

## **IPRO 310: Swimming Aid for Visually Impaired Swimmers**

### Advisors

**Professor Daniel Ferguson**

Professional Engineer Ray DeBoth

Mohammad Mahmoud

### Business and Marketing Team

**Elizabeth Bauer**

Ivan Tovalin

Palika Goldstein

### Active Sonar Device Team

**Miguel Dela Cruz**

Svetlana Mokhuach

Jeffrey Stanford

Palika Goldstein

### Passive Device Team

**Axita Patel**

Garrett Ezell

Abin Koshy

Ivan Tovalin

## 1.1 Objectives

I PRO 310's objectives are to continue the designing and building process of devices that help visually impaired swimmers. The I PRO 310 team intends to design, create and test a sonar device that actively aids a visually impaired swimmer. The team also plans on redesigning, building and testing a swimming lane tapper that passively aids visually impaired swimmers. In addition, the 310 I PRO team has a business and marketing team that will be surveying members of the visually impaired community to assess their need and acceptance of the proposed devices.

In order to accomplish these objectives the I PRO 310 team is determined to achieve several goals by the end of the summer 2007 semester by dividing up tasks among three sub-teams.

Specifically, the **Business and Marketing sub-team's** objectives are to:

- Produce a thoughtful and thorough report that captures the essence of issues blind swimmers face as well as the design criteria for the future prototype. The information will be gathered by conducting interviews and surveys with blind or visually impaired athletes or coaches. Information gathered from these interviews and surveys will then be used to design and create a prototype that will address some of the issues faced by the visually impaired or blind while they swim.
- Literature search lead to a post left by an engineer in Ohio who had developed and patented a unique swimming pool lane marker. The design was created to produce a track of air bubbles the length of a swimming pool and was designed to be installed into existing pools with no pool modifications. We contacted Notre Dame about the idea of a bubbler and they mentioned that they had considered a similar technique of using bubbles to guide the swimmer but they had dismissed the idea early in their research.

The **Active Sonar Device sub-team's** objectives are to:

- Design and build prototypes that will assist visually impaired people to swim. There are three million blind or visually impaired people in the US and another half million in Mexico and Canada. Many of these individuals do not participate or find it too expensive to participate in athletic endeavors because of the physical constraints imposed by their disability. It is this I PRO's goal to make it easier and efficient for the visually impaired to partake in activities like swimming, both competitively and recreationally. The Sonar Subgroup, we are in charge of designing and building a device that uses sonar technology to fulfill this I PRO's goal.

Lastly, the **Passive Device sub-team's** objectives are to:

- Redesign and build a device that has been previously conceived by a Notre Dame project team call the 'Lane Tapper'. With the Notre Dame team's permission, our

team hopes to create a version of this device that can be permanently mounted to standard pool lane dividers. Another goal for the passive sub-team is to test the ease of use and effectiveness of the prototype in the water. In conjunction with testing we plan on recording both the test plan and results in an Engineer's Notebook for future reference of the following semester's teams.

Overall, the IPRO 310 team hopes to provide an extensive record of information regarding visually impaired people, specifically swimmers, so as to better understand their needs.

## **1.2 Project Background**

This project was formed as a joint effort between the Rose-Hulman Institute and IIT. In the spring of 2006, a team of four electrical engineers undertook the project to create a device that would allow blind and visually impaired individuals to swim in standard pools more easily / independently. The team successfully created, tested and documented a prototype of the above mentioned device. Their design was built using infrared (IR) to communicate between an underwater transmitter and a receiver secured on the swimmer; the receiver issues beeps via waterproof headphones to warn the swimmer of an approaching wall. After successfully building a working prototype, the team tested the transmitter and receiver to verify the system's correct operation. At the end of the semester however, the team had a prototype that did not correctly meet its requirements. This led them to begin work on modifying and improving the design and coding of the device.

