IPRO 337 Midterm Report

Spring 2007

Energy Efficient Lighting Design Using LEDs and Other Technologies

Advisor: Nancy Governale-Hamill

1.0 Objectives

A.

- Incorporation of energy efficient lighting technologies into an existing 6,000 sq ft space, thereby adding to the transformation of the space into a new useful zero-energy lab.

- Testing and measurement of energy consuming Devices that are scaled for renewable energy systems such as photovoltaic, battery storage, and fuel cells.

- Demonstration of the use of day lighting for ambient light. Demonstration of use of low energy consuming systems for task lighting and night time lighting.

- Development of low energy consuming lighting systems including fixture mock ups, lamp mock ups, day lighting harvesting systems, fiber optic day light utilization systems, fixtures utilizing LED, low wattage fluorescent and direct and indirect lighting fixture design.

B.

- Design, construct and test fixture mock ups, lamp mock ups, and day lighting harvesting Ideas.

- Design and develop a website for Ipro 337.

2.0. Results to Date

A. There are four sub-teams in the project, with team members alternate between team depend on weekly tasks. These four teams are: Product Research, Rendering, Mock-up, and Website Design.

- Product Research: In addition to research for the right products, team members were able to invited industry professionals to give demonstrations and workshops for the entire project team. These guests are:
    1. Mr. Barry Kies from Key Lighting Sales, Inc
    2. Lighting Distributor came and gave a Demonstration of different lighting elements and the visual effects they produced. The project team learned about lighting standard for different scenario from the brochures that were given to us.
    3. Mr. Tim Moss from Electronic Design Engineering Philips Lighting Electronics.

Visits to local manufactures were also organized, they included visit to FocalPoitnt.

- Rendering: Team members conducted on-site visits, data collection and created a clear and concise lay out of the space. Additional rendering were done when new lighting scheme was designed by the Product Research Team.
- Mock-up: Team members ordered samples from finalized products authorized by faculty advisor and project team. Mock-ups were created to demonstrate outcome of the design.
- Website Design: Team members collect inputs from project team and organized them to create an informative website to showcase the entire project.

B. Several types of illumination were considered to accomplish project's goal. They are: conventional light, LED light, Hybrid Solar System (HSL), and sunlight.

	Conventional	*LED*	*HSL*	*Sunlight*
Products onsidered	-series bulbs T8, T12, T5)	nel, Directional,		
Pro	Inexpensive High-efficient Long Lasting	Superb efficiency Long lasting	Virtually unlimited source Low initial cost ($4.00/ft^2)	Free! Higher light output Really long lasting
Con	Inexpensive High-efficient Lon	Expensive Low light output	Size vs. Efficiency[1] Low return rate ($500.00/20yrs/system) Long Lasting	Variable efficiency Space location

C. Elements from the location and different lighting fixtures were studied and incorporate into proposed designs. For example, new light fixtures were created by molding the aluminum and metal in different direction to maximize reflected light. Another idea is to hang large decorative picture panes with special coating to reflect sunlight. The project team considered all options available to achieve the goal.

D. This section goes together with C

E. As mentioned in part A, samples will be ordered to create mock up. If there is a particular sample that best accomplished the goal, then it will be a working prototype. This, of course, includes any fixtures that maximize the light output of that sample. If there are additional components required (painting, cleaning…) then they will be included as well.

[1] (4ft^2 roof-mount dish/1000ft^2 illumination)

F. The project goal is to use energy-efficiency light to illuminate an office space. Traditional lighting prefers incandescent light bulbs, which is extremely inefficient. The project team solves this problem by introduced new method of lighting that uses less energy to produce more light therefore lower the cost of operation.

G. This should go into F

3.0 Revised Task / Event Schedule

Changes made to the task schedule include: designs for new lighting fixtures, evaluation of new lighting fixtures, selecting designs for mock-up, and model (mock-up) development and team assignments for website development.

Designs for new lighting fixtures
Initially the plan was to design a separate a conventional and a non-conventional lighting setup for the entire hall using readily available lighting fixtures (luminaries). Now the plan is to design luminaries with desired efficiency and direction.

Evaluation of new lighting fixtures
These new lighting fixture designs will be tested using our computer based rendering environment that has already been designed by the design team.

