Illinois Institute of Technology

Project Plan

IPRO 327

Advisors: Prof. Kurzydlo

Sustainable Water Distribution System for Pignon, Haiti

IPRO 327 Project Plan

Section 1.0

OBJECTIVES

IPRO 327's objective is to create a complete set of drawings and specifications of a water distribution system for Pignon, Haiti that can be easily built and used by the town. This is a continuation of a spring 2007 IPRO, which completed mapping of the town. We now seek to design the physical water distribution system that can be sustained for twenty years. To do this, we have identified several factors significant to the success of this system that we will be focusing on. These include finding a water source that can provide a continuous and adequate flow of water, design of a pump and the power source to run it, design of water kiosks and faucets, and design of the piping network with erosion protection. User fees will also be determined for both public and private water lines. The water system will also be designed so that its output may grow with the population of the town over the next twenty years. Through our work, we hope to create a system that can be implemented by Pignon to provide a clean and reliable water source for its citizens.

Section 2.0

PROJECT BACKGROUND

Pignon is a town of about 10,000 citizens sitting in the mountains of north-central Haiti. The country has long been one of the poorest and undeveloped nations in the western hemisphere but has recently seen an upswing in its economy under new governmental leadership. Aid from numerous volunteer organizations from around the world is also helping to stabilize the nation and provide a better quality of living for its

citizens. Pignon has received a great deal of help from different organizations to improve the small town, receiving their first electrical streetlights in 2005, and now, through our group at IIT and Haiti Outreach, a new water distribution system. Haiti Outreach, the project's sponsor, is a non-profit, non-governmental organization that works with different communities in Haiti on water distribution systems and other community development projects. Haiti Outreach projects are based on ideas of both grassroots community participation and community ownership, with the goal of bringing about a realization in the community of what can be accomplished when everyone works together.

In November 2006, a student chapter of Haiti Outreach was formed at IIT to address the numerous problems facing the nation and the town of Pignon. From this group, two large projects were started that numerous students and IPRO groups have faced, including our current project of designing a water distribution system. Working on a project that is in a different country presents many problems for task completion. Gathering needed information is difficult and working with the local government of Pignon has proved a challenge. Working in a developing nation is even more complex, with different standards to follow and a way of life very different from our own.

The current water distribution system in Pignon is in desperate need of repair. The maintenance of the system has been meager and water is only available to 20 percent of the population from two to five hours a day, only every five to fifteen days. This forces much of the population to walk several miles to reach alternate sources of water, such as rivers, springs, or wells that are often contaminated. The IIT Haiti Outreach Group and this IPRO are working on creating a water distribution system that is both safe and

reliable. To do this, we must find a water source that will be able to provide the needed amount of water and use different technologies to distribute it throughout the town as needed. Different power sources will be used throughout the day, including solar power, electrical power, and a ram pump. Surveying of the town has already been completed and GPS data collected but mapping using AutoCAD or a similar computer aided drafting program is yet to be finished. The size of the piping will be determined through computer programs and then plotted on AutoCAD. Once all aspects of the project are finished, a complete set of design specifications will be printed out and made into a book for the town's implementation.

It is through Haiti Outreach that our project will go from an idea to a reality. They are not only sponsoring the IPRO project but will help with the building costs in the town of Pignon. IIT students have already made two trips to Pignon, with half of the costs covered by Haiti Outreach and another trip is being planned for early January. (The remaining costs for the trip, as well as for the final specification books will be fundraised.) The rest of the work will be up to the town, though. The job of the IPRO is to come up with a set of design specifications and drawings that can be given to the town for implementation. However, those in charge on the Pignon side will be able to decide what parts of the plan they will follow and any changes they want to make. The mayors of Pignon have already made clear that changes may be made that could cause the project to fall below our design standards. The IIT team has refused to compromise the project's integrity, though. We will sign off on a design that we believe is safe and up to standards and would not approve of any changes that could negatively impact the system.

Section 3.0

METHODOLOGY/BRAINSTORMING/WORK BREAKDOWN STRUCTURE

The problem that has been presented to us is to provide a set of operation manuals for the design of a water distribution system for the city of Pignon, Haiti. The water system is required to sustain for a minimum of twenty years. The water distribution system will consist of public water kiosks that can be patrolled and paid as per person use as well as private faucets to those who request them. The private faucets will require a meter to keep track of the water usage for that location so that the appropriate charges can be applied to the consumer. Another system requirement is that addition of new faucets public or private should be easy, causing no complications to the existing system.