Since the team at Rose-Hulman was made up solely of electrical engineers, they did not have a full understanding of the new product development process. The IPRO 358 team in the Spring 2007 semester came together to round out their efforts to this end. The team is currently composed of students from the computer, mathematics, engineering and life sciences backgrounds. We hope to better understand the problem and hence find a better solution to it. Currently, the main problem is that we still know very little of the needs of the visually impaired community simply because most of the members of our group have not been in contact with any visually impaired people. One of the first things the IPRO 358 group sought to do was to interview as many visually impaired people as possible. This provided a foundation for the rest of the 358 project team by clearly identifying the problem that needed to be solved. They continued by dividing up tasks for each of the three sub-groups. These were the Build sub-group, the Patent sub-group, and the Market Research sub-group. Several changes were made by the end of the semester which resulted in designing and building a device and then concentrating on making the prototype work. Meaning they had decided that a full market feasibility study could not have been achieved by the end of the semester.

The IPRO 358 team came across some major obstacles, in the end they could not get the device to operate as needed. Their research and designs, however, have provided a base for the 310 team by identifying the problem that needs to be solved. We hope to follow the 358 team's example and continue to interview members of the visually impaired

community to gain a clear idea of which of the solutions we plan on pursuing will be viable.

### **1.3 Methodology/Brainstorm/Work Breakdown Structure**

This project is divided into tasks for each of the three sub-groups. These are the Sonar Device sub-group the Passive Device sub-group, and the Market Research sub-group. A summary of the groups function is attached below.

Please see attached Excel Chart for IPRO Deliverables Scheduled Tasks and Task Assignments.

### **IPRO 310 Team Members**

- Abin Koshy
- Elizabeth (Lissa) Bauer
- Ivan Tovalin
- Palika Goldstein
- Jeffrey Stanford
- Axita Patel
- Svetlana Mokhuach
- Garrett Ezell
- Miguel Dela Cruz

### **Business and Marketing Sub-Group**

- Team Members
  - Elizabeth (Lissa) Bauer (Sub-Group Leader)
  - Ivan Tovalin
  - Palika Goldstein
  - Mohammad Mahmoud (Special Advisor)

#### **A. The Problem**

- One of the main problems that our IPRO faces is that we do not know the needs of the visually impaired because we have not had a lot of contact with people who are blind or visually impaired.
- We do not know how well a blind/visually impaired swimmer can differentiate different sensory information such as audio and tactile information. For instance, if our prototype sent an audio signal would the swimmer be able to differentiate the signal from other noises made by their swimming strokes? The same question can be asked with the differentiation of vibrations from a possible prototype design from other sensations in the water.

#### **B. Solving the Problem**

- In order to have a small feeling of what it is like to swim without sight, an experiment will be conducted at the Keating swimming pool with all the members

from IPRO 310. Each student will attempt to swim a full lap with blacked out goggles. This will help us experience some of the obstacles that blind/visually impaired swimmers come in contact with and help us understand the full extent of the predicament they are facing.

- Conduct interviews with blind/visually impaired swimmers and their coaches to find out challenges that these swimmers face as well as their thoughts on the idea of a prototype being built that might help them swim more autonomously.
- The survey, that was created but not conducted by the Spring 07' IPRO, will be sent out to different schools for the blind or visually impaired to gather information on challenges and rewards faced by blind/visually impaired swimmers.
- The information gathered will be analyzed and used to create a prototype that best fits the needs of a visually impaired or blind swimmer. All the information will also be documented in detail, both in the engineers' notebook as well as on igroups, for the fall IPRO that will continue the project.

#### Deliverables

- 10-15 filled out surveys addressing issues faced by blind or visually impaired swimmers.
- 3-5 or more conducted interviews with blind or visually impaired athletes, preferably swimmers or swim coaches.

