IPRO 310: Designing and Building Prototypes for Assisting Blind Swimmers, Spring 2008

MIDTERM REPORT

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Illinois Institute of Technology

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Introduction

IPRO 310 is continuing into its fourth semester of creating devices to assist the millions of blind and visually impaired people in the United States to swim independently and without sustaining injuries. Due to the size of the team, now and in the past, IPRO 310 divides itself into 3 sub-teams. The three sub-teams are the passive sub-team, the active sub-team, and the research sub-team; which this year has become the business plan/EnPRO sub-team.

Though we meet as a single IPRO several times a week, most of the work done outside of class will be in separate teams. Because of the great differences between each segment of the project, each sub-team has devised their own plan. The passive team will first present their plan to create a large device that can be installed into a pool to assist blind swimmers. Following that, the active team will present their plan to create a small device that can be worn by a blind swimmer to warn them about obstacles. Lastly, the business team will present their plan to devise a business plan to start a successful start-up business by using the device that the passive team is working on.

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Passive Team Midterm Report

1.1 Revised Objectives

The passive team's main objective for this semester has not changed since the submission of the project plan. The main objective is still to end up with a device that would be suitable for a long term durability test in a pool facility of a school with blind swimmers. The secondary objective has changed in that a portion of it has been accomplished by the conducting of the first "live" usability test with blind swimmers. The objective now is to conduct a second usability test with blind swimmers to test modifications that will be applied to the device to make it safer and more robust, while at the same time improving the experience for blind swimmers.

1.2 Results to Date

A practice pool test was conducted early on in the semester to familiarize new team members with the procedures that need to be followed during "live" pool tests. This practice pool test resulted in a series of modifications to the passive device that were applied over the weeks leading up to the first "live" pool test. The modifications included the addition of a variety of "end lane tappers", as well as the application of new construction methods to enhance the durability of the prototype. The new version of the prototype also included modified lane tappers to follow the recommendations of test volunteers.

The first live pool test provided excellent feedback on current progress on the prototype as well as exposing a handful of minor flaws that need to be addressed prior to the secondary pool test. We had a very positive reaction to the construction of our passive device by the blind swimmers. Of the four end lane tappers constructed, only three proved to be of any use. One of the lane tappers consisted of vertical foam tubes. These lane tappers were unable to function because they suffered from hyper-buoyancy. Although they failed during the pool test, there is no reason to not further explore this idea. They can readily be modified to provide less buoyancy yet still create a safe barrier that the blind swimmers can utilize.

The three other end lane tappers can be utilized with minor, if any, modifications as all received positive praise from the test subjects. However, due to their personal preferences, each swimmer made some suggestions. One of the swimmers preferred a simple foam tube. A second swimmer seemed to have a greater preference for the tapper consisting of a series of tennis balls interspaced with foam, while the third swimmer liked all three devices equally well. Their preferences seemed to have been based on a combination of their swimming style as well as their degree of visual impairment, as two subjects were totally blind, while one was legally blind.

On a different tack, the side tappers, while not garnering any negative feedback from the test subjects, lacked in durability as well as in a minor engineering defect. Upon impact by a test

subject, a small percentage of the side tappers near the deep end of the pool where dislodged. In addition, all of the tappers are vulnerable to rotating and being flipped into parallel lanes when the subject is performing the crawl stroke and backstroke. These issues will be addressed before the second pool test. A modification of the vertical foam gate will also take place in order to test its effectiveness.

There were two points that all the subjects made concerning the devices. One is that the end lane tappers should be moved back to allow for more room to stop at the ends of the pool. This modification will be implemented as well. The second and most important piece of feedback is that all the swimmers felt safe and secure while swimming, which is what the main objective of this IPRO is.

The modifications completed so far and the pool tests all apply to the main objective of the passive team which is to have a device ready for a long term durability test at the end of the semester.

1.3 Revised Task/Event Schedule

A series of modifications will be conducted on the prototype resulting in a new version for testing in a few weeks. This will deal with any faults or concerns that came up during the first live pool test. The second live pool test will be held April 20, 2008. We are currently going over possible modifications to this version of the device, and have a tentative estimate at 468 man hours of labor to complete the new version in time for the second live pool test.

The following is a list of remaining tasks, including the details and skills required for each task. The time required for each task is also included.

