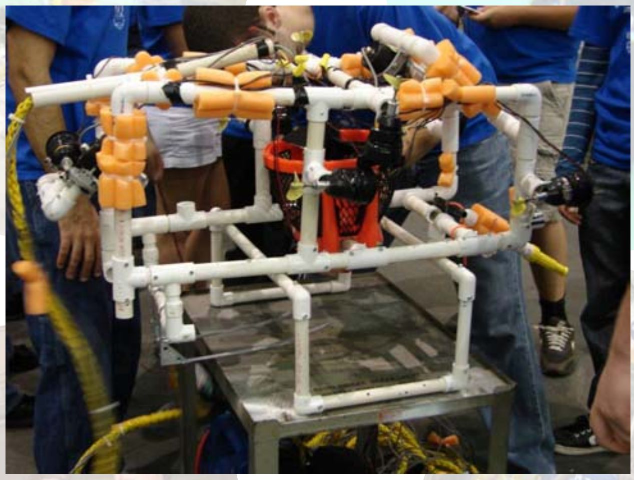
WALTRIP HIGH SCHOOL ROBOTICS
TEXAS REGIONAL MATE ROV CONTEST
1ST PLACE



ROBOT NAME: H2WHOAHHHHH!
TEAM INSTRUCTOR: MR. RICHARD LIPHAM

ROBOTICS CLASS

ARROYO, CHRIS
BARBIN, LLOYD
CAROLLO, TYLER
CARTER, GRAYSON
GUTIERREZ, ABRAM
HLAVINKA, BRADLEY
LU, MELISA
MUELLER, MICHAEL
PORTERFIELD, ELIZA
ROBERTS, STEVEN
WILSON, TAYLOR