#### Milestones

- Visiting the individual schools
- Bringing back results of the interviews and surveys

#### **Active Sonar Device Sub-Group**

- Team members
  - Miguel Dela Cruz (Sub-Group Leader)
  - Jeffrey Stanford
  - Svetlana Mokhuach
  - Palika Goldstein

#### A. The Problem

- The sonar subgroup is continuing on last semester's design. This design uses sonar technology and it consists of a transducer, a microcontroller, and a vibration unit.
- These three components are to be put together and will be worn by the swimmer. The idea is that the transducer is going to send out a signal for a period of time. The signal sent will bounce off the walls of the swimming pool and then back to the transducer. This signal is then transferred to the microcontroller where it will calculate the strength of the signal received. The microcontroller will then send out a signal that is proportional to the signal received to the vibration device. This signal that is sent to the vibration device is then converted to different vibration

strength. These vibrations will then serve to inform the swimmer whether he is in the middle of the pool or near the wall.

- The main problem our subgroup is facing is that will our concept design work? We have the main components right now to build the device but do these components have the capabilities for the device to for our purpose? If so, how do we put these components together to form one functioning unit?

#### B. Solving the Problem

- The first thing we are planning to do is to see if the components are working individually. Initially, the separate components will be divided amongst the members of the subgroup where they will test the functionalities of their assigned components. After that, the subgroup will design a way to put these components together. We will spend time building the unit and then testing it.

#### C. Testing

- We will test our device in the pool. The device will be placed in three different distances from the edge of the pool. We will then see if the device: is sending out the proper signal, is able to receive the signal, is sending the right voltage for the vibration unit to vibrate.

#### D. Documentation

- There will be a short session where Svetlana, which is in charge of the engineering notebook, will explain to us how to document experiments, researches, and findings we obtain. Occasionally, the whole subgroup will check each other's input in the notebook to see if requirements are being met.

#### E. Analysis

- Analyzing the test results will go hand in hand with obtaining the test results. When testing the device, if, for example, the transducer is unable to pick up the signal sent, and then our analysis is that the device is not working as we want to.

#### F. Milestones

- Build working transmitter
- Finish Underwater Testing of Transmitter + Receiver

### **Passive Device Sub-Group**

- Team members
  - Axita Patel (Sub-Group Leader)
  - Garrett Ezell
  - Abin Koshy
  - Ivan Tovalin
  - Mohammad Mahmoud (Special Advisor)

#### A. The Problem

- The passive subgroup is reengineering a design originally created by a Notre Dame project group. This design is called a ‘Lane Tapper’ and is considered a passive device because it does not require a power source nor does any part of this design require being attached to the swimmer to be effective.
- This design is basically a flexible rod with a soft texture end to provide tactile stimuli, which is attached to the lane marker and sits on the surface of the water.
- The swimmer will know their position in the lane and proximity to the wall through either different lengths of tappers or an absence of tappers in different parts of the lane. Vertical extensions can also be added to increase sensory feedback and thus increase body awareness, making it easier for the swimmer to know where they are at. The bracket in which the rod is attached would easily fit most existing lane markers.
- The main problem our subgroup is facing is that we hope to deliver a prototype that will best serve the customer; in this case the customer happens to be the visually impaired community. In our preliminary interviews it was apparent that the visually impaired are not embarrassed or ashamed of their situation but do strive to live, work, and play at the same level as sighted people. The problem we face is trying our best to create a design and prototype that can eventually be modified to be as invisible and low maintenance as possible. We hope to make a device that is easy to use and can be used in any type or size pool.

#### B. Solving the Problem

- The first thing we are planning to do is compile a materials analysis that we can use to choose the best material for our device. After that, the subgroup will design a way to put the tappers on at two separate lane dividers permanently. This will have to take into consideration the way in which the dividers are stored out of the pool. We will then spend time building the device, testing the device and then redesign and test as needed.

