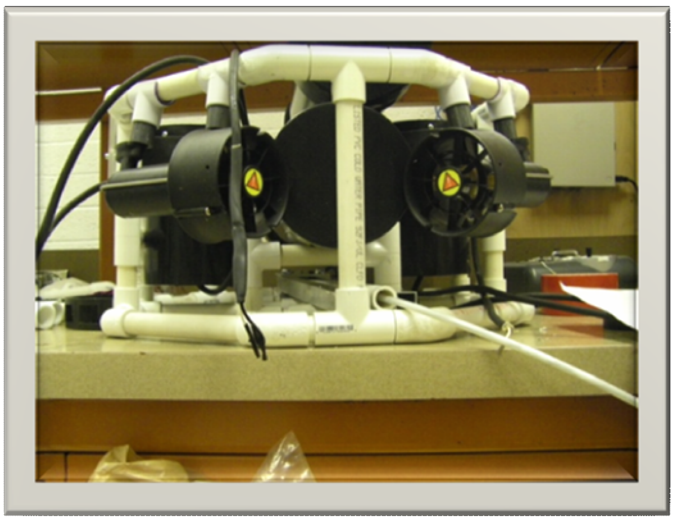
ASU WISE ROV TEAM

Arizona State University
Tempe, AZ
Women in Applied Science & Engineering
2008 MATE International Competition



Our team members
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Technical Report by
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Table of Contents

Abstract

The ASU WISE ROV team has entered the MATE International competition for the 2nd year with more knowledge gained from the previous competition last year. This is our 2nd year as a team participating at MATE. With the experience gained during last year's competition and fresh new faces with bold ideas only time will tell whether this team has made progress from the beginnings.

The team consists of seven women from various academic disciplines and diverse backgrounds. The current senior team members will utilize their previous experience with this project to correctly guide and harness the talent of the innovative and overly eager freshmen on the team.

After many trials and tribulations, the team finally came around to sticking with the original ROV design not only because of its elegance, but also for its useful octagonal structure, which perfectly allow us to place the motors at 45˚ angles. However, the frame was slightly modified and other small accessories were added. The ROV, Aurora II, is designed for accuracy, maneuverability, and simplified transport. The design is centered on a lightweight PVC frame, adjustable motor mounts angled at 45˚, and two ABS pipes which provide a better control on buoyancy. Two batteries were used for off-board power; a 7.2 V battery was used for the VEX Control System, and one 12V battery was used to power the motors, lights, cameras, and the robotic arm.

Our ultimate goals are to prove ourselves that we are equally capable of designing, building, and operating an underwater robot and to inspire young women to enter any career in engineering or science. Women have the capacity, intelligence, and the abilities to succeed in any of those areas. Our team is going to try to prove that in the upcoming competition.

Design

The design of A.U.R.O.R.A II was modified many times because of the challenge to create a robot that was different than the first but still functional. The design of the first robot, A.U.R.O.R.A., was a very unique, elegant, and mathematically approved design; it veered from the classic box look and edged towards a more circular design. The team debated about venturing away from the octagonal design but in the end stuck with that design and modified the robot slightly.

The final design started to come together after a many more meetings and the ultimate decision of using an on-board power system. After taking the decision to have off-board power, the designs for housing the control system and battery started to come into play.

The frame was made out of PVC piping because of its properties and relatively cheap price. PVC is inexpensive, easy to maintain, has a high tensile strength, and a low minimum temperature. It is available from local shops and there were also some PVC pipes left over from last year. The frame was almost an exact copy of A.U.R.O.R.A. with a few exceptions.

The motors were placed in a kite shape and at a 45 degree angle to give our robot more stability and easily maneuverability in the water. The 45 degree angle position of the motors allows movement in a 360 degree range, while the vertical motors permit up and down movement. With this set up, the sum of our vectors when all of our motors are on, gives us a forward motion; but if some motors rotate in a counter-clockwise direction the ROV is capable of moving diagonally, to the right, or to the left which can be competitively advantageous. The motors were mounted on the sides of the PVC frame with little PVC elbow attachments that allow the motors to be easily moved to and from the robot.

Electrical Systems

In any project our main goal was to design our own control system using the Board of Education from Parallax. In doing this we learned about the circuit board and operations however due to time constraints and difficulties encountered our team decided to use the VEX control system in order to maintain time constraints. The Board of Education (Figure 1a) allowed our team to understand the functions of a actual control system.

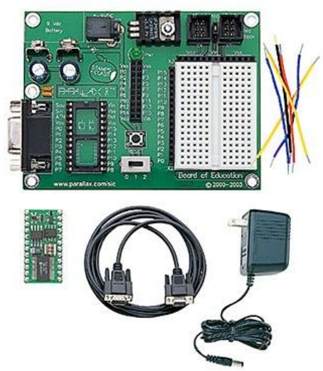


Figure 1.b

Figure 1.a

The VEX Control System is used to control AURORA II. A 7.2 V battery is used to power the VEX system, while a rectangular 16 inches long plexi glass is used to hold the VEX system, the speed controllers, the 7.2 V battery, the 34 amps circuit breaker, and a (black rectangle with two rows of screws). Velcro was used to hold each object in place on the plexi glass rectangle. It was decided to use a RC battery to power the VEX system because it is better suited for our needs and our budget. The RC battery is listed as a 7.2V2000mAh Ni-Cd Battery Pack and it comes with its own charger*. A phone cord is then used to send the signal (program) from the VEX system to the tether, and then to our transmitter on the surface. PWM cables are used to connect the speed controllers to the VEX system, while the circuit breaker is connected between the speed controllers and battery to protect the motors from any electric shortage.