In order to solve these problems our IPRO will work together with the Haiti Outreach group. Since this is a continuing IPRO, several aspects have been started that still require completion. Last semester, a digital map of Pignon was created to show the locations of the existing water pumps and which ones were in operation. This map needs to be updated to include the most recent aerial photos available. It is important for the map to be as professional as possible since it will be submitted for approval by the government of Pignon.

During the first week of the semester one of the students continuing into this IPRO traveled to Haiti and surveyed the citizens of Pignon. The survey will be used to re-estimate the population, provide information on average household occupancy and on how much water an average person consumes.

Using the data on the amount of water consumption from the surveys, the size of the water distribution system can be determined. A program called EPANET will be used to create a model of the water distribution system. EPANET is a software program that

models the hydraulic and water quality behavior of a water distribution piping system. EPANET tracks the flow of water in each pipe, the pressure at each node, the height of water in each tank, and the concentration of a chemical species throughout the network during a simulation period. This program can analyze the system for a certain number of years, which will provide important information to us as to whether our system design will last for the required twenty years.

Once the details of the water system have been designed and tested in EPANET the pipes need to be sized to handle the peak flow, limit the head loss, and allow decent velocity in the pipe for twenty years. Since the pipes won't actually be replaced for twenty years they need to be designed for a longer period. Feasibility research on various pipe materials will be conducted. At this stage of work the design will have to be approved by a professional in the field. After the design has been approved, AutoCad plans and profile plans of the system for construction must be created.

Since this project is for the public of Pignon there must be a way to regulate the amount of water that is distributed. To do this, water kiosks will be designed. A water kiosk will include a water connection, a water meter and main valve with three to five distribution pipes with valves located inside the kiosk. An AutoCad plan of this design will be required in the final submittal. A purifying system must be designed to assure that the public will be consuming safe, clean water. The disinfecting solution will be pumped when the supply pump is on. In order to have accurate information, a detailed literature review of purifying methods used in developing countries will be conducted and a report written.

In order to complete these tasks, the IPRO team is divided into five groups. The five group designations are as follows: Pump Design, Water Kiosk/Water Tank Design, Faucet/Erosion Protection Design, IPRO Deliverables and Feasibility/Specifications.

The potential solutions for this project will not be tested until the city of Pignon decides to construct the system. Results of research and testing will be documented through the production of the operations manual. These results will be important for the Haitian authorities to use for future projects of similar design.

The IPRO deliverables group will generate the IPRO deliverable reports. This group will lead various IPRO meetings to discuss the progress of the project and each team's tasks. Each sub team leader is responsible for scheduling individual tasks for the members of their group. At set periods of time, this group will meet separately from the IPRO meetings to plan what information is needed for each deliverable. Every deliverable will be produced by this group and presented at IPRO meetings for peer editing. If additional assistance is needed for a deliverable (e.g. an Architect to help design the poster) the group will explain what the deliverable requires and ask for volunteers. After peer editing and team discussion has been completed, the final product of the deliverable will be produced and the information will be submitted to the IPRO department.

Section 4.0

EXPECTED RESULTS

The expected results of this project will be a set of operational manuals that could be delivered to the Haitian authorities in order to reproduce the project in other Haitian

towns. If the city of Pignon accepts our plan for the water reclamation system the design of the system itself will be tested during construction. If the construction runs smoothly according to the documentation provided by our team the project was successful. The expected data of results from research and testing should be that the water reclamation system withstands twenty years or longer.

Section 5.0

PROJECT BUDGET

Activities	**Expenses**
Send 5 students to Haiti (estimate $1000 each)	$5,000
Project Plan Set (2 sets, 50-24" x 36" sheets each @ $5 each)	$500
Specification Booklet (2 booklets @ $25 each)	$50
IPRO Day (3 final posters @ $50 each)	$150
ESTIMATED GRAND TOTAL	**$5,700**

Section 6.0

SCHEDULE OT TASKS AND MILESTONE EVENTS

Project Plan	13 days	9/13/2007	9/28/2007
Ethics Code	24 days	9/15/2007	10/17/2007
Meeting Minutes	59 days	8/28/2007	11/15/2007
Mid-Term Report	13 days	10/1/2007	10/17/2007
Mid-Term Presentation	6 days	10/1/2007	10/8/2007
Final Report	22 days	11/1/2007	11/30/2007
Abstract	18 days	11/1/2007	11/26/2007
Posters	11 days	11/12/2007	11/26/2007
Power Source Research	13 days	9/18/2007	10/4/2007
Pump Research	16 days	9/18/2007	10/9/2007
Volume of Flow Research	11 days	10/4/2007	10/18/2007
Tank Storage Design & Analysis	31 days	9/18/2007	10/30/2007
Water Kiosk Design	31 days	9/18/2007	10/30/2007
Water Purification Research	16 days	10/9/2007	10/30/2007
Update Digital Map of Pignon	11 days	9/25/2007	10/9/2007
Update EPANET Model	21 days	9/25/2007	10/23/2007
Erosion Protection Research	11 days	10/11/2007	10/25/2007
Piping/Sizing and AutoCad Plans	21 days	10/2/2007	10/30/2007
Feasability Research	7 days	9/13/2007	9/20/2007
Currency Research	6 days	9/18/2007	9/25/2007
Budget Analysis	5 days	9/24/2007	9/28/2007
Survey Data and Population Research	11 days	9/18/2007	10/2/2007
User Fees Calculations	11 days	11/1/2007	11/15/2007
Specifications	16 days	11/1/2007	11/22/2007