#### C. Testing

- We will also be testing our device in the pool. The general testing of the tappers will consist of placing the modified lane dividers in the pool, then having a swimmers swim the length of the pool first, in a lane without these dividers, and then again in a lane with the modified dividers. We will be comparing the swimmers’ reaction to the tappers in terms of effectiveness, interference, speed, and straightness. After preliminary testing is completed and any redesign issues are addressed the device will be retested with visually impaired swimmers if possible.

#### D. Documentation

- The passive sub-team will be using an Engineers Notebook in the form of a 3-ring binder to organize and record all design elements. The notebook will contain the design sketches and specifications, the materials analysis, the test plan, the results of testing and an analysis of the test results. The whole sub-group will be

responsible for one notebook putting names and dates on all pages and checking to see that all notebook requirements are being met.

#### E. Analysis

- Analysis of test results will be based on a comparison of results of swimmers' performance and reactions between modified and non-modified swimming lanes. A negative analysis will result in redesigning and retesting of the device, as well as a reassessment of results.

#### F. Milestones

- Pool Test of Sideline Tappers Concept
- Testing how to add sideline tappers to pre-existing pools efficiently

### IPRO Deliverable Reports

The IPRO deliverables are just as important as the project deliverables because they help teams organize their time and resources. It also holds the team to a standard that is very much a part of the non-academic world preparing us for the professional environment.

Please see attached Excel Chart for IPRO Deliverables Scheduled Tasks and Task Assignments.

DATE	TASK	START	FINISH	DURATION (days)	HOURS NEEDED (hours)	TEAM MEMBERS
5-Jun	FIRST CLASS BRIEFING, LEARNING OBJECTIVES PRETEST	6/5/2007	6/5/2007	1	3	TEAM
7-Jun	REVIEW BLIND ATHLETE VIDEOS, DO INITIAL PLAN, MEET SPRING TEAM LEADER	6/7/2007	6/7/2007	1	3	TEAM
9-Jun	IPRO GAMES	6/9/2007	6/9/2007	1	5	TEAM
12-Jun	FIELD TRIP TO CHICAGO LIGHTHOUSE FOR THE BLIND	6/12/2007	6/12/2007	1	3	TEAM
14-Jun	4 1/2 HOUR ASSESSMENT BRIEFINGS, REORGANIZE AS NEEDED	6/17/2007	6/14/2007	7	3	TEAM
15-Jun	PMGT WORKS HOP	6/15/2007	6/15/2007	1	4	TEAM
19-Jun	PRESENTATION OF SUB-TEAM PROJECT PLANS	6/14/2007	6/19/2007	5	3	A, M, G, L
21-Jun	PRESENTATION OF DESIGN NOTEBOOKS & POOL PARTY-BLIND SWIMMING EXP. CYPRESS SEMINAR PROJECT PLAN DUE	6/14/2007	6/21/2007	7	7	S, G, L TEAM A, M, G, L TEAM
22-Jun	REFLECTION ONE DUE	6/14/2007	6/22/2007	8	8	TEAM
26-Jun	ETHICS SEMINAR DURING CLASS PERIOD	6/26/2007	6/26/2007	1	3	TEAM
27-Jun	CYPRESS SEMINAR	6/27/2007	6/27/2007	1	5	J, S, P, M, G
28-Jul	PEER REVIEW ONE DUE	6/21/2007	6/28/2007	7	2	TEAM
3-Jul						
5-Jul	MIDTERM PRESENTATIONS, REFLECTION TWO DUE LO POST TEST, TEAMWORK SURVEY	6/26/2007	7/5/2007	9	9	TEAM
6-Jul	MIDTERM REPORT DUE CODE OF ETHICS DUE	6/26/2007	7/6/2007	10	10	A, M, G, L
10-Jul						
12-Jul						
17-Jul	PRESENTATION SKILLS AND IPRO DAY TIPS SESSION	7/17/2007	7/17/2007	1	3	TEAM
19-Jul	MINUTES DUE	6/5/2007	7/26/2007	16	48	I
24-Jul	PEER REVIEW TWO DUE, REFLECTION THREE DUE	7/19/2007	7/24/2007	5	5	TEAM
26-Jul	DEBRIEFING SESSION IN CLASS, COURSE EVALUATION, TMWK SURVEY, SELF ASSESSMENT OF LRNG OBJS EXHIBIT POSTERS DUE, PRESENTATION DUE ABSTRACT DUE, CDROM, TOC DUE, UPLOAD TO IKNOW DUE CERTIFICATE OF COMPLETION OF IPRO OFFICE REQUIREMENTS	7/10/2007	7/26/2007	16	100	TEAM
27-Jul	IPRO DAY	7/27/2007	7/27/2007	1	5	TEAM

