Team 21: Autonomous Robosub Axolotl

Interim Design Presentation

Project Leader: Kyle Miller
Team: Santiago Franco, Darryl McGowan, Sondra Miller, Gregory Robertson, Stuart Royal, and Alex Smith
Advisors: Dr. Clark, Dr. Frank, Dr. Harvey

Outline of presentation

- Competition overview
  - Rules, goals, and other information
- Mechanical Design Overview
  - Design concepts
- Electrical Design Overview
  - Power system overview
- Software Overview
  - Top level system
  - Vision system
- Schedule
- Questions

The Competition

- Competition sponsored by AUVSI and ONR held in San Diego
- 30 entries from schools worldwide in 2012 competition
- Produce an AUV to complete various tasks such as obstacle courses and torpedo firing
- Points awarded for successful completion of tasks within 15 minute time limit

Mechanical Concepts

Concept 1: Simply reuse last year's design

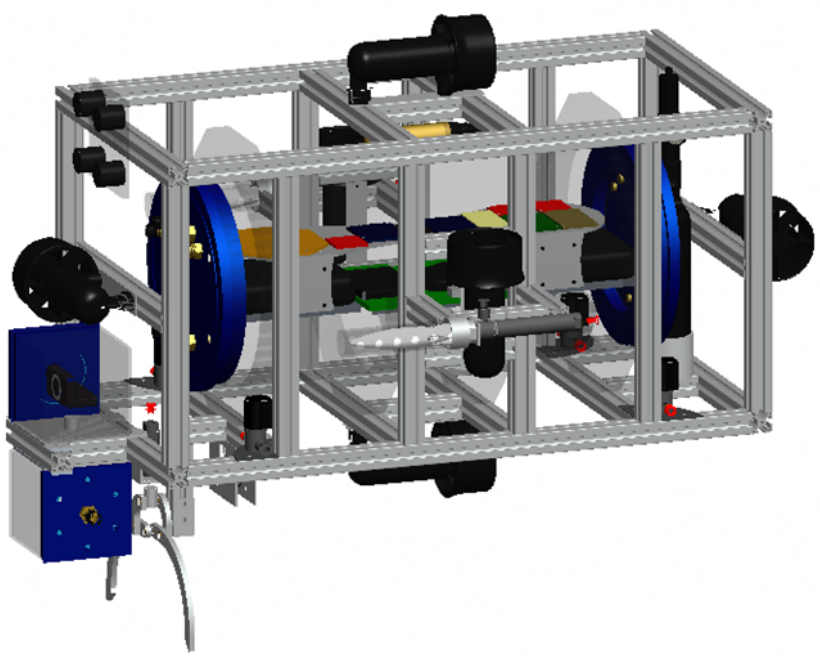


Figure 1 CAD of Concept 1

Mechanical Concepts

Concept 2: Redesign end caps, retain the frame from last year's design

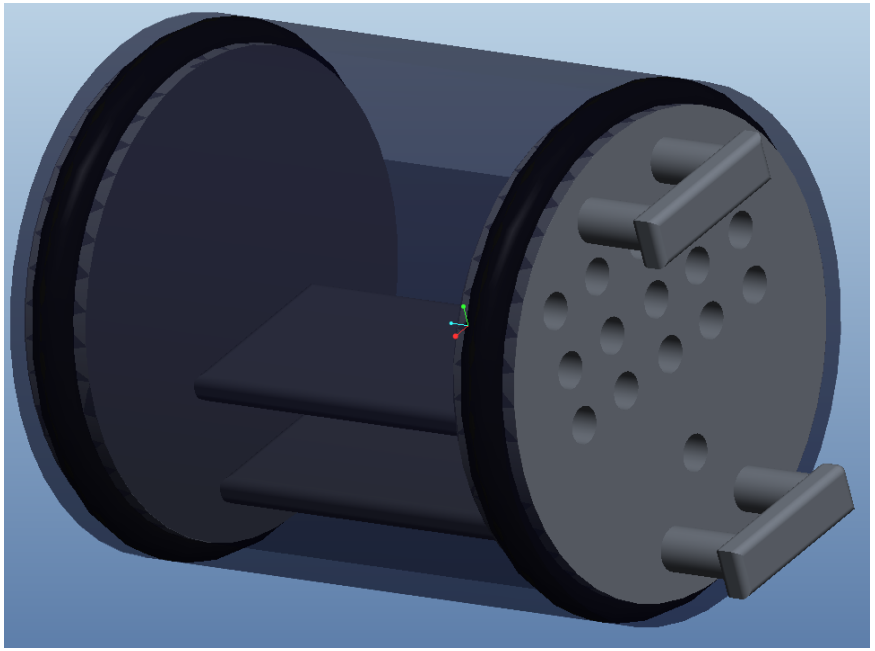


Figure 2 CAD of Concept 2

Mechanical Concepts

Concept 3: Redesign hull and frame

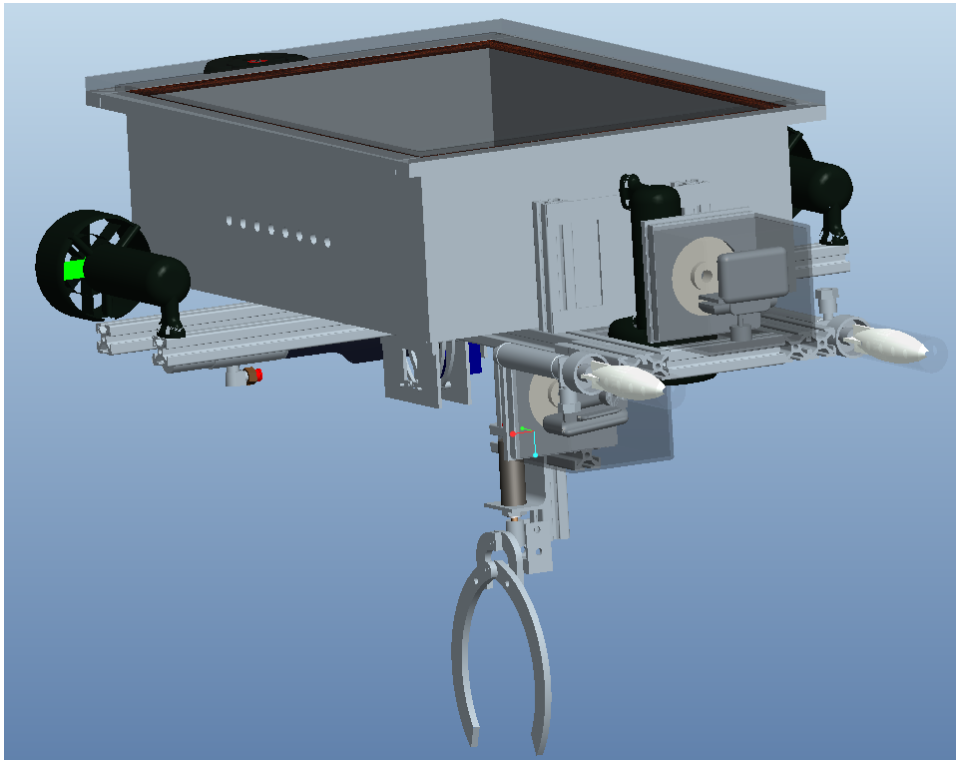


Figure 3 CAD model of Concept 3

Concept Decision Matrix

	Weight	Accessibility	Cost	reproducibility	Building Time	Total
weight	.25	.3	.2	.05	.2	1
Concept 1	5	1	10	1	10	5.6
Concept 2	4	4	6	4	8	5.2
Concept 3	8	10	3	8	4	6.08

Table 1 Decision Matrix

Buoyancy Calculations

	Total Area Occupied	Weight of Sub Design
U.S. Units	2,962 in^3	74.26 lbs
S.I. Units	0.485 m^3	33.68 kg

