Tempe High School Robotics

Robobuff1.0

National Underwater Robotics Challenge 2009

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Abstract

For this year our mission priorities are to turn on the remote lights for visibility and thin go for samples from ice berg. Our design this year is for maneuverability so that we can move around easily and quickly. Along with the design is our innovative Wiimote control system which allows us to fully use our maneuverability. While doing this we gained many valuable skills that will help us in the future. And of Corse there was just a little cost foe everything that we used to make the ROV. And in the end we have the final product, our ROV for this year Built during our summer break with our most dedicated team members.

(Pic from FRC compaction)

Mission Priorities

	Point Value		Difficulty	Risk	Time	Team Opinion		Totals
Free Anchor	15	1	4	5	3	3		16
Activate emergency ascent device on ROV	15	1	4	5	3	4		17
Turn on remote sensing station lights	20	1	4	5	3	5		18
Re-attach the broken mooring of sensing station	20	1	3	5	3	3		15
Retrieve old scientific package	55	2	2	5	2	3		14
Retrieve glacial core sample from tunnel (5 min time limit)	200	5	1	1	5	1		13
Measure temperature of vent	20	1	3	5	3	1		13
Record sound of vent	40	2	3	5	3	1		14
Retrieve four core samples and six bioluminescent samples	164	5	1	5	1	5		17

Higher number corresponds to better or easier rating.

We constructed a chart in order to weigh the different aspects of the mission. On this chart we had various categories that would rate which scoring would be the best route. From this, we decided that retrieving core samples and bioluminescent samples would give us a good score without taking too much time. Also, turning on the assist lights was important to make it easier to see for the rest of the mission.

Design Possibilities

We considered many different design options while designing our robot. From different control systems to different hardware configurations, we were focused on finding a combination that would accommodate the needs of the mission.

-THE PICKLE JAR

One of the first ideas that we had to contain our electronics was a pickle jar. This idea did not get very far along in the process. The more we thought it through, more issues arose. One of our first problems we encountered was the lack of space within the jar. There wasn't enough space to hold all of the electronics comfortably. Another dilemma we came across was where (or how) we were going to mount the motors and sensors. The final nail in the coffin was the fact that glass and public pools don't mix.

-THE PVC TUBE

Another idea which was conceived was to encase the electronics in a watertight PVC tube. The main problem with this design was that the largest PVC tube we were able to find with connectors was 4" in diameter. That didn't allow much room for the electronics. This design however would provide a more simple way to mount the motors and sensors.

-THE EXTRUDED ALUMINUM FRAME

This idea was to use a use a watertight box for the electronics, and a modular aluminum frame. This idea would allow quick assembly and reassembly, enabling us to tweak the design on the fly. The issue with this was creating a watertight box to house the electronics. In the past, creating a water tight box has been a challenge for our team.

In order to determine which thrusters we would use, we conducted a few tests.

1. 500 GPH w/silver fan blade vs. 500 w/ airplane propeller
2. 500 GPH w/sliver fan blade vs. 1100 GPH pump
3. 500 GPH w/airplane propeller vs. 1100 GPH pump

From these tests, we learned that the 500 GPH w/ silver fan blade would give us the most thrust. Our second choice was the 500 GPH w/airplane propeller and surprisingly the 1100 GPH pump was the worst.

Innovations

Once we found a design that fit the needs of the mission, we had many innovations we wanted to implement. The biggest innovation was the unique control system. We've seen wiimotes used to control land robots before, but never on an underwater ROV. This also provided complications on how we were to control the unique movements you can achieve underwater that are impossible on land. For instance, the wiimote's accelerometers allow the driver to accurately imitate the roll movements that our robot is doing. We also have a custom electronics box, which is unique in itself. It is improved off of our 2008 ROV electronics box, which sadly was not watertight. For the frame of the robot, we are using extruded aluminum, which will allow us to quickly change the configuration of our robot. These different innovations make our ROV stand out from the rest.

Skills Gained

We have gained many valuable skills during the process of designing and building this year's ROV. One of the more vital skills we gained was how to make a water tight box. Without this skill we would not be competing, or if we did we would not do very well. Another great skill is to think outside the box or be innovative. There are so many problems that pop up so they can't be solved by regular means. One example is our claw. It is made out of so many different things that were just lying around is our shop. And finally the most important skill would be team work. Not that it is new to our team, but that everyone who participated had all worked together before so we were twice as efficient as we ever where.

Expenditures

ROV in a Box 2008	Inventivity LLC	Used only motors, camera, lights	1	$250	$250	Purchase
Poly-carbonate box	ProPlastics	Electronics box with cover and gasket	1	$285	$285	Purchase
Arm	Harbor Freight	Graber arm with hardware	1	$12	$12	Purchase
Aluminum frame	Hei-Tek Industries	80/20 Aluminum T-slot frame with connectors	Var.	$264	$264	Purchase
Bilge Pump	Bass Pro	500 gal/hr	2	$27	$54	Purchase
Bilge Pump	Bass Pro	1100 gal/hr	2	$43	$86	Purchase
Motor Controller	Lego Ed.	8 station motor controller	1	$17	$17	Purchase
Connecters	n/a	Electrical connectors	6	None	None	Donation
Cabling	n/a	Electrical cabling	Var.	None	None	Donation
Control interface	n/a	Electronics interface and controller, from last year	1	None	None	Donation
		Total:		$898.	$968.	

