Initial Project and Group Identification Document
Divide and Conquer

Water Condition Buoy System
Senior Design I
Group 11

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1.0 Potential Customers:

- Fishing companies that want to provide their customers with the best possible location for fishing.
- Companies that provide diving aiming to enhance their customers' experiences by pinpointing ideal locations.

2.0 Project Narrative Description

The main objective of this experiment is to design and implement a water condition data buoy system that allows recreational as well as commercial users to check fishing and diving conditions through a computer without having to be near the water. The device will monitor and record data including water temperature, water clarity and wave height. These three features are valuable to any fishing or diving business or enthusiast. Water clarity will be measured through the use of fiber optics, water temperature will be measure through a water temperature sensor, and wave height will be measured through the use of a gyroscope/accelerometer (wave height sensor).

2.1 Motivation of Project

This project is designed to make observing diving or fishing conditions as simplistic and accurate as possible through a data buoy system. Anyone with a computer setup to interface with the device will be able to check the main water conditions valuable for fishing and diving without having to be near the water.

The device will monitor water clarity and water temperature then transmit data every 15 minutes. The wave height will be calculated by monitoring the accelerometer and taking an average over the 15-minute time period.

There are a few devices out that measure wave height and water temperature, but it is rare to see the water clarity feature. This gave us the motivation to push it one extra step and add this additional feature. Through the use of photonics and fiber optics we have found a way to measure and monitor water clarity.

2.2 Goals and Objectives

The goals and objectives of this project are the following:

Design and create a low powered, solar energy system that transmits data wirelessly to a computer for ease of access. Implement and understand sensor and fiber optical interfacing, wireless communications, solar power energy as well as power efficiency, and systems integration.

2.3 Project Functionality

This data buoy system will be designed with regards to energy efficiency, accuracy, reliability, and ease for user interfacing. The function of this project will be to fully execute, monitor and report the statuses of the following:

Microcontroller to distribute (transmit/receive) signals to various sensors on the data buoy.

Temperature Sensor to monitor and transmit data to the user of the underwater temperature near the buoy.

Wave height sensor to monitor and record wave activity including the height of the waves where the buoy will be located and transmit the data to the user.

Laser Diode that will send light through fiber optic wire received by a photodetector which will determine the water clarity near the system.

Solar Panel that will charge a battery during daytime use.

Battery that will power the system and stay charged with the use of a solar panel.

Wireless Communications Component making ease of user interfacing from computer to the data buoy.

2.4 Marketing Trade-off Matrix

↑ Positive ↓ Negative ↑↑ Strong Positive ↓↓ Strong Negative

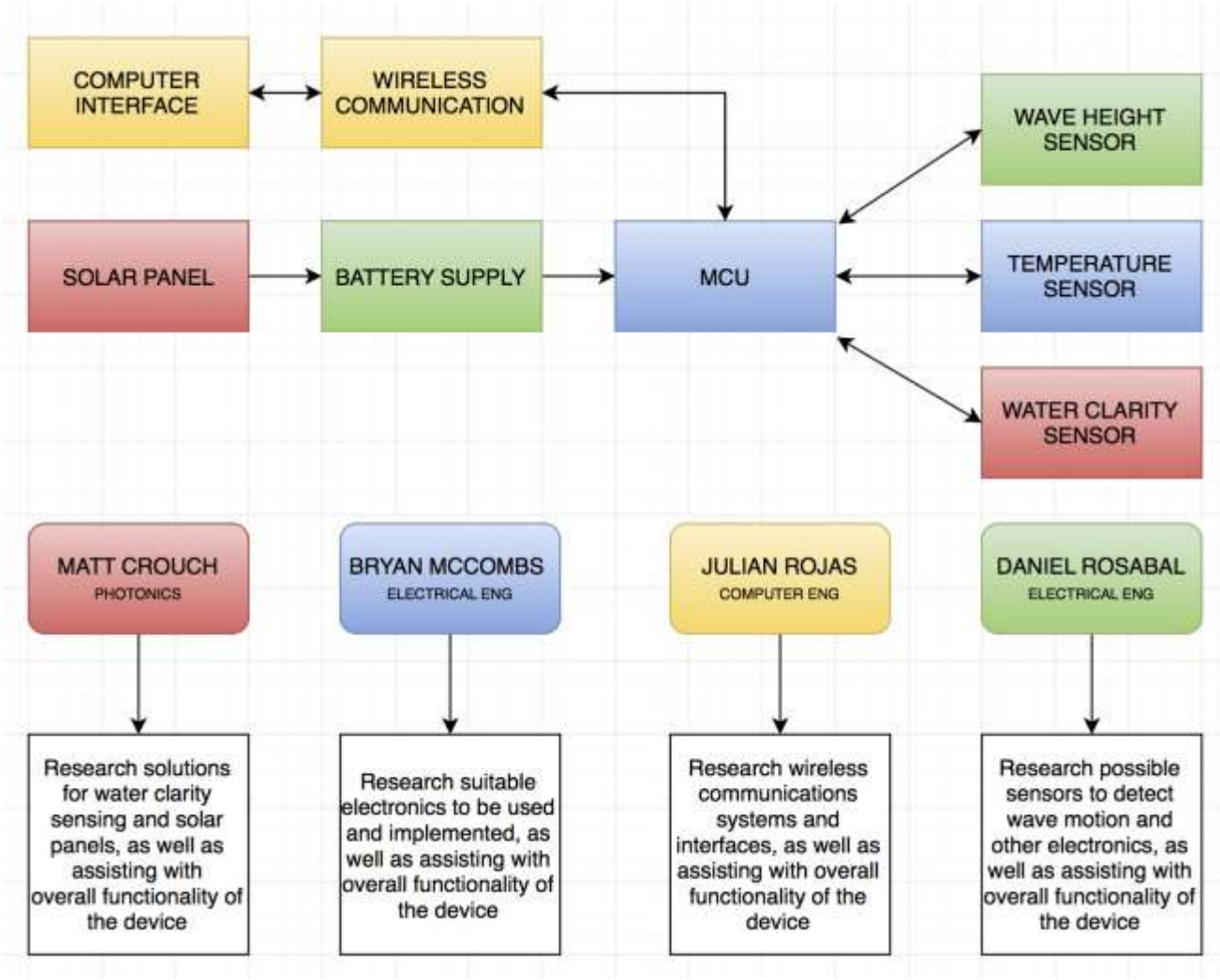
	Low Power	Functionality	Setup Time	Dimension	Performance
Usability	↑	↓	↑↑	↑	↑
Accuracy	↑	↑	↓	↑	↑↑
Cost	↑↑	↓↓	↑	↑	↓
Durability		↑	↓	↑	↑