Task	Task Details	Skills Needed	#People	#Hours/ Person	Hours/ Task
Pool Test Cycle 1 3/9/08	Conduct a pool test to determine the success of the passive device with help from other sub-teams.	People skills, Project management, Swimming ability, Observation skills.	10	8	80
Problem Recognition Cycle 2 3/10/08-3/15/08	Decide which parts of the passive device need modification.	Critical Thinking	4	3	12
Brainstorming Cycle 2 3/23/08-3/29/08	Come up with solutions to the problems identified.	Abstract thinking, Know Materials/ Mechanical skills	4	5	20
Research and Prototyping Cycle 2 3/30/08-4/5/08	Figure out what materials we need and what solutions will work.	Knowledge of Vendors, Materials and Mechanical skills	4	8	32

Parts Procurement Cycle 2 4/6/08-4/12/08	Buy all parts necessary for building the necessary version of the device.	Knowledge of Vendors, Accounting Skills	4	2	8
Assembly Cycle 2 4/13/08-4/19/08	Assemble the complete passive device for testing with help from other sub-teams.	Mechanical skill	8	10	80
Pool Test Cycle 2 4/20/08	Conduct a pool test to determine the success of the passive device with help from other sub-teams.	People skills, Project management, Swimming ability, Observation skills.	10	8	80
Engineering Notebook 2/10/08-5/3/08	Maintain engineering notebook.	Organization skills, writing skills.	1	20	20
Project Plan 2/9/08-2/22/08	Write and compile the project plan.	Project Management, Writing skills.	2	5	10
Midterm Oral Presentation 2/19/08-3/3/08	Prepare and present at the Midterm Oral Presentation.	Presenting skills.	2	5	10
Code of Ethics 2/23/08-3/7/08	Write and compile the Code of Ethics.	Critical Thinking, Research Skills, Writing skills.	4	4	16
Midterm Report 3/1/08-3/14/08	Write and compile the midterm report.	Project Management, Writing skills.	2	5	10
Meeting Minutes 4/18/08	Write and sumbit meeting minutes	Listening/Writing skills, Reliability.	1	10	10
IPRO Day Preparation 4/21/08-5/2/08	Prepare abstract, poster, and presentation.	Writing, Design and Presenting skills.	4	10	40
Final Reports 4/26/08-5/2/08	Complete final reports	Writing skills.	4	5	20
Slack Time			4	5	20
Total					**468**
Hours from other sub-teams					**94**
Total from Passive Team					**374**

1.4 Changes in Task Assignments and Designation of Roles and Team Organization

Since the project plan that was originally submitted, the only change to the team organization was the addition of a new member, Peter Niedzinski. Aside from that, however, the team organization remains the same. There have been no changes to the team organization because the team has been efficient in producing results, and so there is no need for changes. The individual task assignments and roles are listed below.

Name	Major	Skills/Strengths	Experience/ Academic Interests	Tasks	Roles
Pedro Cruz	4th year Business Administration - International Business	MS Excel, Word, Powerpoint. Speaks 3 languages (English, Spanish, German)	IPRO 310 Veteran, Leadership Positions at 2 College Soccer Clubs, Internship at Águas de Niterói, Gatorade Pan-American Games promotion	Full Cycle Participant, Midterm Report IPRO Day. 106 hrs	Passive Sub-team leader. Business Plan Team Member
Samuel Solomon	4th year Computer Science	Wood/metal/plastic working, soldering, wiring (robots/circuits), cabling (sound/lighting systems), reading plans/circuit diagrams/blueprints.	Trained and Managed event production crews in highschool and college. Former President and 4 year member of Illinois Tech Robotics.	Full Cycle Participant, Project Plan, IPRO Day. 111 hrs	Passive Team Member, Agenda Maker
Jodi Warns	3rd year Biomedical Engineering	Ms Excel, Word, Powerpoint, Matlab. Chemistry and Biology lab Techniques.	Laboratory Technician Assistant at Wayne State University, Administrative Assistant at AGM Automotives, Senator in IIT's Student Government Association.	Full Cycle Participant, Code of Ethics, IPRO Day, Minutes Submission. 111 hrs	Passive Team Member, Minute Taker
Talha Yousuf	4th year Computer Science/ Computer Engineering	MS Office, Front Page, Outlook/Exchange, NetMeeting, Visio, Adobe Acrobat, Photoshop, Pagemaker, Macromedia Flash, Dreamweaver, Auto CAD.	Assistant Web Developer/ Network Support at Maria High School. Technical Support at Liberty Tax Service. Built LAN Servers and Workstations	Full Cycle Participant, Midterm Oral Report, IPRO Day. 116 hrs	Passive Team Member, Passive team Engr-ing notebook.