Batteries

The robot is powered by two batteries; one 7.2 V battery for the VEX Control System and one 12 V lead acid battery for the motors, camera, and robotic arm. Instead, they are attached directly to 12 Volt D.C. battery source. The arm is designated to operate through using a control switch.

Sensors

Robotic Arm

The arm was built by PADT and we designed and created the claw. The arm itself was two aluminum bars, about a foot long, connected at one end by a clamp which also held two short bars that would move to and from each other when the cord was twisted. The claw, which is attached to the two short bars, was created out of a wine opener/can opener. Each prong was attached to its own bar and epoxied the inside of the prongs and slit them to give the claw better grip.

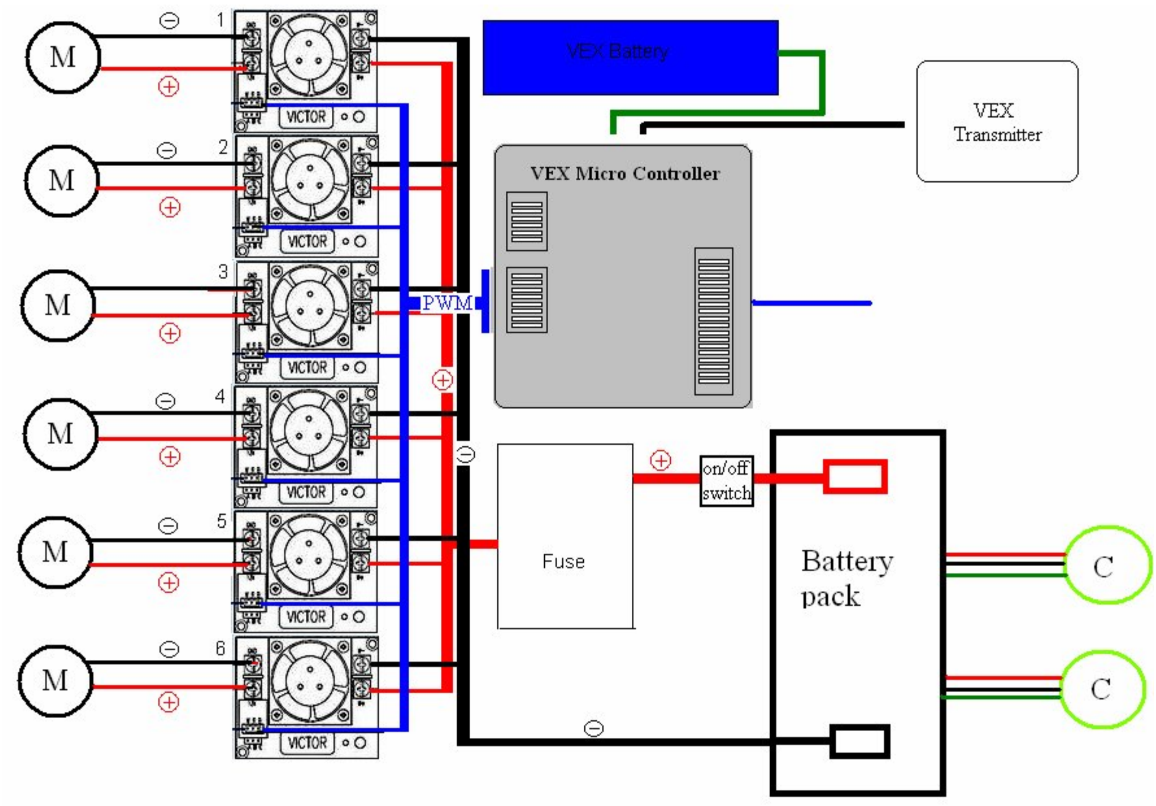
LED Lights

LED lights are very bright and allow a broader view in the darkness. A square plate of LED lights was purchased and then water proofed. Epoxy was used to water proof the lights; an aluminum can was used as a mold and the square plate of LED lights were placed in the middle of the mold and epoxy was poured into the mold. After the epoxy dried, it was attached to the ROV frame.

ROV Cameras

Two colored cameras will be used in our design to basically to allow the ROV to be able to view the forward motion and to view the robotic arm. The cameras are attached to the ROV at the front; one is placed directly above the robotic arm allowing the driver to see where and what the robotic arm is picking up. The other camera is placed at the front allowing the driver to see where she is driving.

Electrical Schematics



Expenditures

Item	Price	
Parallax DS2760 Thermocouple Kit	0	Donated
Basic Stamp 2p 24-Pin Module	0	Donated
Board of Education Development Board	0	Donated
ROV in the box	$282.65	
PING))) Ultrasonic Sensor	$29.95	
4" ABS Pipe	0	Donated
End fitting to ABS pipe	0	Donated
Attachment to ABS pipe	0	Donated
LED Clusters	$19.95	
Servo gripper & Servos	$45.95	
PCV frame		Donated
ABS pipe		Donated
ABS caps	6.12	
ABS threaded caps	2.96	
epoxy, abs glue,	23.19	
2 Seabotix motors	810.00	
Victor speed controller, pwm cables	$143.35	
thermocouple		Donated

Total $1364.12

Skills Gained

In a project such as A.U.R.O.R.A. II our team tried to utilize all materials used last year and try to focus on improving our design from last year. Basically not entirely changing the entire design but to improve the design and what we learned from last year as a team. The improvement in A.U.O.R.O.R.A. II was to have a better handle with buoyancy.

Our team attempted to build our own circuit board in the beginning stages of our design however due to time constraints it was a building tool to help us understand how the microcontroller operates. Continuation of making our own microcontroller will be postponed for the competition next year.

References

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BMJ http://www.bmj.com/archive/6991e-2.htm

Acknowledgments

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