Table 2 Volume and Weight of AUV

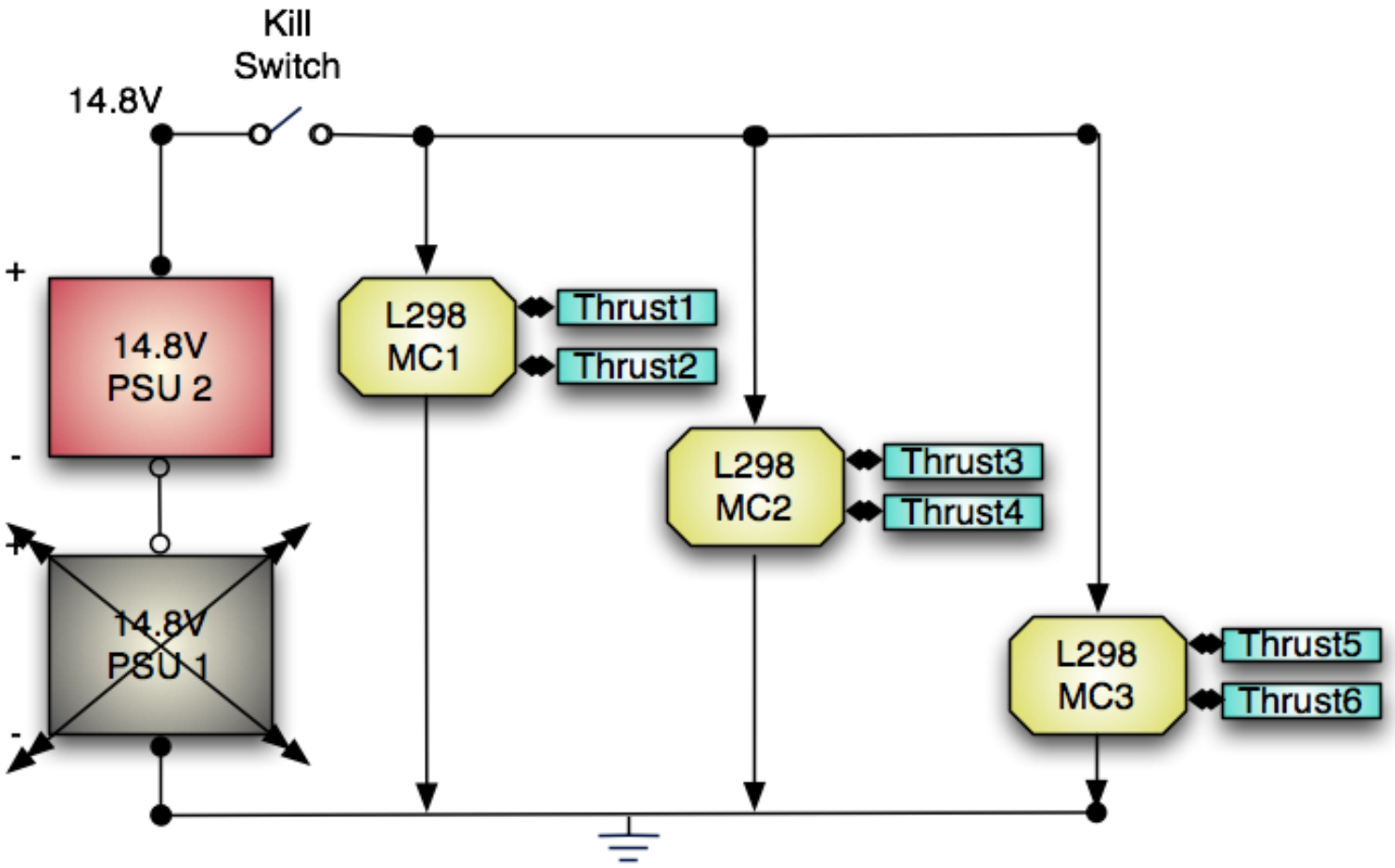
Buoyant Force Upwards = $\rho_{water} \cdot g \cdot V_{sub} = 488.1N$

Weight Force Downward = $W \cdot g = 330.4N$

$488.1N - 330.4N = 157.7N$

Positive buoyant force remaining.