Peter Niedzinski	3rd year Biology	Jack of All Trades (quite literally have large amount of experience in everything but Computer Science)	Assistant at Bentley Automotive Restoration, Member of IITea. Member of the Polonia Folk Dance Ensemble.	Full Cycle Participant, Midterm Oral Report, Passive Team Midterm Report Compilation, IPRO Day	Passive Team Member, Prototyping and construction

1.5 Barriers and Obstacles

One ongoing obstacle that this team has faced is finding visually impaired swimmers that are available to test our device. Fortunately, we overcame this barrier by staying persistent and found more contacts. For the first live pool test, we had three visually impaired swimmers. Another approach we took to overcome this barrier is by asking IIT students on the swim team to wear blacked-out goggles and use our device.

The majority of the obstacles that this team has encountered deal with the design of the device. One design problem is finding a way to accommodate swimmers of all body sizes. For example, a tall swimmer would not need long side tappers designed for shorter swimmers. Such side tappers would prevent a tall swimmer from swimming effectively. To overcome this problem, we will try to make the side tappers adjustable.

Another design problem that we are facing is preventing the side tappers from rotating. Also, when swimmers performed the crawl stroke and the backstroke, their arms would hit the side tappers and they would flip into the next lane. We intend to deal with these barriers by modifying the tappers' connections to the T-connectors as well as the T-connectors to the lane line. Another approach that we are contemplating on to solving this problem is by utilizing a counter buoyancy device in the redesign of the tappers.

Another design problem that we are facing is adjusting the device to the personal preferences of the swimmers. For example, from the pool test, we learned that one swimmer preferred the simple foam tube design while another swimmer preferred the tappers with the tennis balls. Finding a way to satisfy all the swimmers based on their personal preference is an obstacle that we are currently facing. We intend to deal with this problem by making the end lane tappers capable of being released quickly so that the swimmer would be able to select the tapper that is most compatible for them. Another approach to solving this problem is simply to decide on the tappers that receive the highest average rating from the swimmers. In order to do this, we perform more tests in order to receive more feedback.

Active Team Midterm Report

2.1 Revised Objectives

The objectives for the active team have not changed since the submission of the project plan. The active team's objectives are still centered on upgrading the currently existing device. More specifically we plan to develop and implement a multi-mode, remotely activated, variable intensity vibration transducer unit that can be worn by a swimmer. We also need to develop a battery circuit, an ON/OFF switch circuit and then repackage the existing SONAR device to improve its reliability and portability. The upgraded device will then be tested on blind and visually impaired subjects in a pool test.

The Active team is working on this project in conjunction with the Rose-Hulman Institute of Technology, which also has a team of students working to build a similar device. Another objective of the Active team will be to make modifications to whatever device they come up with.

2.2 Results to Date

During the first live pool test on March 9, 2008, we were able to test a prototype that we have constructed on visually impaired swimmers. This prototype consists of two sets of small vibration motors, one to be placed on the left side of the swimmer and the other to be placed on the right side of the swimmer. These motors can be activated via a remote that has two buttons, one for the left motors and the other for the right motors. However, because of time constraints, we were not able to produce a wireless device. Thus, these vibration motors were placed on the swimmers' body with wires protruding from them and connected to the remote. Also, we were unable to obtain a belt to fasten these motors on the swimmers' body. So, we used waterproof surgical tape to hold the motors on the swimmers' body.

The pool test showed that the swimmers responded well to the vibration signals, and it allowed them to swim straight. A team member used the remote to guide the swimmer as he swam down the pool lane. If the swimmer began to stray to the left, the team member would press the button to activate the left motor to warn the swimmer that he or she is veering to the left and should adjust. Likewise, if the swimmer began to stray to the right, the team member would press the button to activate the right motor to warn the swimmer that he or she is veering to the right and should adjust. The fact that the swimmers indicated that they felt safer with the device shows that this is a very effective device. Another aspect of the device that was tested during the pool test is the intensity of the vibrations. There were three different intensity levels that were tested on the swimmers.

