IPRO 325: Water Sub-Team Midterm Report

1.0 Revised Objective

IPRO 325's objective is to create a program at IIT which looks to make an impact in the most immediate problems dealing with the world's rural poor. We seek to do this via the following objectives:

- Extend our current research
- Create working prototypes of products for the world's poor in each of our subgroups
- Raise awareness on campus about the problems facing the world's poor
- Further develop the idea of the IIT Affordable Village and make recommendations on how to proceed

The Water sub-team, after extensive research into specific rural regions with severe water problems, has focused its efforts toward a village in Nicaragua. It has been identified that our greatest area of impact within the village will be a solution that sanitizes the local water, making it safer to drink. We seek to do this via the following objectives:

- Produce a working water sanitation prototype
- Produce manuals to educate the local population
- Produce a final report outlining the process of implementation by a student group

Our goal is to help alleviate biological contaminates that negatively affect the people of this region through the consumption of water.

After detailed research on energy related issues of the people in developing countries, the energy subgroup decided to create cheap and affordable prototype of a solar cooker. The group found that this prototype has the potential to cause great impact on the lives of people in impoverished communities, and it can also be developed in the timeframe of the project. We'll also create illustrated "do-it-yourself" manuals and video materials that will be used in implementing the prototype, as well as raising awareness of the issues of the poor and the benefits of renewable energy among the IIT community, which was part of our original objective.
In addition, each member of the energy subgroup is continuing research on an energy-related topic, and eventually proposing an IPRO for next semester, as originally planed.

2.0 Results to Date

The Water sub-team, thus far in the semester, has successfully:

- Identified a specific target area in Nicaragua for the final prototype to be implemented.
- Established a line of communication with organizations already working in and around our target area; as well as, organizations conducting similar work with the issues of water access, sanitation and irrigation.
- Determined the most severe water problem in our target area to be sanitation.
- Designed an experimental outline to combat the sanitation problem in our target area.
- Developed an appropriate solution, in the form of an extremely affordable prototype design, which utilizes local and salvageable materials, to begin experimentation.
- Begun to envision a plan to turn our single prototype into an efficient "Water Farm".

The Water sub-team aims at producing the plans and prototype for a "Water Farm". This farm will sanitize water through the process of UV Irradiation, with the use of 16-20oz. plastic beverage bottles. From our research, we have determined an impoverished rural village in Nicaragua as our target area for the implementation of our design. From the knowledge we have obtained about this area, we will test our prototype design using water that is contaminated with similar biological agents found at the site.

In addition, we will document our procedures and findings in two manuals: 1) written for future IPRO students, explaining how to proceed with the project; 2) written for the local population to explain the benefits of our prototype, how to use it, and how to maintain it.

In the research phase of the project, the energy group conducted extensive study on solar cookers. We familiarized ourselves with the concepts of solar cooking, the requirements, the benefits of it as well as the shortcomings. We studied vast amount of different designs, ranging greatly in complexity of design and price starting as low as $15 and going up to $260. Similar projects have been tried all over the world, some being very successful while others have died out. We have analyzed different approaches to implementing solar cookers in developing countries, examining the factors that contributed to the success or failure of these projects in different countries. As a culmination for the first phase, we had a meeting with a company that has great experience in manufacturing and distributing solar cookers around the world. The information and knowledge they provided greatly helped us to proceed to the next stage of the project. The research phase was delayed with one week due to extra curricular activities of some members, which resulted in the delay of the design phase. To make up for the lost time, the team used Spring Break, which was initially excluded from the working plan, to finish up the research phase and begin the design.

In the design phase, our team has created several preliminary designs of solar cookers, including CAD drawings and materials lists. These designs are based on well-examined concepts but optimized for production in rural regions of developing countries. In addition, we have created testing procedures to examine the performance of our solar cookers in several areas, namely: water pasteurization, boiling, and baking.