Electrical Systems Outline



Electronics and Actuator Power Systems

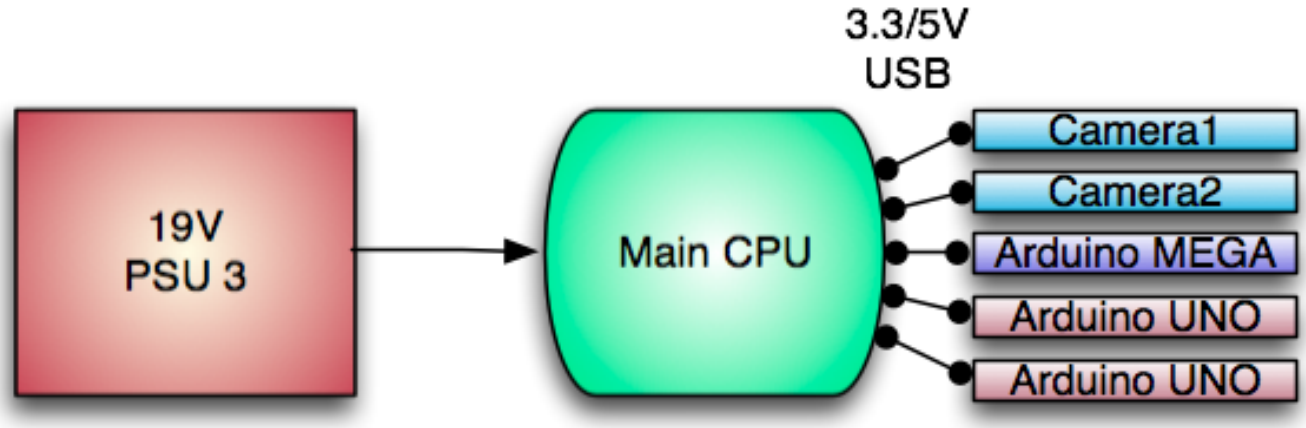


Figure 4 Electronics power system

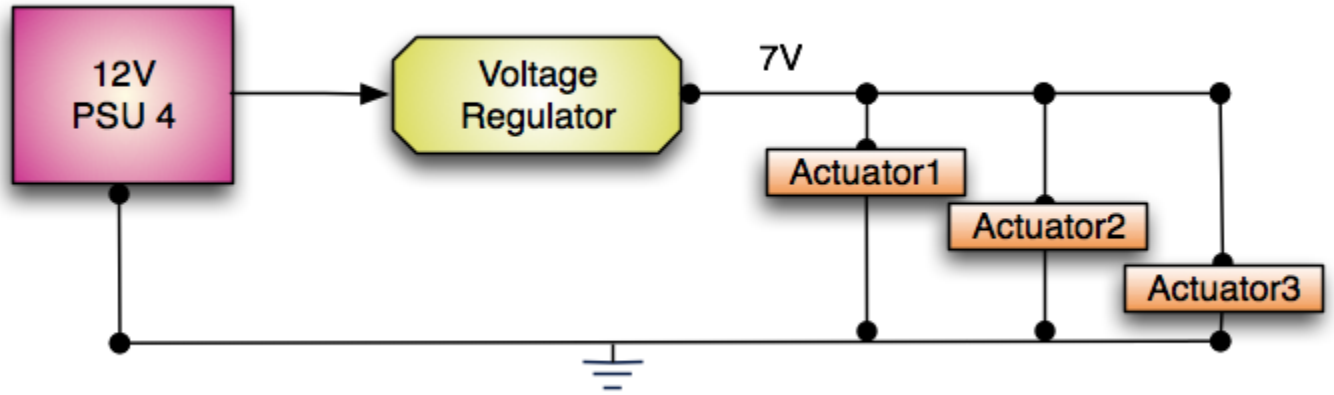
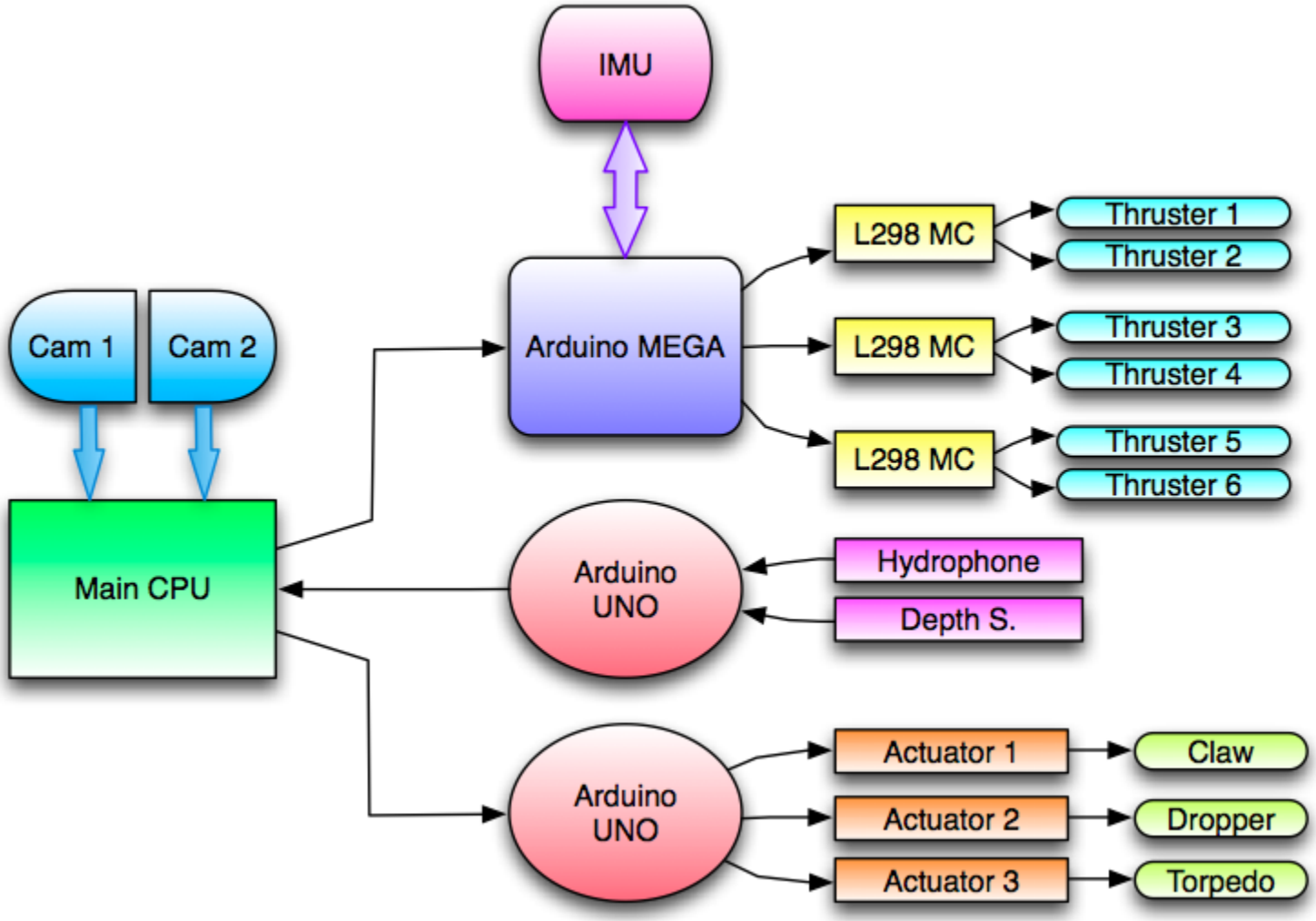