During the pool test, we received feedback from the swimmers concerning our device. One point that all the swimmers made is that they prefer the strongest vibration intensity level over

the lower intensity levels. Another point that all the swimmers made is that they would prefer if the intensity of the vibrations to increase the more off course they swim. An important question that we asked each swimmer is if they would prefer if the vibrations were a sign of danger or if the vibrations indicated which way to swim. All but one swimmer said that they would prefer the vibrations to be a sign of danger. Lastly, each swimmer gave a suggestion on how far from the wall they would like to be warned. One swimmer said that the vibrations should begin when he is one foot from the side lane markers and about four feet from the end of the pool. The other two swimmers said that the vibrations should begin about an arm's length away from the lane markers and the end of the pool.

Aside from the pool test, we have accomplished some of the tasks that we originally set. First, we obtained a waterproof case and tested it by placing it underwater for 30 minutes. We also modified the waterproof case by inserting screws in it in order to mount the circuit boards. Another task that we completed is attending the Cypress Semiconductor PSoC (Programmable System-on-Chip) training seminar. From this seminar, we received free PSoC development boards that we will use to complete the necessary circuits for our device.

The results from the pool test, along with the other accomplished task, directly address the problems of visually impaired swimmers. The pool test allowed us to have a better understanding of the problems that the swimmers face in the pool. It also allowed us to know what modifications need to be made on our device. Obtaining the waterproof case was a big accomplishment because one of the problems from the previous semesters was that the device was durable underwater because the case was not waterproof.

2.3 Revised Task/Event Schedule

With the first pool test of our device completed, the next milestone is the second and final pool test. For this pool test, we aim to have a wireless vibrating device to test on the visually impaired swimmers. We also aim to have a comfortable belt in order to strap the device onto the swimmers. Also, there are three different circuits that we intend to have completed before the next pool test. These circuits include an on/off circuit, a circuit that will indicate the swimmer that the device is on, and a battery test circuit. In order to complete the two latter circuits, we will use the PSoC development board. Finally, we intend to mount all of these circuits and the circuits used from last semester into the waterproof case.

In addition to all this, we have received word from the Rose-Hulman Institute of Technology that they have a SONAR driving circuit with a voltage signal. In this circuit, the closer the subject is to an obstacle, the greater the voltage. This device is setup so that there are two separate devices. There is one device mounted on the wall of the pool that sends out a SONAR signal. The second device consists of the receiver and vibration motors, and these are to be fastened onto the swimmer. The receiver has a circuit that receives signals from the transmitter and outputs a voltage signal. Our assigned task is to take the voltage signal that the circuit sends and output varying vibration intensities based on the voltage. Thus, the closer the subject is to

the wall of the pool, the greater the intensity of the vibration. This will be implemented using the PSoC development board. The PSoC will translate this signal, analyze it, and output the signal to a vibration transducer.

Another additional task that was assigned to us is to determine whether or not there is a vibration or a tactile sensation language. We need to find out if the visually impaired individuals can interpret different vibration signals. To do this, we will contact a rehabilitation specialist at The Chicago Lighthouse and ask him a few questions concerning vibration signals.

The following is a list of the remaining tasks, including the hours needed for each task, the due dates for each task, and the tasks assigned to each person.

TASK NAME	START DATE	DUE DATE	ESTIMATED # OF HOURS	TASK ASSIGNMENTS
Circuit Design				
Add ON/OFF circuit	17-Mar	31-Mar	15	Shabri, Soji
Design battery test circuit	19-Mar	1-Apr	15	Jeff, Shabri, Soji
Implement battery test circuit	1-Apr	10-Apr	20	Jeff
Design circuit to Interface RF Kit to drive motors	1-Apr	10-Apr	15	Jeff, Shabri, Soji
Obtaining Parts				
Obtain RF Multi-Channel Transmit/Receiver Kit	24-Mar	1-Apr	5	Jeff
Obtain belt for motors	24-Mar	1-Apr	5	Emmanuel
Order parts for the battery test circuit	17-Mar	1-Apr	5	Jeff, Shabri
Building/Manufacturing				
Mount hardware in new case	1-Apr	18-Apr	20	Jeff, Amit, Emmanuel
Build the prototype	1-Apr	18-Apr	25	Whole Subteam
Research				
Contact rehab specialist to find out about vibrations		10-Apr	5	Amit, Emmanuel
Pool Test				
Plan Second Pool Test	18-Apr	19-Apr	10	Whole Subteam
Second Pool Test	20-Apr		7	Whole Subteam
Rose-Hulman Device				
Implement varying vibration transducer	24-Mar	10-Apr	20	Jeff, Shabri, Soji
Use PSoC to output signal to vibration transducer	1-Apr	10-Apr	25	Jeff, Shabri, Soji