## **1.4 Expected Results**

By the end of the semester, the IPRO 310 team hopes to have achieved the following results:

### **Business and Marketing Sub-Group**

- Make contacts with surrounding schools for the blind/visually impaired for the present IPRO as well as for future IPROs.
- Better understanding of visually impaired athletic swimmers preferences in regards to:
  - Willingness to try out new prototypes
  - Passive vs. Active Swimming Aids
  - Interface Preference (tactile vs. audio)
  - Single-unit vs. Multi-unit designs
  - Prototype location on the swimmer
  - Mounting options (i.e. adhesive vs. strapped)
- Identified the market preferences that impact the design parameters of an engineering solution.
- Results of this primary and secondary research will be used in the development of a prototype that will address some of the issues faced by visually impaired swimmers as they practice, compete or just swim for recreation and exercise.

### **Active Sonar Device Sub-Group**

- *Transducer*
  - I expect that the transducer will be able to send out and receive signal properly. I also expect that the transducer will be able to transfer the received signal to the microcontroller.
- *Microcontroller*
  - I expect that the microcontroller will be able to interpret the signal received from the transducer into a meaningful data where the microcontroller will be able to calculate the strength of the signal. When the strength of the signal is calculated, an appropriate signal will be sent to the vibration unit.
- *Vibration unit*
  - I expect that upon receiving the signal sent by the microcontroller, the vibration unit will vibrate accordingly. I also expect that the unit will produce enough vibration for the swimmer to feel it where ever it may be attached on the body.
  - Building this unit will solve one of the major problems blind swimmers have, how do they know if they are near the end wall. However, further designing will still be needed in order solve the problem of swimming in a straight line. This device will is predominantly designed for competitive swimming

purposes. Further research and designing will be in order for recreational blind swimmers.

### **Passive Device Sub-Group**

- Our sub-team expects that building the passive device will eat up a lot of our time. However, having a test plan ready for the prototype is our best solution to this.
- We expect that the initial reactions of the swimmers to the passive device will be skepticism. With actually testing, is expected that these initial reactions will be revised and positive in the end.
- It is also expected that the sighted swimmers will initially have difficulty with the presence of the lane tappers perhaps due to some interference. Some initial laps with the lane tappers may be needed for the swimmers to get used to the device.
- The swimmers' are also expected to have some varying speed issues due to contact with the tappers. Again we hope with repeated lengths of the pool the swimmer will get used to the presence of the tappers and be able to use them more effectively.
- Lastly, it is expected that our initial design will not be the final design but a positive first effort that will need minimal redesign or modification.

### **1.5 Project Budget**

Each sub-team has different needs and requires the use of different resources. The following details the project budget for each sub-team.