Figure 5 Electronics power system

Top Level Diagram

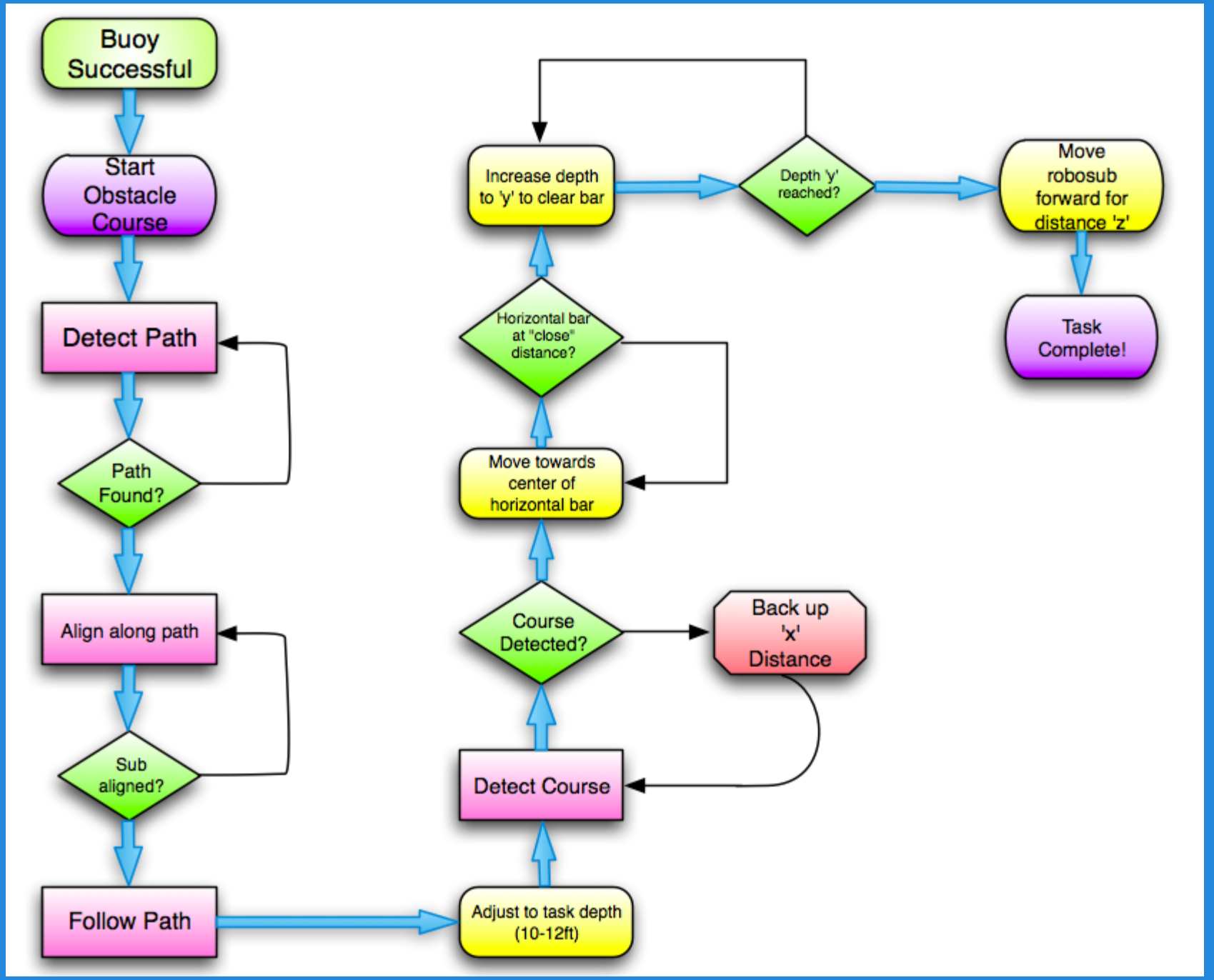


Software Design

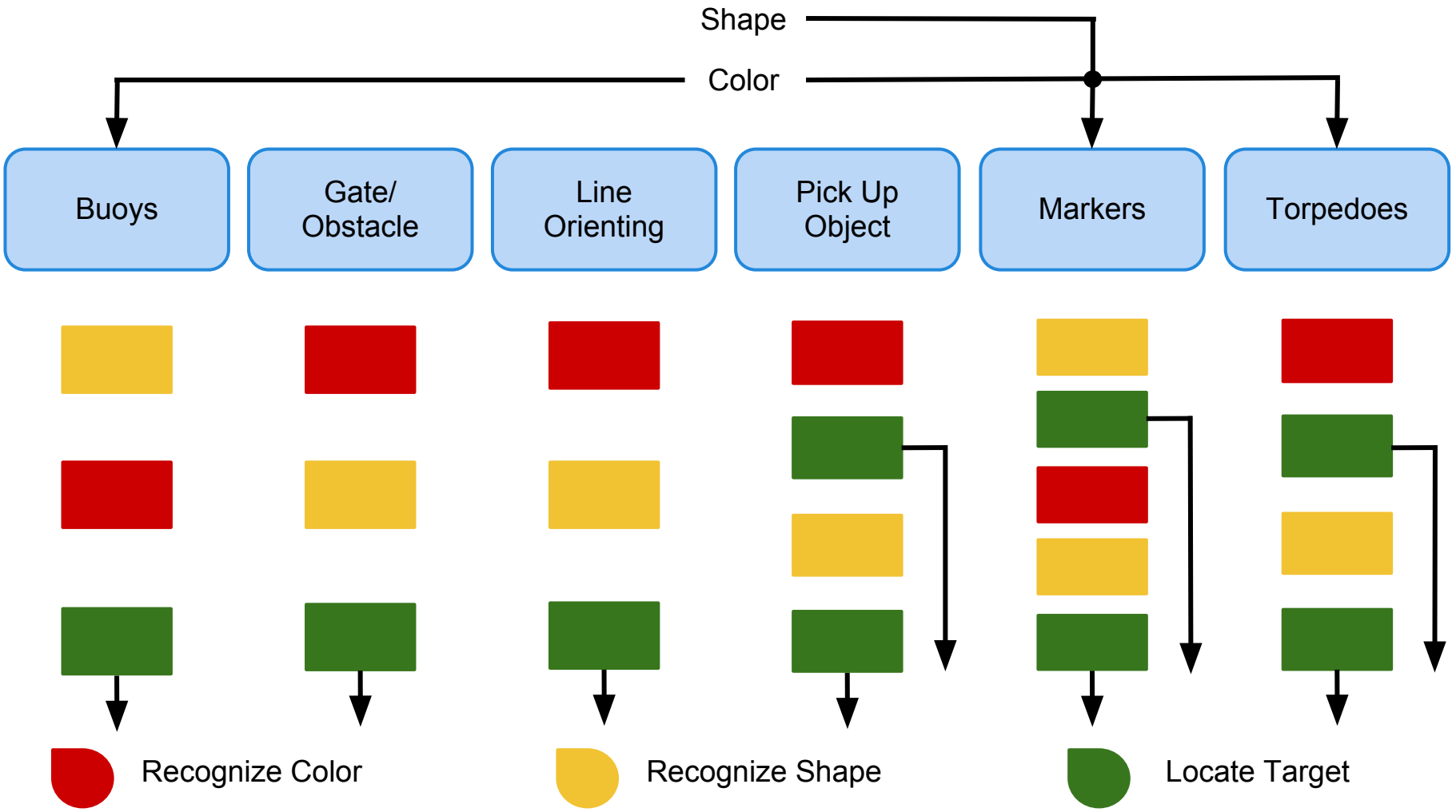
- Top Level
  - Input
    - Logic signal - identification of target
    - distances/directions - from sensors
  - Output
    - To movement controller
      - cylindrical coordinates
      - velocity of movement
    - To vision system
      - address of necessary vision module
    - To actuators
      - logic signals