IPRO Deliverables				
Final Report		2-May	10	Whole Subteam
IPRO Day Preperation		2-May	20	Whole Subteam
Total			**222**	

2.4 Changes in Task Assignments and Designation of Roles and Team Organization

Since the submission of the project plan, there have been no changes in task assignments, designation of roles, or organization within the team. No changes have taken place because everyone is satisfied with their roles and there have been no conflicts. Also, this team is producing results and making improvements to the device, and so there is no need to make any changes.

First is a chart with some background on each team member. Following the background, the tasks of each member will be listed.

Name	**Major/Minor**	**Skills and Strengths**	**Experience and Academic Interests**	**Role**
Emmanuel Sakla	Biology, Pre-med	Chemistry and Biology lab techniques	Doctor Shadowing at Hines VA Hospital	Active Device Team, Midterm Report
	Minor in Psychology	Proficient in Microsoft Office	Volunteering at Hines VA hospital	
			Volunteered at St. Luke Medical group diabetes screening	
Jeff Schejbel	Electrical Engineering	Excellent workbench skills (soldering, board assembly, repair, etc.) and practiced with many shop tools.	Electronic Design Technician (1/93 to 10/07); member of the Hardware Design Group within the Engineering Department. Designed embedded electronics circuitry for equipment that monitored and controlled the dispensing of petroleum based liquids.	Active Device Team Leader
		Fifteen years experience in digital and DC circuit design, Field Programmable (FPGA) and Complex Programmable Logic Device (CPLD) design.		IPRO Day Presentation
			IEEE Student member	In Charge of Engineering Notebook

Amit Patel	Biomedical Engineering	Proficient in Microsoft Office 2007, Chemistry Lab procedures, and MATLAB software	Education Facilitator at the Museum of Science and Industry - June 2007-Present	Project Plan Timesheet Monitoring
		Fluent in Gujarati	Sales Associate, The Home Depot.	Active Team Minutetaker
Shabarinath Pabba	Electrical Engineering	Working with Programmable Logic Devices (PLD's), Implementation and Conversion of State Machines & Assembly Level Programming, Analyzing Signals and systems. Working with Logical circuits, Counters, Registers, Analyzing and designing synchronous sequential circuits.	**Desk Assistant**, Department of Public Safety, IIT	Active Device Team
			Co-owner, Nitisha Electrical Store, Secunderabad, India **Co-owner**, Nitisha Medical and General Stores, Secunderabad, India	Midterm presentation In charge of Lighthouse Tour
		Programming Skills: Java, Assembly language.		
Olasoji Denloye	Electrical Engineering	JAVA programming, MATLAB, SPICE, Assembly language programming.	Resident Advisor, Office of Residence Life – IIT; 2007	Active Device Team
		Analog and digital circuit construction and implementation, Learned to use Logic analyzers and oscilloscopes as powerful tools to investigate filters, PLDs, FSMs and transformers	Autonomous Robot Fall 2005	Ethics sub-team
			Student Assistant, Office of Financial aid – Illinois Institute of Technology (IIT)	Compiled Resumes and Team Background

2.5 Barriers and Obstacles

One obstacle that we came across after building our first prototype is that we noticed that the vibrations from the motors cancel out when the vibrations are not in phase. In our prototype

that we used in the first live pool test, we had three vibration motors for the left side and three vibration motors for the right side. The fact that the vibrations would cancel out means that when all three motors are turned on, the vibration intensity is not as strong as when only two motors are turned on. Fortunately, the prototype that we built had an option where we can turn on only two of the three motors. When constructing our next prototype, we will keep this in mind.

An obstacle that we are currently facing is trying to design the device so that it is comfortable for swimmers of all body sizes. One step that we are going to take to solve this problem is finding an adjustable belt with which we can use to fasten the motors onto the swimmers. However, as we learned during the pool test, not only is it the body size of the swimmer, but also the type of bathing suit the swimmer is wearing. We found it difficult to fasten the vibration motors onto a female wearing a one-piece bathing suit because of the fabric of the bathing suit. To solve this problem, we will have to test the belt with the device on swimmers wearing bathing suits of different fabrics.