Selecting designs for mock-up
Only those design fixtures that yield optimal results using the rendering software.

Model (mock-up) development
These fixture designs will be used to develop a model as the final IPRO deliverable.

Website development assignments
Team allotment for the website creation has been completed. A website development sub-team has been created; the website creation process has started and developmental goals have been created to measure the progress of the sub-team.

The impact of these changes can be seen in the following task schedule; the total project duration increased by 5 days – still with in our timeframe. Please also see the GANTT chart attached as an appendix.

ID	Task Name	Duration	Start	Finish	Pred	Resource Names
1	**Project Organisation**	**11 days**	**Thu 1/25/07**	**Thu 2/8/07**		**Complete Team**
2	Define the project	4 days	Thu 1/25/07	Tue 1/30/07		
3	Determine project requirements	1 day	Thu 2/1/07	Thu 2/1/07	2	
4	Division Into Teams and Task Division	1 day	Thu 2/8/07	Thu 2/8/07	3	
5						
6						
7	**Research Team Tasks**	**20 days?**	**Fri 2/9/07**	**Thu 3/8/07**	**4**	
8	**Energy Efficient Lighting Research**	**15 days?**	**Fri 2/9/07**	**Thu 3/1/07**		
9	Research on Flourescent Light Sources	5 days?	Fri 2/9/07	Thu 2/15/07		Marcin Antol
10	**Led Lighting Research**	**15 days?**	**Fri 2/9/07**	**Thu 3/1/07**		
11	Application and History	15 days?	Fri 2/9/07	Thu 3/1/07		Anthony Glencoe
12	Products	15 days?	Fri 2/9/07	Thu 3/1/07		Christian Hubbard
13	Alternate Lighting Sources	15 days?	Fri 2/16/07	Thu 3/8/07		Leslie Williams
14	Light Sensors	1 day?	Fri 2/16/07	Fri 2/16/07		Marcin Antol
15	Lighting Fixtures (Luminaires) - Conventional	8 days?	Fri 2/9/07	Tue 2/20/07		Michael Ericksen
16	Lighting Fixtures (Luminaires) - Non-Conventional	1 day?	Thu 3/1/07	Thu 3/1/07		Michael Ericksen
17	Compile Conventional Lighting Report for Design Team	2 days?	Wed 2/21/07	Thu 2/22/07	9,15	
18	Compile Non-Conventional Comparitive Lighting Report for	2 days	Fri 3/9/07	Mon 3/12/07	10,1	
19						
20						
21	**Design Team Tasks**	**57 days?**	**Thu 2/8/07**	**Mon 4/30/07**	**4**	
22	Sub Team Division Finalized	0 days	Thu 2/8/07	Thu 2/8/07		
23	**Lighting Simulation**	**15 days?**	**Fri 2/9/07**	**Thu 3/1/07**		
24	Develop Rendering Environment	15 days?	Fri 2/9/07	Thu 3/1/07		Colin Emch-wei
25	Measurement of Light/Materials Research	8 days?	Fri 2/9/07	Tue 2/20/07		Brian Neiswander
26	Existing Space Measurements	8 days?	Fri 2/9/07	Tue 2/20/07		Carolina Hidalgo
27	Research of Current Spatial Condition	8 days?	Fri 2/9/07	Tue 2/20/07		Olasoji Denloye
28	Space Layout (Furniture Layout)	8 days?	Fri 2/9/07	Tue 2/20/07		Hin Hei Ng (Paul)
29	Rendering Environment Complete	0 days	Thu 3/1/07	Thu 3/1/07	24,2	
30	***Designs for New Lighting Fixtures***	***5 days***	***Wed 3/21/07***	***Tue 3/27/07***	***29***	***Complete Team***
31	***Evaluation of New Lighting Fixtures***	***7 days***	***Wed 3/28/07***	***Thu 4/5/07***	***30***	
32	***Select Designs for Mock up***	***7 days***	***Fri 4/6/07***	***Mon 4/16/07***	***31***	
33	***Model (Mock Up) Development***	***10 days***	***Tue 4/17/07***	***Mon 4/30/07***	***32***	
34						
35	**Deliverables Team Tasks**	**67 days?**	**Thu 1/25/07**	**Fri 4/27/07**		
36	**Prepare Project Plan**	**9 days?**	**Tue 2/6/07**	**Fri 2/16/07**		
37	Part I : Sec 1.0-2.0	8 days?	Tue 2/6/07	Thu 2/15/07		Anthony Glencoe
38	Part II : Sec 3.0-5.0	8 days?	Tue 2/6/07	Thu 2/15/07		Minh Nguyen
39	Part III : Section 6.0	8 days?	Tue 2/6/07	Thu 2/15/07		Omar Husain
40	Part IV : Section 7.0	8 days?	Tue 2/6/07	Thu 2/15/07		Leslie Williams
41	Compile Completed Project Plan and Submit on iK	1 day	Fri 2/16/07	Fri 2/16/07	37,3	Omar Husain
42	**Prepare Midterm Report**	**9 days**	**Tue 3/13/07**	**Fri 3/23/07**		
43	Task Division among Team	8 days	Tue 3/13/07	Thu 3/22/07		
44	Final Report Revision and Submit	1 day	Fri 3/23/07	Fri 3/23/07	43	
45	Meeting Minutes Report	9 days	Tue 3/27/07	Fri 4/6/07		
46	**IPRO Day Deliverables**	**41 days?**	**Thu 1/25/07**	**Thu 3/22/07**		
47	**Website**	**1 day**	**Thu 3/22/07**	**Thu 3/22/07**		
48	***Team Finalization***	***1 day***	***Thu 3/22/07***	***Thu 3/22/07***		
49		1 day?	Thu 1/25/07	Thu 1/25/07		
50	Poster	9 days	Tue 4/10/07	Fri 4/20/07		
51	Abstract	9 days	Tue 4/10/07	Fri 4/20/07		
52	IPRO Day Presentation	7 days	Tue 4/17/07	Wed 4/25/07		
53	Deliverables Complete	0 days	Wed 4/25/07	Wed 4/25/07	36,4	
54						
55	PROJECT COMPLETION	0 days	Fri 4/27/07	Fri 4/27/07	51,3	