3.0 Revised Task/Event Schedule

ID	Task Name	Duration	Start	Finish	Resource Names
1	**Design Phase**	**9 days**	**Sun 3/4/07**	**Fri 3/23/07**	
2	Design Scketches	2 days	Mon 3/5/07	Thu 3/8/07	Jeremy,Danny
3	Create List of Material	2 days	Fri 3/9/07	Sat 3/10/07	All
4	Obtain Materials	2 days	Sun 3/18/07	Mon 3/19/07	All
5	Build Prototypes	2 days	Thu 3/22/07	Fri 3/23/07	All
6	Country Research	3 days	Sun 3/4/07	Thu 3/8/07	Nirav
7					
8	**Testing Phase and Implementation**	**12 days**	**Sat 3/24/07**	**Sun 4/8/07**	
9	**Perform experiments**	**4 days**	**Sat 3/24/07**	**Thu 3/29/07**	
10	Water Pasturization	1 day	Sat 3/24/07	Sat 3/24/07	Nikola
11	Boiling	1 day	Sun 3/25/07	Sun 3/25/07	Danny
12	Baking	1 day	Mon 3/26/07	Mon 3/26/07	Jeremy
13	Heating	1 day	Thu 3/29/07	Thu 3/29/07	Nirav
14	Compare with Sun Oven	1 day	Fri 3/30/07	Fri 3/30/07	Jeremy,Danny
15	Analyse Performance	1 day	Sat 3/31/07	Sat 3/31/07	Nikola
16	Design Improvements	4 days	Sun 4/1/07	Fri 4/6/07	All
17	Create Instructional Booklet	2 days	Sat 4/7/07	Sun 4/8/07	Danny
18					
19	**Final Report**	**2 days**	**Mon 4/9/07**	**Thu 4/12/07**	
20	Final Paper	2 days	Mon 4/9/07	Thu 4/12/07	Nikola,Jeremy,Nirav
21	Final Presentation	2 days	Mon 4/9/07	Thu 4/12/07	Nikola,Danny
22					
23	**IPRO Day Presentation**	**1 day**	**Fri 4/27/07**	**Fri 4/27/07**	**All**

[MS Project File (water subgroup) to be attached]

4.0 Updated Task Assignments and Designation of Roles

Team members:
Jaime McClain
Justin Harris

Brian Schiller
Tony Osborn

Team member assignments:
Jaime McClain- Team leader; Educational Materials
Justin Harris- Materials Research and Collection, "Water Farm" Construction Coordinator
Brian Schiller- Experiment Coordinator
Tony Osborn- "Water Farm" Construction, Education Materials

Energy Subteam
Nikola Baltadjiev – subteam leader
Individual research: Small-scale wind turbines
Task coordinator, conducting pasteurization experiments, performance analysis
Danny Kim
Individual research: Direct power from water flow
Drafter, conducting boiling experiments, instructional booklet designer
Jeremy Locquiao
Individual research: Biogas plants
Prototype designer, conducting baking experiments, design improvements

Budget

Item	**Cost**	**Proposed Budget: $350**
SunOven®	$175 (**spent**)	$200
Materials	$100	$100
Equipment	$75	$50

5.0 Barriers and Obstacles

The Water sub-team initially had a hard time deciding which sanitation method would be most appropriate for our region in Nicaragua. Although we had done extensive research into the area, none of the team members had been to the region or had first-hand experience with problems that the rural poor face. In addition, many of the organizations we contacted were slow to follow up, so we experienced a period of slow progress. However, through patience and persistence, we have since been able to get the feedback needed from volunteers in the region; and, as a team, have decided, enthusiastically, on a solution.

Through our second phase of exploration and testing of our solution, our sub-team has encountered more barriers and obstacles, including:

- Difficulty finding specific information about the life-cycle of PET plastic bottles to determine a maintenance/replacement schedule for our prototype.
- Obtaining necessary testing materials, specifically bacteria.
- Replicating the conditions of our target area to produce truer results.
- Obtaining lab space to carry out the necessary experiments.

To address the obstacles pertaining to the experiment and material collection, we plan to continue looking for additional resources. If we are unable to obtain some of the bacteria, we will have to change our experiment to accommodate the change. We are actively searching for experts in biology, chemistry, and polymers to answer our questions.

Some barriers and obstacles our sub-team expects to encounter:

- Replication and construction of local materials (i.e. adobe bricks)
- Developing an effective means of communication with our intended user group.

The energy subgroup has experienced problems in one of two categories: internal (within the subgroup) and external (encountered in the research process). Internal problems involved lack of communication between team members, resulting in delayed work submission. To cope with such problems the subgroup has organized mandatory meetings outside of class, where each member of the team is presenting his progress so far and his plans for the upcoming week. Problems, encountered in the research or design process, are also addressed at these meetings, where the best possible course of action is being decided by all team members.
Since our prototype needs sunlight to be tested, if the weather is cloudy and rainy, it will present a major obstacle when we reach the testing phase. In such case, the group will try using incandescent light bulbs and other lab equipment to simulate sunlight and try to relate the results to actual condition.