Another obstacle that we are facing is trying to configure the device based on the size of the pool. If we are to use the device from Rose-Hulman Institute of Technology, we will have to find a way to adjust the signals sent out based on the size of the pool so that the swimmer is notified of the end of the pool at the right time. The only way to overcome this obstacle is by doing further research on the PSoC development board and on SONAR devices.

Business Plan Midterm Report

3.1 Revised Objectives

The business team's main objective for this semester is to assist IPRO 310 in developing feasible and effective business plan associated with Market Research, Value proposition, Competitive Analysis and Financial Model for entry business. The different phased objectives will each proceed as following:

- Conduct market research on blind people and visually impaired with prospective target markets to decide a specific niche for market entry
- Continue market research with forecasting future value of blind or visually impaired swimmers
- Conduct competitive analysis with prospective competitors on the same devices or tendency
- Understand the value of assistant devices for blind swimmers and conduct value proposition on how well the products will be accept by the target market
- Determine a marketing strategy based on competitive analysis, value analysis and market research
- Assess ROI, Rewards/Risks, Income Statement/Cash Flow in order to build financial model
- Finalize Business Plan based on the above points

3.2 Results to Date

Expected Results

- Understand the initial target market for the passive and active device. This will include gaining an understanding of the size and growth of target market, forecasting future value for business entry.
- Determine competitive strengths and weakness in the passive device compared to other present or future devices on the market.
- Find short and long term value of the passive device, and update in order to avoid becoming obsolete.
- Create financial model to assess ROI, Risks, Income Statement and Cash Flow
- Formulate business plan for start-up business
- Pursue and participate in real business competition successfully

Results to Date

- Understand the initial target market for the passive and active device. This will include gaining an understanding of the size and growth of target market, forecasting future value for business entry.
- Formulated rough draft of a business plan for start-up business

3.3 Revised Task/Event Schedule

The following are the remaining milestones, which represent main progress toward the completion of our tasks and of our expected results.

- March 14: Mid-Term written report
- April 10: Financial Model completion
- April 10: Business Plan Improvement completion
- April 14: Final Business Plan completion
- April 21-April 25: Rehearsing for IPRO day
- May 2: IPRO Day

Week	Tasks	Hrs	Key Deliverables
3	Conduct Market Research Generate a Tentative Project plan	24 4	Project Plan Draft
4	Finalize Project Plan Continue Market Research Visit Lighthouse for the Blind Meet with Jeanie Link	2 24 3 2	Project Plan due Wednesday
5	Continue Market Research Meet with Suzanne Mueller Conduct competitive analysis	10 2 15	
6	Formulate a Value Proposition	25	
7	Formulate Business Model	30	Competitive Analysis Report Due Value Proposition Report Due
8	Finalized 1st Draft of Business	20	Business Plan Rough Draft
9	Assess: ROI, Risks/Rewards, Income Statement & Cash Flow Consult Professor Twombly for insight Meet with Dr. Pistrui (proof reading)	15 1 1	
10	Split into Two Groups: • Fine Tuning – improve Business Plan	10	

	• Financials – Continue creation	15	
11	Both Groups Continue Improvements	25	
12	Final Meetings • Twombly • Dr. Pistrui Finalize Business Plan Create Final Presentation • PPT • Exhibit	 1 1 10 5 5	 Final Business Plan PPT Rough Draft Exhibit Rough Draft
13	Finalize PPT Finalize Exhibit Practice	3 3 3	Final PPT Due Final Exhibit Due
14	IPRO Day	3	Final Drafts: Business Plan & Presentation

3.4 Changes in Task Assignments and Designation of Roles and Team Organization

The current EnPro 350 roster consists of 4 members who all major in business, which is ideal for an EnPro team who are working with an established IPRO.