#### **Business and Marketing Sub-Group**

- In order to gather critical information needed we will be planning at least one trip out of the city to conduct interviews and meet people who might potentially be very useful resources for our project. The most feasible locations that contain Schools for the Visually Impaired are in Wisconsin (115 miles), Indiana (180 miles), or Southern Illinois (240 miles).
  - Keating Pool Reservation
    - Pool Party:  $1.5\text{hrs} \times \$8.50 = \mathbf{\$12.75}$
    - Pool reservation for prototype testing:  $4\text{hrs} \times \$8.50 = \mathbf{\$34}$
  - Travel Expenses (Note: Amount depends on what schools cooperate with us):
    - Wisconsin Center for the Blind and Visually Impaired:  $112\text{ miles} \times \$0.40 = \$45 \times 2 = \mathbf{\$90}$
    - Indiana School for the Blind:  $180\text{ miles} \times \$0.40 = \$72 \times 2 = \mathbf{\$144}$
    - Illinois School for the Visually Impaired:  $240\text{ miles} \times \$0.40 = \$96 \times 2 = \$192 + \$130\text{ hotel stay (2 rooms for 1 night)} = \mathbf{\$322}$

## Active Sonar Device Sub-Group

- *Vibration unit*
  - We are planning to buy multiple vibration units and test it to see which one will produce enough vibration for the swimmer to feel. This will cost about \$8.00.
- *Microcontroller seminar*
  - Traveling expenses are needed for the people going to the Cypress seminar. Three people are going; one way is about \$5 by Metra. It will probably be around \$30.00 total.

Since we have the rest of the components, this will be our budget for now.

## Passive Device Sub-Group

The passive team has to build the proposed device from scratch. All the materials will need to be purchased in order to do this. A preliminary list of materials and costs is given below.

<b>Item</b>	<b>Cost (\$)</b>
Pool Lane Divider: \$195.76 x 2	391.52
Foam Rods	57.60
Plastic Tubing	45.00
Gutter Tubing	40.51
Adhesive	10.98
Foam Connectors	41.26
Tubing Connectors	31.99
Pool use for testing: 4hrs x \$8.50	34.00
Pool use for testing: 4hrs x \$8.50	34.00
<b>Initial Estimate</b>	<b>686.86</b>

## 1.6 Schedules of Tasks & Milestone Events

### Business and Marketing Sub-Group

TASK	START	FINISH	DURATION (days)	HOURS NEEDED (hours)	TEAM MEMBERS
Summary Task Research	06/04/07	06/21/07	17	23	L
Research data gathered from Spring IPRO	06/04/07	06/12/07	8	8	L
Research Institutions for the Blind/Visually Impaired	06/11/07	06/14/07	3	10	L
Lighthouse visit	06/12/07	06/12/07	2	3	TEAM
Blind Swimming Experiment at Keating	06/21/07	06/21/07	2	2	
Project Plan	06/15/07	06/18/07	3	10	A, MG, L
Summary Task Primary Research	06/19/07	07/17/07	28	57	L, M
(conduction of interviews and survey)					
Assemble a list of appropriate questions	06/19/07	06/22/07	3	2	L, M
Make contact with blind institutions	06/19/07	06/26/07	7	6	L, M
* Contact Wisconsin Center for the Blind and Visually Impaired	06/19/07	06/21/07	2	2	L, M
* Contact Indiana School for the Blind	06/21/07	06/23/07	2	2	L, M
* Contact Illinois School for the Visually Impaired	06/23/07	06/25/07	2	2	L, M
Train Interviewers on Interviewing Process	06/25/07	07/01/07	5	1	L, M
Clarify interview method	06/27/07	06/30/07	3	2	L, M
Conduct Interviews and surveys	07/02/07	07/17/07	15	40	L, M
Midterm Report	06/29/07	07/06/07	7	10	A, M, L
Summary Task Follow-up	07/05/07	07/24/07	19	22	L, M
(done in unison with interview and survey conduction)					
Analyze data as it comes in for the design and build team	07/05/07	07/17/07	12	15	L, M
Thank you	07/12/07	07/17/07	5	2	L, M
Writing Summary	07/17/07	07/23/07	5	5	L, M

	Key
L	Lissa
A	Axita
M	Mohammed
MG	Miguel
Team	Entire IPRO Team

#### Milestones

- Visiting the individual schools
- Bringing back results of the interviews and surveys