* Task Listed in Blue Italics indicate additions/modifications to task schedule.

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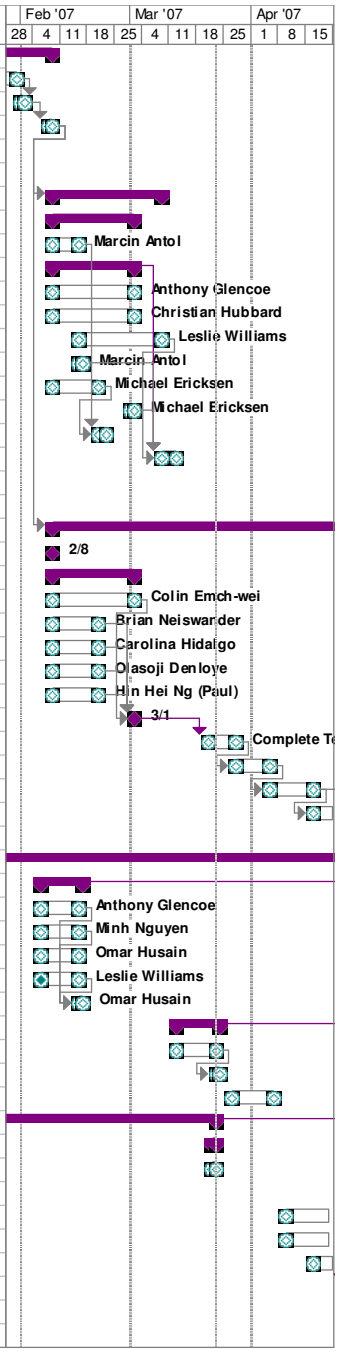

4.0 Updated Task Assignments and Designation of Roles

A. Overall, since the project plan, the team organization has remained the same. However, we are in the process of adding two new sub-teams to help us move closer to our goals. These new sub-teams will include a web design team and a mock-up team.

