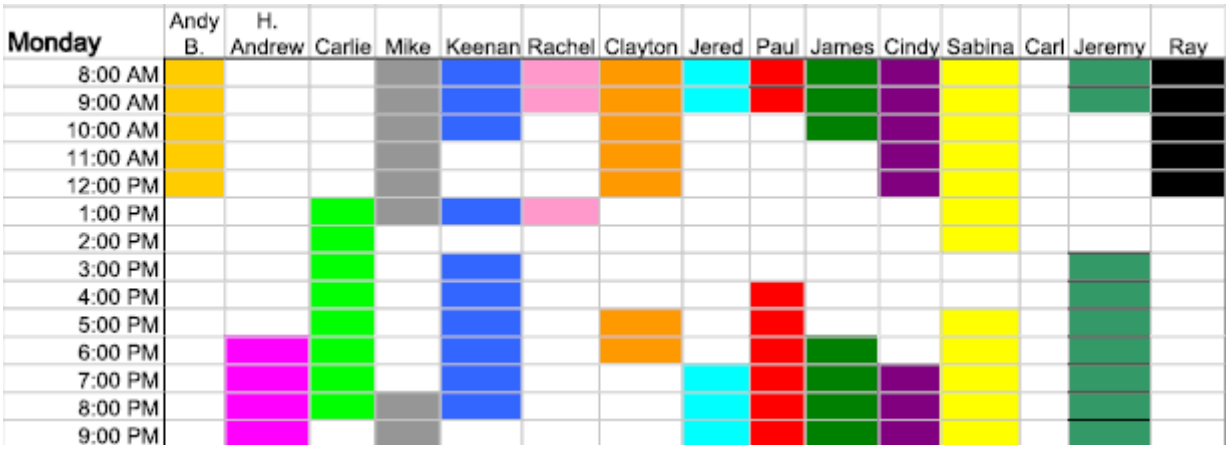
Item	Estimated Cost ($)
Transportation Reimbursement	$375.00 (5 vehicles, $75.00/vehicle)
Prototyping Materials	$450 .00 (e.g. 1' x 2' acrylic piece = $15.00)
Public Relations (meeting with representatives from M.S.I, marketing supplies, etc.)	$150.00
Miscellaneous	$50.00
Total	$1025.00

4. Designation of Roles

- Minute Taker: Rachel Hendricks
- Agenda Makers: Weekly Rotating
- Time Keeper: Rachel Hendricks
- iGroups Moderator: Carlie Douglas

VII. Appendix

A: Team Schedule



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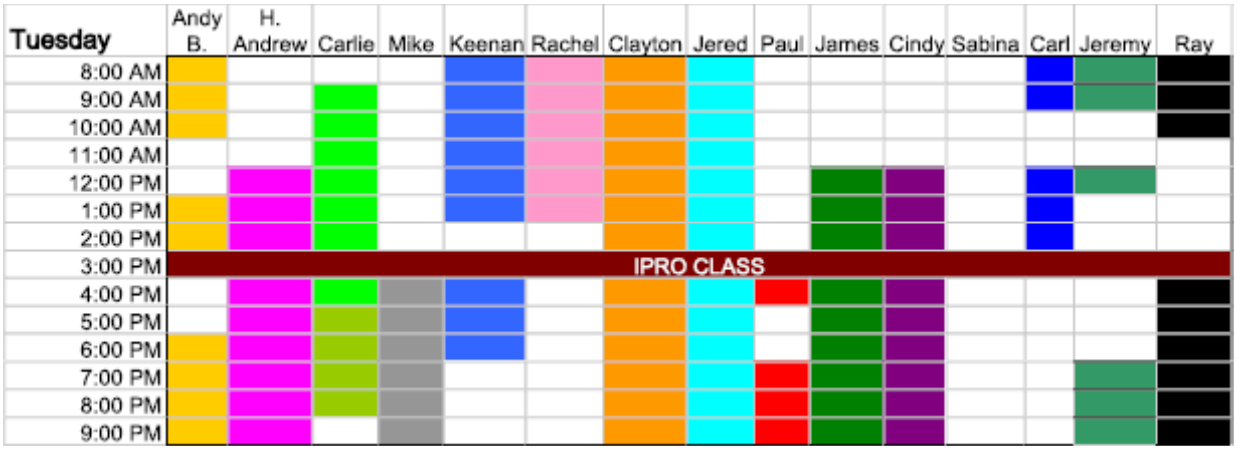

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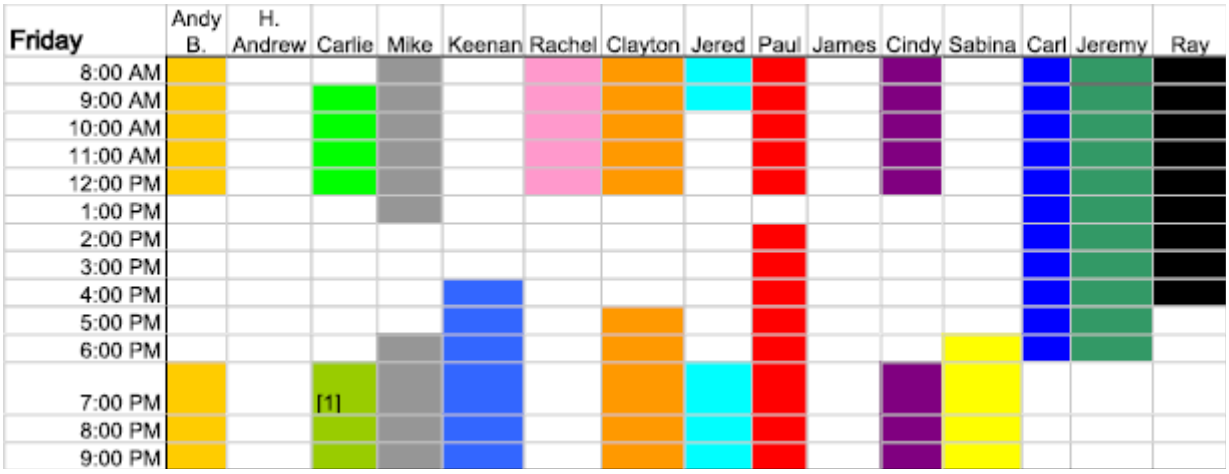
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B: Gannt Chart