## Active Sonar Device Sub-Group

Project Deliverable	Due Date	Teams
Functioning microcontroller with proper programming	June 28	Computer Science and Electrical Engineering
Functioning Transducer	June 28	Electrical Engineering
Vibration Unit	June 28	Electrical Engineering
Design	July 3	Electrical Engineering
Build	July 10	Electrical/Mechanical Engineering
Test	July 17	Whole subgroup
Report for IPRO presentation	July 24	Whole subgroup

## Passive Device Sub-Group

TASK	START	FINISH	DURATION (days)	HOURS NEEDED (hours)	TEAM MEMBERS
Research Visually Impaired (VI) & Needs	08/04/07	08/19/07	15	22	TEAM
Review previous semesters research	08/04/07	08/09/07	5	5	TEAM
Review previous semesters IPRO day deliverables	08/04/07	08/09/07	5	5	TEAM
Visit to Lighthouse	08/12/07	08/12/07	1	3	TEAM
Research existing patents for VI swimming aids	08/10/07	08/14/07	4	4	ST
Presentation of 3 potential passive solutions	08/12/07	08/14/07	2	4	ST
<b>Choose one passive solution to pursue</b>	<b>06/14/07</b>	<b>06/14/07</b>	<b>1</b>	<b>1</b>	<b>ST</b>
Research Notre Dame device	08/12/07	08/19/07	7	4	ST
Our redesign of ND device	08/14/07	08/21/07	7	7	G,I
Materials research	08/14/07	08/21/07	7	7	AB
Materials selection	08/17/07	08/21/07	4	2	AB
Build Prototype	08/21/07	07/01/07	10	19	A,AB,G,I
Obtain Materials	08/21/07	08/25/07	4	5	AB
Find location to build & store prototype	08/21/07	08/25/07	4	2	M
<b>Construct device</b>	<b>08/25/07</b>	<b>07/01/07</b>	<b>6</b>	<b>12</b>	<b>A,AB,G,I</b>
Test Prototype	08/19/07	07/08/07	19	13	A,AB,G
Develop testing design	08/19/07	07/01/07	12	3	AB
Conduct testing	07/01/07	07/08/07	7	6	A,AB,G
Record all data	07/01/07	07/08/07	7	3	AB
Record swimmer's reactions to device	07/01/07	07/08/07	7	1	A
Analysis of Tested Prototype	07/08/07	07/14/07	6	7	A,AB,G
Review collected data	07/08/07	07/10/07	2	2	A
Draw comparisons to control test	07/08/07	07/10/07	2	2	AB
Tabulate calculated data	07/10/07	07/12/07	2	2	G
<b>Decide if redesign is necessary (Conclusions)</b>	<b>07/12/07</b>	<b>07/14/07</b>	<b>2</b>	<b>1</b>	<b>A,AB,G</b>
Redesign Prototype	07/14/07	07/15/07	1	4	G,I
Modify prototype according to redesign	07/16/07	07/18/07	2	8	G,AB,I
Obtain other materials if necessary	07/16/07	07/18/07	2	2	AB
Reconstruct device	07/16/07	07/18/07	2	6	G,I
Testing of Modified Device	07/19/07	07/20/07	1	5	A,AB,G
Conduct testing	07/19/07	07/20/07	1	3	G
Record all data	07/19/07	07/20/07	1	1	AB
Record swimmer's reactions to device	07/19/07	07/20/07	1	1	A
Analysis of Modified Device	07/20/07	07/23/07	3	6	A,AB,G
Review collected data	07/20/07	07/23/07	3	2	A
Draw comparisons to control test	07/20/07	07/23/07	3	2	AB
Tabulate calculated data	07/20/07	07/23/07	3	1	G
<b>Conclusions</b>	<b>07/20/07</b>	<b>07/23/07</b>	<b>3</b>	<b>1</b>	<b>A,AB,G</b>
<b>Complete Engineers Notebook to be turned in</b>	<b>08/14/07</b>	<b>07/25/07</b>	<b>41</b>	<b>21</b>	<b>A,AB,G,I</b>
Prepare for IPRO Day	07/18/07	07/26/07	8	48	ST

key	
	Milestone
A	Axita
AB	Abin
G	Garrett
I	Ivan
M	Mohammad
ST	Entire Sub-Team
TEAM	Entire IPRO team

## 1.7 Individual Team Member Assignments

Please see attached Excel Chart for Individual Resume breakdown and team assignments.

