IPRO 327 – Sustainable Water Distribution for Pignon, Haiti
Final Report, Spring 2007

Introduction

Our IPRO sought this semester several objectives: to produce several useful topographical maps of the town of Pignon; to produce the preliminary design of a water distribution system; and to raise money to support our trip to Haiti during spring break.

Background

Haiti is the poorest country in the Western Hemisphere. Much of the country suffers from deforestation, and there is very little water available. Waterborne diseases are rampant. In the town of Pignon has a population of just over 15,000. Currently, the only drinking or cooking water comes from hand pumped wells. To bathe or wash clothes, the people use the river. This is also the river the livestock bathe and drink out of, so it is hard from sanitary.

The population of Haiti is very young. The median age is 18 years old. With this age distribution, it is possible to greatly influence the development of this country. By our involvement, we can help Haiti to enter the modern world as an independent country.

Before the beginning of our project, there was no accurate topographical information of the town. Also, there were no accurate mappings of the town structures.

Haiti Outreach is a non profit organization, based out of Minnesota. They brought this problem to IIT, and are going to use our products to help build a water distribution system in Pignon.

Purpose

To address the problem, we set out with several objectives:

To produce useful maps, we compiled the journals of Mark Taylor, a Master's Candidate in Architecture at IIT. He had traveled to Pignon in January of 2007, when he sketched the town. Topographical maps, including the elevations of points, were also needed. This data was not available, and so we sent a team to Pignon to survey the town and obtain the needed data.

For the design, we set out first of all, to find a software platform that would allow for the design of a water distribution system for a city. After the platform was found, the design would start.

To raise large sums of money quickly, we contacted several offices on campus that had supported us in the past and sought money from them. On a long-term scale, we researched and sent letters seeking support to various civil engineering companies in the Chicago area.

Research Methodology

At the beginning of the semester, the work was divided between the subgroups as follows:

Group 1: Mapping	**Group 2: End User**	**Group 3: Fundraising and Administration**	**Group 4: Design**

✓ David Durra ✓ Mark Rokita ✓ Shawn Shoulders ✓ Eric Radliff	✓ Ermin Skrebo ✓ Amy Sissala ✓ Alex Kircher ✓ Garret Forkan ✓ Nate Hollister ✓ Kinjal Tailor	✓ Chi Tam ✓ Chon Pong Chung ✓ Alayna George ✓ Shoiab Ratnani	✓ Joshua Sullivan ✓ Ivan Rasic ✓ Ashfaq Mohammad ✓ Piotr Sawulski ✓ Matt Ballog ✓ David Williams ✓ Ben Susek

These subgroups were evaluated at the middle of the semester. It was found that Groups 1 and 2 had a lot of overlapping work. Information from Haiti also suggested that we should look into water purification to make our system a viable option. Therefore, at week 12, the focus of Group 2 switched to focusing on water purification.

This method of dividing our work was very effective. Also, since we had a large team (22 members), the division into subgroups was absolutely necessary.

As we found out, it was very difficult trying to get accurate and technical information from such a remote and primitive place. It became clear that sending our team members to Haiti was the only way to get the information that we needed. Because we had ordered our teams in this way, we were also able to let some work wait until the team came back with our information.

Another organization factor was that, due mainly to the size of our team, we only met once a week as a whole team. This left the subgroups free to meet the other scheduled time during the week. The weekly team meeting was then a report seminar, where the previous work was reviewed, and information was exchanged between subgroups.

Assignments

The following summary tasks were assigned to the subgroups, as listed:

Group 1: Topographical Mapping	**Group 2: Site Map, Existing Structures, End User**	**Group 3: Fundraising and Administration**	**Group 4: Design**	**Spring Break**
Convert collected data into topographic maps: 100 hrs	convert site map to topo map: 40 hrs	Get Funding: 60 hrs	Research pumps and fountains: 30 hrs	Survey needed points: 40 hrs
Make other useful maps 30 hrs	estimate population: 20 hrs	Keep Accounts of all money received: 30 hrs	Identify and acquire needed software: 10 hrs	Locate current fountans, pipes: 10 hrs

Prepare list of needed data for next trip to site: 10 hrs	Determine average Haitian water usage: 25 hrs	Keep up to date with all deliverables: 40 hrs	Design pump improvements: 20 hrs	Examine link from source to pump, pump to cistern: 15 hrs
Collaborate with design team on what file type needed for maps: 2 hrs	Required v. Current Capacity: 40 hrs	Inform team of deadlines: 5 hrs	Work with End User Group on current system issues: 30 hrs	Examine other possible water sources: 20 hrs
Deliver useable maps to design team: 5 hrs	Identify locations of existing fountains and wells: 25 hrs	Help organize trip: 10 hrs	Design pipe network path: 35 hrs	Check water quality: 10 hrs

Individual task assignments from each subgroup:
Subgroup 1:

- Researched possible sources of topographic map for Pignon – All
- Combined field data (January trip) and "Google-Earth" map – Eric
- Researched and acquired USGS topographic map of Haiti – David
- Above maps found to be inadequate for design and no sources of more accurate maps could be located……surveying trip planned – Mark
- Researched and acquired all necessary equipment for trip – Mark
- Registered equipment with customs – Shawn
- Conferred with "design" and "population teams to acquire working road map prior to trip – David
- Surveyed Pignon using site levels – Shawn
- Used EPANET to create topographic map using surveying data – All
- Created hybrid topographic map – All

Subgroup 2:

- Task: Transferring sketch map of Pignon into digital form for population counting as well as to have a decent political map of the town. - Each student took a different section of the original sketch done by Mark Taylor and turned it into an Adobe Illustrator file which was compiled into one map through a combination of efforts by Alex Kircher and Nate Hollister.
- Task: adding in the buildings from the aerial google earth image which were absent from the sketch. – Assigned to and completed by Nate.
- Task: create color coded population density map. – Assigned to and completed by Alex.
- Task: research into different types of water filtration possibilities. - Everybody took different aspects of water filtration and researched possibilities

- Task: narrow down the possibilities for research and implementation of the filtration possibilities. - Based on the research we produced, as a whole group, we decided which two possibilities would be most viable.
- Task: Create a sketch design of the two possibilities. - Ermin headed up the two different possibilities with the rest of the crew playing important backup roles
- Task: Compile report of what we did. - Kinjal and Amy did that.

Subgroup 3:

- Identify needed funds – Shoaib
- Request funding from on-campus offices - Alayna
- Write letter to be sent to industry – Chi, Shoaib, Chun
- Research possible interested companies in the Chicagoland area- All
- Create and submit IPRO Deliverables: Project Plan, Midterm Report, Meeting Minutes, Final Report, Presentation, Abstract – All

Subgroup 4:

- Research similar systems – Josh and Ivan
- Research available material in Pignon – David and Piotr
- Compile information – Ben and Ash
- Based on information from trip, design computer model of system - Matt

Obstacles

- Communications

  Because of the size of our team, communication was a huge problem. There were many problems communicating between subgroups because frankly, we were not working closely together. This was overcome by appointing people to be subgroup leaders, and from then on all communication between subgroups was carried on through the leaders.

- Funding

  This was a problem because we needed money fast. As was previously mentioned, to solve this problem we sought out offices on campus for large donations (Office of David Baker, IPRO Office). This left us free to focus our energy the second half of the semester on writing letters to companies.

- Time Constraints

  We had only three months for work. This was overcome by dividing up work. We also built in to our structure a group that had less to do, so could help when other teams were swamped. Also, we narrowed our focus, and did not put effort into concerns outside of our goals and objectives.

- Third World Aspect

  This was an aspect in almost everything. The needs of the customers were completely different from that of the states. The materials available for construction were different. Communication with the town is difficult as there is no electricity there. This was overcome mostly by research and patience. We all now have a much greater appreciation of the status of the nation of Haiti.

- Non-profit organizations

While starting this project, there was a lot of undefined responsibility, especially between us and Haiti Outreach. Who was in charge of the construction? What scale was the project supposed to be? Were we supposed to dialogue with the town and find out their wants? This was overcome in a similar manner to the third world issues, by patience and asking a lot of questions. This was relieved by having Dale Snyder, the founder of Haiti Outreach, living in the states, so that we could contact him more easily than the volunteers in Pignon.

- Software

None of the CAD software available on campus was sufficient to design a system of this magnitude. This was eventually overcome by the discovery of a software platform, EPANET. This is US Government software, and is free to download for anyone. This makes distribution of the system design much easier because anyone who wants to can download the platform.

Results

The preliminary design has been completed. It is attached with this report. Also, possible sources have been looked at. The group has prepared a design report to guide the construction of the system.

Maps have been assembled. A topographical map, as well as political maps and population density maps have been prepared. These are attached as separate files with this report.

Several water purification options have been researched. However, modeling and testing will be needed to decide which option to pursue.

Over $5,000 was raised for the trip.

All IPRO deliverables were created and submitted on time.

Recommendations

Group 1: When technical information is needed, the most reliable and most accurate way to obtain it is to send team members to collect the data first hand. These people also bring back first-hand accounts of the true conditions of our problem.

Group 2: For water purification, there are two recommended options that should be researched in the coming semester:

1. Look into the terraced filtration. Very eco-friendly.
2. Check out the possibility of using UV rays for sterilization.

Group 3: For the fundraising aspect, continuing members should do as much as possible over the summer. Also, continued relations should be kept up with the American Society of Civil Engineers (ASCE); they have supported us this semester, and I think they would really appreciate being kept in touch. Also, Mr. Joe Raoul (joraoul449@sbcglobal.net) is a Haitian civil engineer who helped us quite a bit by reviewing our work and suggesting ways to adapt better to the resources available. He is a great resource.

Next semester, members should seek support and funding from several of the foundations in the area. Also, all effort should be put into bringing Dale Snyder, founder of Haiti Outreach, to IIT for a fundraising effect.

Group 4: Future teams should consider where a large enough water supply will come from. It could come from several sources. The river is a large source of water and,

through the use of a treatment plant, could supply the system with a very large quantity of water. Another potential source could be to drill several wells. Submersible pumps could be placed in these wells to drive a supply to the cistern near the top of the town. To increase the capacity of the system, an additional cistern could be built. One suitable position is either near the current cistern, or above the school, near point X10 on the map. This location is about 60 ft higher than the current cistern.

Overall recommendations: this IPRO had way too many people. In general, there was simply not enough work for everyone. There are two ways to solve this. One would be to expand the scope of the problem. This is not recommended because a larger scope would have problems with the shorter time span. We would recommend limiting the number of team members in the future to fewer than 15.

References

- Google Earth
- US Geographical Survey
- Survey members from Spring Break: Matt Ballog, Shawn Shoulders, Garret Forkan, Mark Rokita
- Mr. Joe Raoul, a civil engineer from Haiti

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