3.0 Specifications and Requirements

- Housing of Buoy System
  - Dimensions - No larger than 20” L – 20” W – 20” H
  - Weight - No more than 10 pounds
- Microcontroller
  - Input/Output Voltage ~2.5-7.5V
- Solar Panel
  - Input Voltage 12-24V
  - Output Voltage 5-12V
  - Output Current 1.0-2.0 A
- Water Temperature Sensor
  - Detect up to a minimum of 100° F
  - Temperature Error less than ±2° F
- Gyroscope/Accelerometer
  - Measure wave height of up to 5 ft
- Light Source
  - Emit specific wavelength
- Photodetector
  - Detects specific wavelength
- Fiber Optic Wire
  - Core Diameter ~50 microns
  - Length =<5m
- Cost of no more than $100 per group member or $400 for group total

4.0 Block Diagram

4.1 Hardware Diagram



5.0 Cost and Budget

Name	Quantity	Cost	Total
Microcontroller	1	15-20$	15-20$
Water Temperature Sensor	1	20-30$	20-30$
Accelerometer	1	10-15$	10-15$
Fiber Optic Cable	1	?	
Laser Diode	1	?	
Photodetector	1	?	
Solar Panel	1	15-20$	15-20$
Battery	1	10-15$	10-15$
Buoy Housing	1	25-30$	25-30$
Wireless Communication	1	40-50$	40-50$

All costs are estimated for a single built buoy system. Components will be purchased in multiple quantities in case of failure or malfunction.

5.1 Cost Responsibilities

This data buoy system will be fully funded by the group members involved in the design project. At this moment there will be no sponsors. This is subject to change if and when an adequate sponsor is found.

6.0 Initial Project Milestones

SUMMER 2016		
Description	**Duration**	**Dates**
Senior Design I Project Idea	1 week	May 16 - May 20
Project discussion / work division	1 week	May 20 - May 27
Documentation	1 week	May 27 - June 3
Initial Project Documentation		3-Jun
Research past projects	2 weeks	June 3 - June 17
Individual research / writing	2 weeks	June 17 - July 1
Table of Contents		1-Jul
More writing	1 week	July 1 - July 8
Initial Draft		8-Jul
Prototype design & code development	2 weeks	July 8 - July 22
Finish project documentation	1 week	July 22 - July 29
Review documentation	4 days	July 29 - August 1
Final Documentation Senior Design I		2-Aug

Purchase components during break	2 weeks	August 8 - August 22

FALL 2016		
Description	**Duration**	**Dates**
Test components	1 week	August 22 - August 29
Build prototype	8 weeks	August 29 - October 24
Test prototype	3 weeks	October 14 - November 14
Finalize project	1 week	November 14 - November 21
Prepare final documentation/presentation	1 week	November 21 - November 28

7.0 Alternative Project Possibility

An alternative idea is to build a remote controlled boat or submersible to use for examining salt or fresh water for contaminants as well as imaging the floor of the lakes and oceans for litter and debris. The imaging would be done using a CCD or similar camera, and possibly in a wider light spectrum than visible light to allow for more information to be obtained. The water would be passed through a narrow channel on the device between a Near Infrared laser emitter and spectrometer. This would allow spectrum analysis of material in the water, and all materials have a unique spectrum. The goal would be to create a device that could be purchased and allow a person or group to simply place the device in the water and obtain usable and understandable data. This requires a certain set of pre-programmed interpretation of certain spectrum, as well as the ability to mark anything that is unusual. Possible to use software called CAMO to interpret data in the device, or similar.

The device would have to operate in water so waterproof is a requirement. The device being mobile if the best data is to be acquired from a water source. Creating a submersible device would prove more difficult as it would have to be controlled remotely through the water as well.

The major issues with this idea are currently cost, and difficulty. The price without sponsorship is not feasible on the design budget, but emails have been sent to sponsors to consider the project. In addition to sponsorship, the help of a company in creating this device would more than likely be required due to the complexity of the spectrometer calibration and implementation.