ROBOTICS INTERVENTION

CASARES, DYLAN
ECHARRY, HARI
GAVLICK, NICHOLAS
LUCIANO, ASHLEY
MARTINEZ, KOURTNEY
ROGERS, ANDREW
RUSSELL, MEGAN

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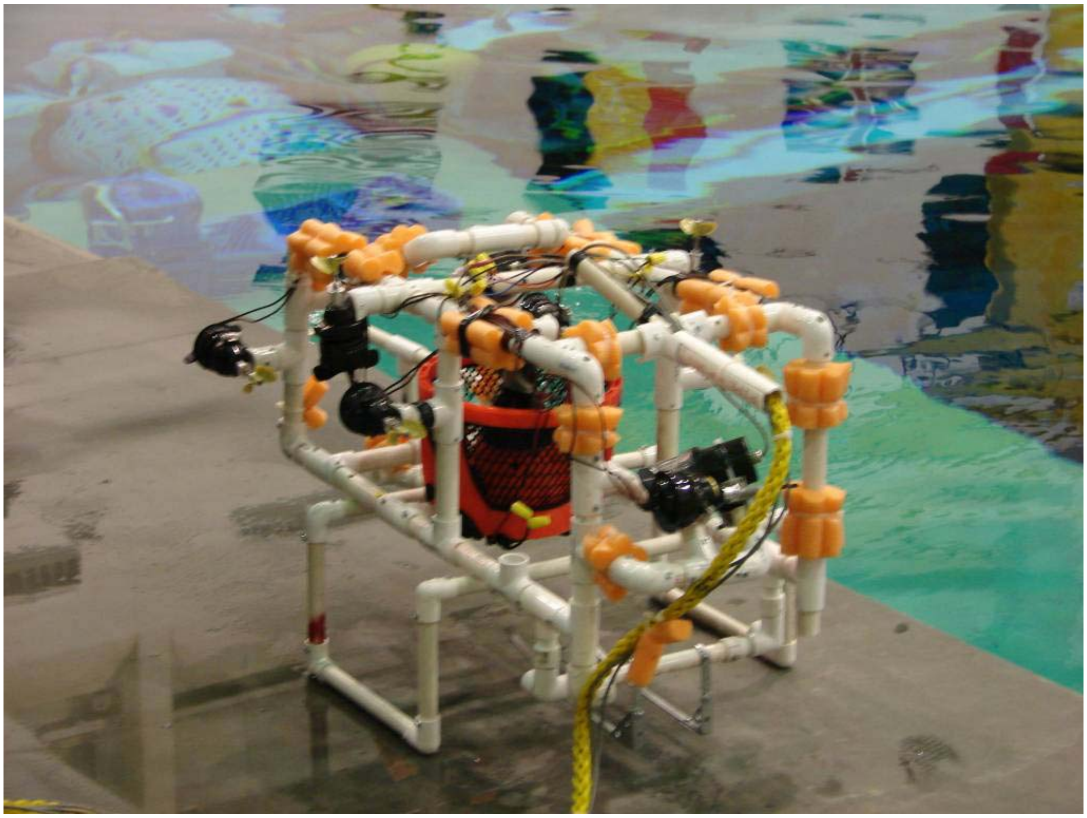
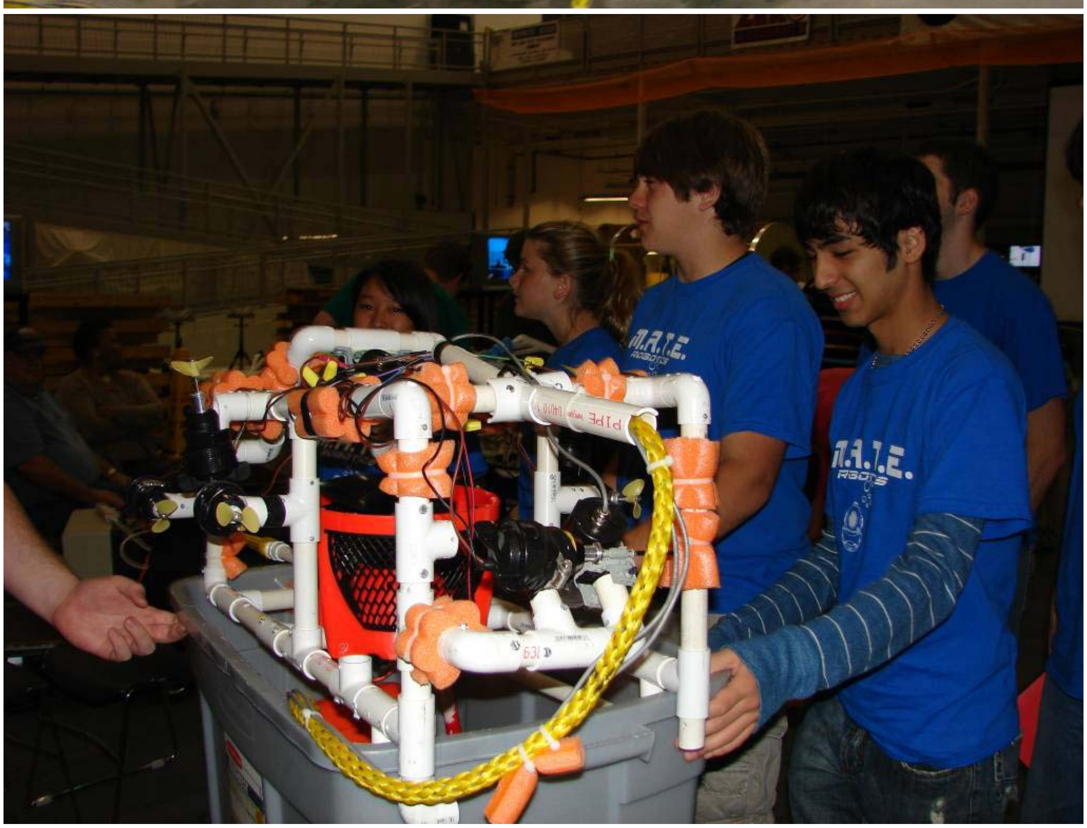
Abstract

M.A.T.E. Robotics is a much anticipated tradition at Waltrip High School for the robotics students and when the theme was announced this year we all put our heads together to formulate a plan to build an effective robot which could complete the given tasks.