Software Design

- Vision System
  - Input
    - address of requested vision module
  - Output
    - Logic signal - identification of target
    - cylindrical vector - direction of target
- Movement Controller
  - Input
    - cylindrical coordinate
    - velocity of movement
  - Output
    - Power to thrusters

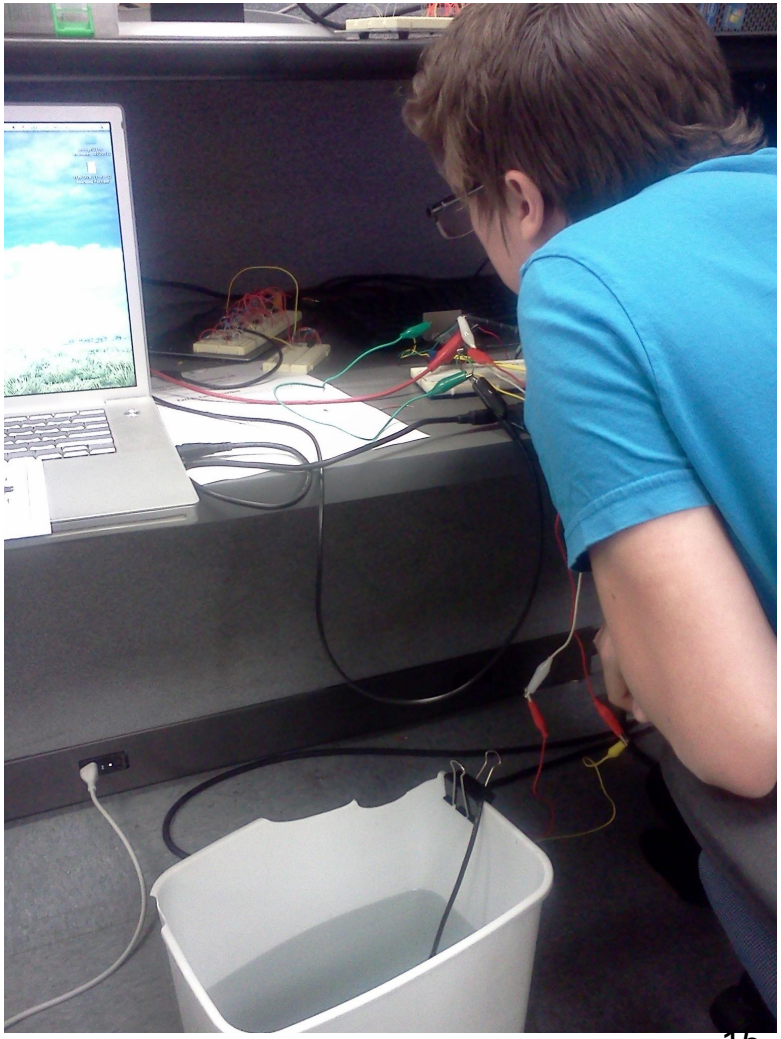

Buoy Successful
Start Obstacle Course
Detect Path
Path Found?
Align along path
Sub aligned?
Follow Path
Adjust to task depth (10-12ft)
Detect Course
Course Detected?
Back up 'x' Distance
Move towards center of horizontal bar
Horizontal bar at "close" distance?
Increase depth to 'y' to clear bar
Depth 'y' reached?
Move robosub forward for distance 'z'
Task Complete!