Tasks are color coded by groups.

- Blue- Group 4 (IPRO deliverables)
- Brown- Group 1
- Purple- Group 2
- Green- Group 3
- Red- Group 5

Section 7.0 INDIVIDUAL TEAM MEMBER ASSIGNMENTS

A. Team Members

Name	Email	Major/Minor	Skills and Strengths	Experience and Academic Interests	Team	Why they are on their team	Assignments
Ballog, Matthew	mballog@iit.edu	Civil Engineering	Managerial skills, Good communication skills, Organized, Hydraulic engineering courses,	Past semester IPRO experience, Traveled to Haiti,	3	Provided needed experiential knowledge from working on past IPRO and traveling to Haiti.	Gathering surveys, Coordinating with Haiti Outreach, System Analysis,
Dennis, Nicole	ndennis@iit.edu	Civil Engineering	Managerial skills, Good communication skills, Organized,	Leadership experience, Interested in construction management, Fluid mechanic and structural engineering courses,	4	Wanted to make sure everyone stayed on task and the projects objective were able to be completed as best as possible.	Deliverables, IPRO Secretary,
Hussaini, Mudassir	hussmud@iit.edu	Architecture	Visual and oral presentations, Graphics, Self-motivated and ambitious,	Experience in Architecture firm,	3	Desired to work on Graphics presentation.	Site plan of the existing map of housing and roads with current population,
Kohler, Jonathan	kohljon@iit.edu	Civil Engineering	Leadership and problem solving skills, Hydraulic engineering courses,	Cost estimating and specifications, Interested in construction management and new construction methods, Participation in Haiti Outreach group,	5	Important task for the team to complete its goal.	Interpreting survey data, Feasibility research, Specifications,
Lis, Tom	tlis@iit.edu	Architecture	AutoCAD, 3dMax,	Residential Construction, On-Site building experience,	1	Interested in finding new power, and obtain resource.	Research water source location to drill, Pump design,
Mendoza, Gustavo	mendgus@iit.edu	Architecture	Design and drawing skills,		2	Wanted to be involved in design.	Research on faucets, Faucet design,
Mohammed, Ashfaq	mohaash@iit.edu	Architecture	Design and drawing skills,		3		Research La Tanya,
Nockov, Ivan	inockov@iit.edu	Architecture	Design and drawing skills,	Office experience using Architecture skills,	2	Outlet for Architecture skills to be used.	Research on alternative materials for water kiosk, Design of faucet station,
Omeralovic, Enis	omereni@iit.edu	Architecture	Design development skills,	Office experience using Architecture skills,	3	Wanted to be involved in designing the faucet systems.	Panorama of town, Creating site plan of town, Ethics seminar, Water kiosk design,
Parv, Ionut	iparv@iit.edu	Civil Engineering	Hydraulics engineering courses, Structural design courses,		3	Choose randomly.	Water tank design, Haiti cement research,
Radloff, Eric	eradloff@iit.edu	Civil Engineering	Project planning, Cost estimating,	Past semester participation in IPRO,	5	Wanted to work on project plan and feasibility of project.	Interpreting survey data, Feasibility research, Specifications,
Rajic, Ivan	rajiiva@iit.edu	Architecture	Very precise, Knowledge of project,	Past semester participation in IPRO,	2	Wanted to use experience in design.	Pipe design research, Pipe/tank design,