Several steps were taken in order to create our robot over the course of 5 weeks, the first thing our team need was a basic frame to start the robot. We decided to use the frame from our previous robot and proceeded to strip the old robot of all the add-ons, excluding the motors, until bare. We brainstormed then constructed our plans for the new robot and went to purchase the parts (bolts, screws etc.). Our robotics team delegated each job, splitting the team into two groups: one to construct the robot and one to construct the submarine. The submarine constructers proceeded to measure out all equipment, cutting the PVC to needed size and putting the submarine together by means of zip ties, milk crates and screws, following the game requirements. The team building the robot added an additional 2 vertical lift motors, to ensure stability, an additional camera was added, which has the ability to rotate, a docking port to connect to the submarine, a device to secure the “airline,” and a mechanical arm. The entire robot was constructed of cut PVC pipes screws, nuts, bolts, inflatable cut floatation devices, zip ties, and motors. The controls for the robot were connected to the mainframe, using wires, resistors, switches and a circuit board to steer the robot. Lastly, our team proceeded to test the robot in the Waltrip swimming pool several times to ensure its success.

Photographs



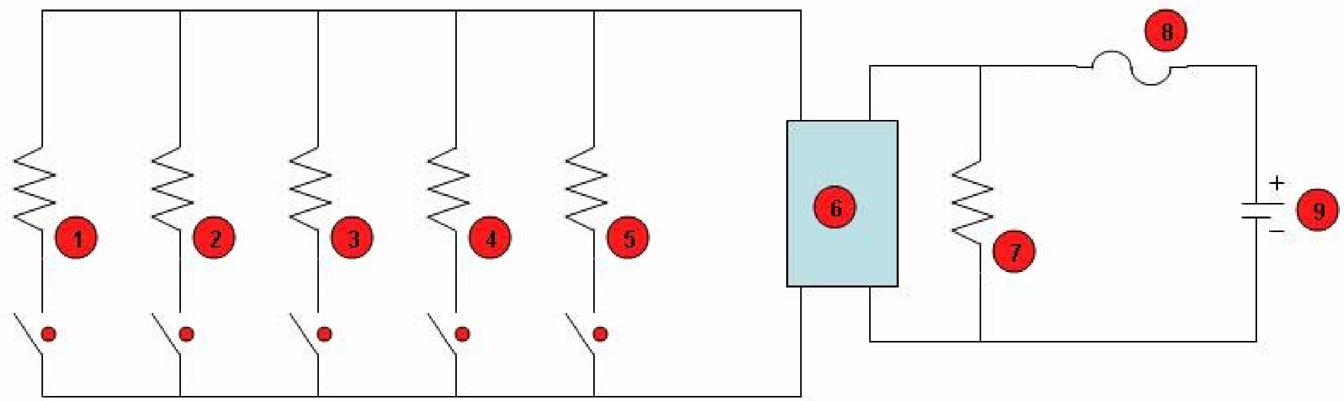


Budget/Expense Sheet

Our teacher, Mr. Lipham, already had most of the parts we used to make the robot such as: water noodles, mini propellers, electrical tape, zip ties, wire, rope, legos, servo, resistor, screws, nuts, and bolts. To build the submarine the cafeteria donated there milk crates to us so we didn't have to purchase those either. Some of the team mates also brought materials from home so we could keep everything at a low expense. We only had to purchase a few extra materials from the hardware store. Mr. Lipham bought those extra materials with a gift card we got from the last robotics competition.

Quantity	Material	Price for Each	Total
5	U-Bolts	$2.15	$10.75
2	PVC Fittings	$1.92	$3.84
10	PVC Pipes	$1.73	$17.30
2	PVC Caps	$1.88	$3.76
Total			$35.65

Electrical Schematics



1. Main Engine
2. Right Engines
3. Left Engines
4. Hover Engines
5. Camera Rotator
6. Control Box
7. Connector to power cameras
8. In-Line Fuse
9. Battery Source

Symbols indicated by a ● is a switch located in the control box.

Design Rationale

Our team designed our robot to be as efficient as possible. We decided to keep the frame nearly identical to last year's robot. The only changes made to the robot's frame were to accommodate multiple accessories such as the cameras and the docking piece. The motors on the robot were also similar to our previous designs. The large motor in the middle and the small motors on the front and back sides remained in their previous positions because they had worked fine in the past. The robot rarely had bad maneuverability so we didn't change much. The new motor we attached to the robot was to allow our back camera to rotate in order to see the damage points on the submarine.