Name: Zhenlin Lu (Business Team)
Year: 3rd
Major: Business Administration (Finance)
Experience: First time in EnPro, volunteer in a law firm, co-owner and founder of "Rain" Clothing Fashion Shop, Teaching Assistant for Business Statistics
Skills: Proficient in MS Office (Word, Excel, PowerPoint, Project), PhotoShop, Quicken, S Plus
Strengths: Strong quantitative, analytical, and interpersonal skills
Role: Project plan for business team and whole team, market research, financial model, business plan

Name: Tito Rodriguez (Business Team)
Year: 4th
Major: Business Administration (Marketing)
Experience: Student Intern, IIT office of Admissions, Midwest Marketing Concepts
Skills: Proficient in Microsoft Suite (Word, Excel, PowerPoint, Project), Visual Basic
Strength: Highly motivated and disciplined
Role: Business Team Leader, competitive analysis, business plan

Name: Pedro Cruz Lima(Business Team and Passive Team)

Year: 4th
Major: Business Administration (International Business)
Experience: Gatorade Pan-American Games Promotion, Águas de Niterói--Finance department internship, Vice-President Indoor Soccer Club (Mohawk Valley Community College)
Strength: proficient in MS Office (Word, Excel, PowerPoint), Speaking English, Spanish, German
Role: Passive Team Leader, business plan

Name: Hernan Canales (Business Team)
Year: 3rd
Major: Business Administration (Finance)
Experience: Manager for Grupo Forestal Industrial Mexicano
Strength: proficient in MS Office (Word, Excel, PowerPoint), Speaking English and Spanish
Role: Value proposition, financial model, code of ethics, business plan

3.5 Barriers and Obstacles

Initially, our most significant barrier was our ignorance towards the needs of visually impaired persons as well as how IPRO 310's assistive devices for the blind created value. To overcome this obstacle we participated in a pool test where we became the "visually impaired" test partners. We put on blacked out goggles and swam in the pool. Prior to doing so, it was not obvious as to how disoriented one would be in the water without ones sight. The business opportunity for such a product immediately became obvious. Also, we visited the Light House for the Blind where we were given the opportunity to interact with some visually impaired people which greatly impacted our misconception that they are disabled. For the most part, all aspects of their lives are similar to a sighted person. The only difference is that some tasks might take them a little bit longer to complete. However, they wish to operate as independently as possible. After our visit to the Lighthouse and participation in the pool test, our team had a better understanding of how the devices being prototyped could be a benefit to the visually impaired as well as how it could be a viable product offering.

Another barrier that our team has dealt with was the misunderstanding of the business itself. It was the business team's understanding that, until recently, the business was to be developed around the product, and not the industry of which the product itself is part of. Most decisions were being made on the belief that the success of our business depended solely on the success of the initial product being developed by the passive team. However, through conversations with Dr. Ferguson we came to a conclusion that our business plan is to emphasize that we are in the assistive devices business, and the product being developed is merely a product that will afford us the opportunity "to get our foot in the door" par say. If our team would have had this knowledge of what the business actually is a few weeks ago, we feel we would have made much more progress. Our views regarding the viability of market size and actual percentage of

market we'd be able to capture didn't appear significant enough for our business based on the passive device alone to be successful. Now with our current understanding, our future market isn't limited to the few visually impaired persons who swim; now we are looking at visually impaired persons who participate in all activities.

In addition to the barriers we've overcome, our team is also experiencing some obstacles that have yet to be resolve. The first issue is that we do not currently possess a Passive Device that is ready for the market. The passive team however is constantly brainstorming, prototyping, and testing designs to try and get a ready-for-market product as soon as possible. Still, there are other issues within the research and development of the product with respect to lack of strict deadlines and visually impaired test partners. Without strict deadlines, the idea generation for product design and manufacturing of product design has suffered. In addition, the lack of available visually impaired test partners also hinders product design and manufacturing because feedback gained from a sighted person wearing blacked out goggles is not as beneficial as the input from an actual end-user. In order to resolve this issue, both the business team and the passive team must meet to discuss a realistic deadline for which the product will be done.

Currently, these have been the only obstacles and barriers we've experienced, however there are some that we are expecting to encounter as we move further through the process. We believe that we will have difficulty with raising the capital necessary for launching our business. We perceive the cause of this issue to be primarily related to the fact that the business doesn't currently have key individuals that have long-term interest and dedication to getting the business to be a success. Without key people, it is highly unlikely that investors will provide the business with capital for this particular reason. We are unsure as to how to resolve such an issue being that the product is still being developed; it would be difficult to get people to support something that might theoretically work. Another thing we must resolve is how to pay these people we wish to hire especially if we can't find funding. It's kind of like the conundrum: "what came first the chicken or the egg." We are put in the difficult situation of answering this question.