B. Team Leaders

- Anthony Glencoe
- Leslie Ann Williams

Sub- Teams

1. Product Research Team

    - Marcin Antol
    - Patrick Bowles
    - Michael Ericksen
    - Anthony Glencoe
    - Christian Hubbard
    - Minh Nguyen
    - Leslie Ann Williams

2. Design Team

    - Olasoji Denloye
    - Colin Emch-wei
    - Carolina Hidalgo
    - Omar Husain
    - Brian Neiswander
    - Hin Hei Ng

3. Deliverables Team

    - Anthony Glencoe
    - Omar Husain
    - Minh Nguyen
    - Leslie Ann Williams

4. Web design team

    - Patrick bowles
    - Brian Neiswander

5. Mock- up team

    - All team members- team will be dependent upon who is available at the time of mock- ups.

Sub- Team Leaders

- Minh Nguyen- Product Research Team
- Colin Emch-wei- Design Team
- Omar Husain- Deliverables Team
- None- Web Design team
- Rotating leader -Mock- up team

Sub Team Responsibilities

1. Product Research Team

    - Research existing energy efficient lighting solutions.
    - Research conventional lighting solutions.
    - Research Led lighting solutions.
    - Research most efficient lighting solution for the best price.
    - Come up with an original lighting design fixture.

2. Design Team
    - Revise the Design scheme for proposed space.
    - Draw floor plan of space in Autocad.
    - Make a 3D model of space and render model on computer.
    - Come up with an original lighting design fixture.
    - Implement original lighting design fixtures into 3d model of space and render different solutions.

3. Deliverables Team
    - Keep track of Deliverables and deadlines.
    - Revise project plan and complete the midterm report.

4. Web design team
    - Design a website for ipro 337 that is able to be easily navigated.

5. Mock- up Team
    - Build mock-up of lighting solutions
    - Help take mock- ups down.

C. Sub- Team Individual Responsibilities

1. Product Research Team

    - Marcin Antol- Research energy efficient Fluorescent lighting solutions.
    - Patrick Bowles- Research daylight harvesting systems.
    - Michael Ericksen- Research light/motion sensors.
    - Anthony Glencoe- Research Led lighting solution.
    - Christian Hubbard- Research solar hybrid solutions and LED lighting solutions.
    - Minh Nguyen- Research Led lighting solutions and light/motion sensors.
    - Leslie Williams - Research daylight harvesting systems and solar hybrid solutions on computer.

2. Design Team
    - Olasoji Denloye- Research materials for space.
    - Colin Emch-wei- Computer aided simulation.
    - Carolina Hidalgo- Research materials for space and assigning uses to space.
    - Omar Husain- Research photometric standards(lighting levels).
    - Brian Neiswander- Research materials for space and assigning uses to space
    - Hin Hei Ng- Design/ furniture layout of space.

3. Deliverables Team

    - Anthony Glencoe- Parts 1.0 of midterm report.
    - Omar Husain- Part 3.0 of midterm report.
    - Minh Nguyen- Parts 2.0 and 5.0 of midterm report.
    - Leslie Ann Williams- Part 4.0 of midterm report.

6. Web design team

    - Patrick Bowles- will upload all of the team information and pictures to the website.
    - Brian Neiswander- will come up with design for the website pages.

7. Mock- up team

    - All Team Members- will help build a mock-up of the lighting solutions that we come up with and decide to test. Will also help in dismantling the mock-ups.

D. The overall team organization has remained the same. However, in order to move forward in this ipro, it is necessary that a mock-up team is developed so that we can

start building some of our lighting design solutions. There is also a need for a future website team so that we can document and have all of our information readily available.

5.0 Barriers and Obstacles

A. The main difficulty is the research phase of the project. Even though team members were given separate product types to research, the overwhelming products availabilities made it time-consuming to pick out the appropriate one. For example, when choosing the best energy-efficient conventional light, a team member has to search through several companies with hundreds of products to offer.
The next difficult phase is deciding the lay-out of the space because illumination levels depend entirely on how the space will be used.

B. To eliminate the overwhelming numbers of lighting products, the faculty advisor makes recommendations to the team on which companies to search for and the types of product that suitable for the project. The team then decided on lighting and energy-efficiency level and finalized the search categories. As predicted, this process saves time and effort while producing accurate and desirable results.

C. Time and money: in order to completely renovate the space. We will need more time and money which we do not have.

D. We intend to deal with this by doing the best that we can with the resources that we have thereby making it worthwhile for the project to be continued and completed by a continuing ipro team with the time in the future.