The arm we designed served several purposes. It can use its vertical appendage to turn the lock on the hatch of the submarine and it can use the smoothed end to go under the hatch and lift it. It can also be used to turn the oxygen switch on or off. We created an alternating attachment piece at the bottom of the robot so that we can switch out the hooks that grab the pods for the docking piece. Our design for holding the ventilation tube was a little unorthodox. We put the tube in a piece of flotation attached to the frame of the robot. This way the tube was secure enough to stay in place but when it is placed in the insertion point it can detach from the robot.

Challenges We Faced

Every team is faced with different challenges, from leadership problems to simple things such as a bad wire. Our team was faced with many of these problem and we, as a team, worked through these problems together.

One of the challenges we had to face with the building of the robot was the making the hatchet turn on the submarine. The game asked us to open up a hatch so that we can drop canisters in the opening. We drew multiple diagrams of how we could use the whole robot to turn the hatchet. We spent many countless hours in trying to fix this one flaw. We thought maybe putting a servo on the end of the robot to turn the hatchet could work but, it would require more time and would just complicate the controls of our robot. So instead, we used a PVC pipe and we attached to the bottom of the robot, so when the robot goes down on top of the hatch it can open it up by turning left or right. Another challenge we face was that our main motor would fill up with water whenever we went to the pool to practice. At the time our motor was facing upward. To simulate a pressurized chamber we decided to invert the motor or turn it upside down. Because of this inversion of the motor the water wouldn't be able to reach a height high enough to cause damage to the motor.

Future Improvements

After testing our preliminary design we found there were some improvements we could make. One improvement that could be made was on our motor guards. The glue that held the motor guards in place would wear down after extended time in the water. To improve this we could use a better adhesive such as, epoxy. Another aspect that could use improving would be the main engine's ability to resist water. As of now, when the engine is submerged for an elongated amount of time, water seeps into the motor, hindering performance. A counter measure to improve this would be to seal all crevices with silicone. These are the improvements we have diagnosed so far.

Submarine Rescue System

One current submarine rescue system is called the LR5 Submersible Submarine Rescue Vessel. It is used by the Royal Navy in the United Kingdom. This rescue system enables rescue divers to go down to a distressed submarine and rescue the people in it. The LR5 is on permanent standby and can be anywhere in the world where help is needed in 12 hours. The LR5 utilizes navigation systems, through water communications, sonar equipment, and radio equipment. It can descend to a maximum depth of 500m and has a maximum speed of 2.5kt and a maximum 1.5kt sea current.

The purpose of this Rescue system is to rescue people and objects from submarines or to take them supplies. Our robot is similar to this in the way that it descends to a distressed submarine and brings it supplies. What's different is that ours doesn't require a crew within the robot and is directed by manpower above surface.

Sources

LR5 about to be lowered into water. Royal Navy. 24 Apr. 2009 <http://www.royalnavy.mod.uk/operations-and-support/submarine-service/lr5-submarine-rescue-system/photo-gallery/*/changeNav/00h001003005001/imageIndex/6/>.

"LR5 Submarine Rescue System : Submarine Service : Operations and Support :." Royal Navy. 24 Apr. 2009 <http://www.royalnavy.mod.uk/operations-and-support/submarine-service/lr5-submarine-rescue-system/>.

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Reflection

Participating in MATE robotics program at Waltrip has been a fulfilling experience. In it I learned about underwater robotics and mechanics. Working on the robot is a good example of a workplace; everyone had their own assignments and tasks to do. And when it came together, the result was a functional robot. I also learned about the electronics necessary for controlling a robot, as well as water proofing for submerging. Robotics helps improve out of the box thinking when having to come up with many different ways to open a door, or pick up a pod all while underwater. Overall, the experience was helpful in developing thinking skills, problem solving abilities and better understanding of engineering.

Acknowledgements

Mr. Lipham: For supplying materials
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