The Robot

On-Board Control System

The control system we chose was the NXT brick and HiTechnic system as used in the FIRST Tech Competition. We became very familiar with it during the competition and decided it would be a good choice for this competition. We also use Victor speed controllers to control the motors of our robot. This allows us the have variable speed control for the motors, both vertical and horizontal.

Surface Control System

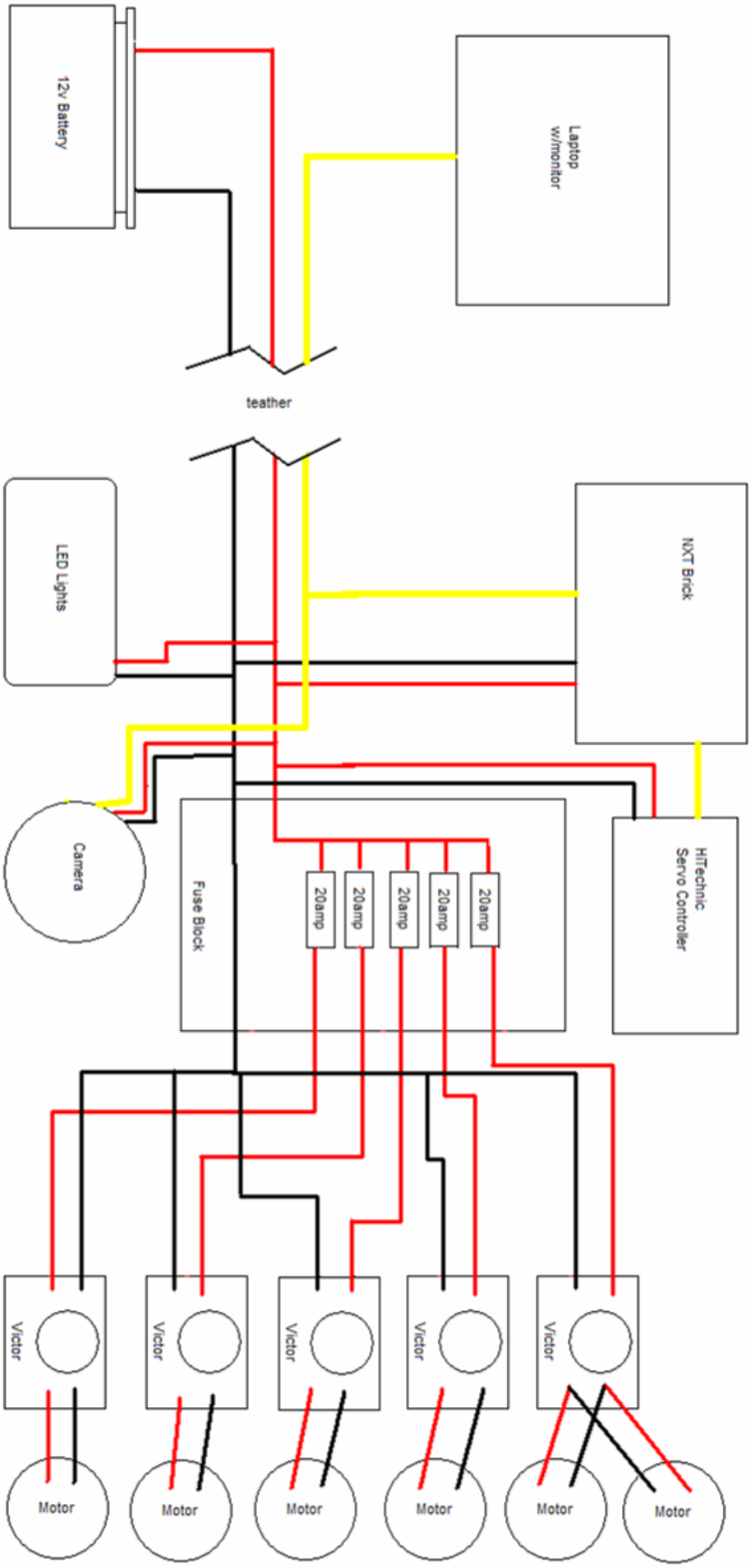
For controlling the robot from the surface, we decided once again to use the FTC control system. This was something we became very familiar with and knew would work. However, we did not use the same controller as in FTC. We used a Wiimote, or for the non-wii fanatic, the wii controller. This was a unique control that gives us realistic movements and vibration and audio feedback, letting us know when certain conditions are met.

Electrical System

The onboard electrical system is made up of a power distribution board, the HiTechnic servo controller, NXT brick, and five Victors (speed controllers).

Electrical Schematic

See following page.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HiTechnic
Servo Controller
Victor
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Acknowledgements

We would like to thank everyone who has helped us in the making of this ROV!

Especially our mentors!

And especially Mr. Warner!

GO WATER BUFFALOES!!!