Vision System



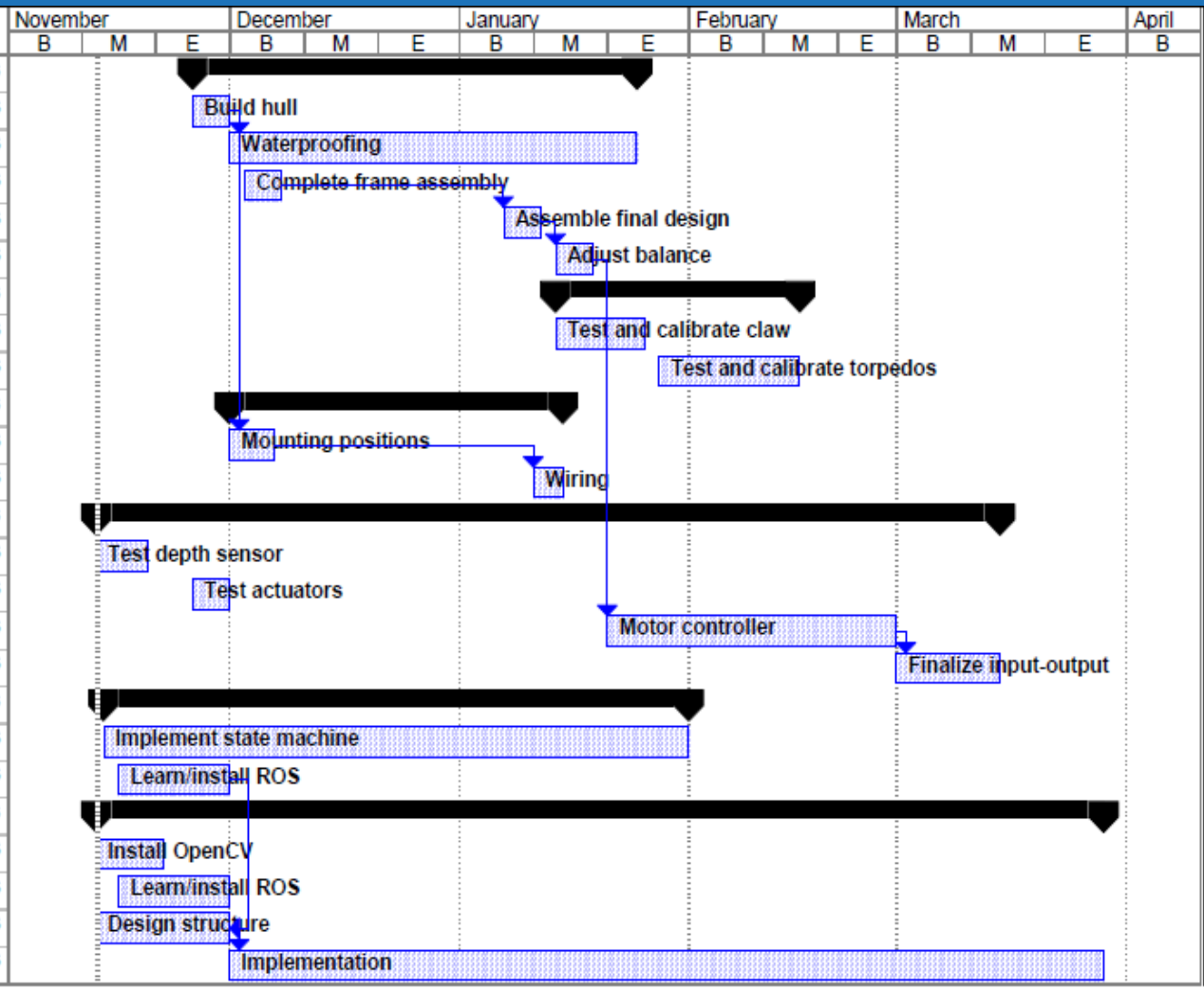
Future Plans

- Complete the fabrication and testing of the physical design
- Interface with all sensors
- Recognize objects and colors underwater
- Perform trial runs designed to resemble actual competition conditions



Schedule

ID	Task Name	Duration
1	**Hull and Frame**	**45 days**
2	Build hull	5 days
3	Waterproofing	40 days
4	Complete frame assembly	5 days
5	Assemble final design	5 days
6	Adjust balance	5 days
7	**Actuated components**	**25 days**
8	Test and calibrate claw	10 days
9	Test and calibrate torpedos	15 days
10	**Electronics**	**32 days**
11	Mounting positions	5 days
12	Wiring	2 days
13	**Arduino**	**89 days**
14	Test depth sensor	5 days
15	Test actuators	5 days
16	Motor controller	29 days
17	Finalize input-output	2 wks
18	**Top-level controller**	**58 days**
19	Implement state machine	2.9 mons
20	Learn/install ROS	11 days
21	**Computer vison**	**99 days**
22	Install OpenCV	7 days
23	Learn/install ROS	11 days
24	Design structure	14 days
25	Implementation	85 days



Questions?