### **Business and Marketing Sub-Group**

Please see Section 1.6 Schedules of Tasks & Milestone Events - Business and Marketing Sub-Group for this sub-team's individual task assignments.

### **Active Sonar Device Sub-Group**

Subgroup members:

- Miguel Dela Cruz (M)
- Svetlana Mokhnach (S)
- Jeffrey Stanford (J)
- Palika Goldstein (P)

Week Number		TO DO	SPECIFICS
June	Week 2 <i>Orient</i>	get oriented with the project, read and understand last semester's research	M: S: J: P:
	Week 3 <i>Prepare components</i> <i>Project plan and budgeting</i>	find lab and equipment/tool access, know our components (specs, limitations, etc), vibration unit, design prototype 1, algorithm for microcontroller.	M: design prototype 1 S: lab and equipn't access J: algorithm for microcontroller P: vibration unit
	Week 4 <i>Design</i>	vibration unit (vb), program microcontroller (mc), connect vb to mc, research on any potential health issue involving with sonar technology	M: schematics of the design S: peripherals of mc, research on potential health issues J: program mc P: work with Ivan on unit housing
	July Week 5 <i>Build</i>	put together design	everyone build unit miguel and palika prepare test procedures
Week 6 <i>Test</i>	testing and analysis	divide up preparation procedures svetlana make sure requirements are being met in inputting data's in engineering notebook	
Week 7 <i>Make adjustments/ fine tuning</i>	make final adjustments, think of alternative ways for the device to run better	everyone performs under to-do	
Week 8 <i>Prepare for IPRO</i>	prepare for IPRO day presentation		

## Passive Device Sub-Group

Please see Section 1.6 Schedules of Tasks & Milestone Events - Passive Device Sub-Group for this sub-team's individual task assignments.

### 1.8 Designation of Roles

Please see attached Excel Chart for Designation of Roles.

#### A. Meeting Roles

- **Minute Taker:** Ivan is in charge of recording decisions made during meetings including task assignments or changes under consideration.
- **Agenda Maker:** Miguel, Lissa, and Axita are responsible for creating an agenda for each team meeting. This provides structure to the meetings and offers a productive environment.

#### B. Status Roles

- **Weekly Timesheet Collector/Summarizer** – Lissa Bauer has been given the responsibility of collecting and organizing the timesheets from all the members of the team.
- **Master Schedule Maker** – Lissa Bauer has been given the responsibility of collecting all the team members' schedules and arranging them into a suitable format so that everybody can plan their out-of-class meetings at a time that will be convenient for all the members
- **Weekly Task List Maker**
  - Lissa Bauer is responsible in compiling a weekly task list for members of the Business and Marketing sub-group
  - Axita Patel is responsible in compiling a weekly task list for members of the Passive Device sub-group
  - Miguel Dela Cruz is responsible in compiling a weekly task list for members of the Passive Device sub-group
- **iGroups Coordinator** – Ivan Tovalin has the responsibility of maintaining the files and hierarchal layout of IPRO 310's iGroups files section.

#### C. Task Roles

- **Interviewer** – Lissa Bauer is responsible for coordinating the effort of creating useful questions, contacting relevant individuals and recording their responses to aforementioned questions.
- **Circuit Programmer** – Svetlana is responsible in creating the code that will successfully operate the desired circuit in the sonar approach.