Name	Email	Major/Minor	Skills and Strengths	Experience and Academic Interests	Team	Why they are on their team	Assignments
Rokita, Mark	rokimar@iit.edu	Civil Engineering	Fluid mechanics courses,Good at gathering information,	Past semester participationin IPRO,Visited Haiti,Participation in Haiti Outreachgroup,	3	Worked on this project last semester and wanted to see the project from startto finish.	Gathering informationfrom Haiti outreach,Past semester demonstration,Pignon citizen survey interpretation,Pipe design,
Shethwala, Fuzel	shetfuz@iit.edu	Architecture	Efficient in AutoCAD, Strong communication skills,	Experience at a Architecture firm,	2	Wanted to use AutoCAD skills to assist in faucet station design.	Design faucet station, Research materials,
Skrebo, Ermin	skreerm@iit.edu	Architecture	AutoCAD,		1	Volunteered to switch groups because other was too large and thought would be a good chance to get more involved.	Solar power pump research, Pump design, Water purification,
Smagur, Peter	smagpet1@iit.edu	Civil Engineering	Team leader in past IPRO, Hydraulic engineering courses, Microsoft Project, PowerPoint, and Office skills,	Experience in selecting pumps in a professional setting, Professional construction surveying experience, Interested in water resources engineering,	1	Felt that his experience was greatly related to the majority of the objectives of his team.	Preliminary plan system analysis, Analysis required volume of flow to Pignon, Research on pumps, Selection and design of pumps,
Stella, Meredith	mstella1@iit.edu	Civil Engineering	Managerial skills - especially scheduling and planning, Skills in compiling and formatting information into user friendly formats,	Fluid mechanics courses, Multiple Structural Analysis and design courses, Interested in Structural Engineering,	4	Thought skills would do well putting together deliverables and managing the group to make sure everyone is on task. Originally wanted to design piping but there were too many people in the group so volunteered to work on deliverables.	Deliverables, Ethics seminar,
Szwajnos, Joanna	szwajoa@iit.edu	Civil Engineering	Construction Engineering and Management, CAE courses,	Internship with HDR Inc.	2	Interested in the topic and found it an opportunity to learn something new while being challenged on the project.	Currency research, Populations growth, Tank design,
Tailor, Kinjal	tailkin@iit.edu	Aerospace/ Mechanical Engineering		Past semester participation in IPRO,	3	Wanted to continue working on what was started last semester.	Ethics Seminar, Project Management Seminar, Water purification research,
Terry, Nastasja	terrnas@iit.edu	Mechanical Engineering	Materials background,	Office experience with aerospace company, Material properties experiments experience in MMAE 371,	3	Wanted to participate in design and thought skills would be useful for erosion protection and water purification.	Water purification research, Materials research, Erosion protection design,

A. Team Leaders:
   Mark Rokita
   Matt Ballog

B. Subteams:

Group 1: Design Pump Power Source
   Tom Lis
   Peter Smauger
   Ermin Skrebo

Group 2: Water Kiosks Design
   Gustavo Mendoza
   Ivan Nockov
   Ivan Rahjic
   Fuzel Shethwala
   Joanna Szwajnos

Group 3: Pipe Size and Erosion Protection
   Mudassir Hussaini
   Ashfaq Mohammed
   Enis Omeralovic
   Ionut Parv
   Mark Rokita
   Kinjal Tailor
   Nastasja Terry

Group 4: IPRO Deliverables
   Nicole Dennis
   Meredith Stella

Group 5: Specifications/Feasibility
   Jonathan Kohler
   Eric Radloff

C. Subteam Leaders:
   Group 1: Ermin Skrebo
   Group 2: Ivan Nockov
   Group 3: Mark Rokita
   Group 4: Meredith Stella
   Group 5: Eric Radloff

D. Subteam Responsibilities

Group 1:
- Research alternate power sources: solar, electric

- Research required volume of flow
- Pump selection
- Pump design

Group 2:

- Alternative materials research
- Water Kiosk Design
- Storage tank research
- Water storage tank design
- Water purification research

Group 3:

- EPANET Model
- Digital Map of Haiti
- Mechanical design of pipes
- Design sizing of pipes in system
- Erosion protection

Group 4:

- Gathering information from subteams need for deliverables
- Preparing and completed necessary deliverables
- Managing the group to make sure the project plan is followed

Group 5:

- Interpreting survey data from Pignon citizens
- Feasibility research
- User fees designation
- Specifications of project
- Budget and Fundraising

E. Subteam Individual Responsibilities

Please refer to Individual Team Member matrix in Part A for this information.

Section 8.0

DESIGNATION OF ROLES

A. Assign Meeting Roles
   - Minute Taker: This person is in charge of taking minutes each week. - Nicole Dennis

   - Agenda Maker: This member is responsible for creating an agenda for each team meeting. - Nicole Dennis

- Time Keeper: This member needs to be responsible for making sure meetings go according to agendas. - Meredith Stella

B. Assign Status roles

- Weekly Timesheet Collector/Summarizer: This member is responsible for collecting weekly timesheets from each member of the team and updating everyone with a summary report. - Nicole Dennis

- Master Schedule Maker: This member is responsible for collecting schedules from all the team members and developing a master schedule, which tells the team when members are available and how to contact them. - Meredith Stella