Waltrip High School

Waltrip Rambotics

1900 West 34th Street, Houston, Texas 77018

Technical Report

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Company Members:

Joshua Hohne – Team Leader and Pilot

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Abstract:

The award winning Waltrip High School returns to MATE for the 8th consecutive year. This year's competition involves working on the oil spill that occurred in the Gulf of Mexico.

The two missions are similar because, in both, ROV's were used to cut the riser pipe and cap the oil well as well as collect samples of water and creatures off the bottom of the sea floor that were possibly affected by the oil spill.

We started off by splitting our class into five separate groups, of 5 to 6 people per group, and each group built their own robot. We tested each robot and decided upon which one worked the best. We then took the most successful ideas and combined them into one robot.

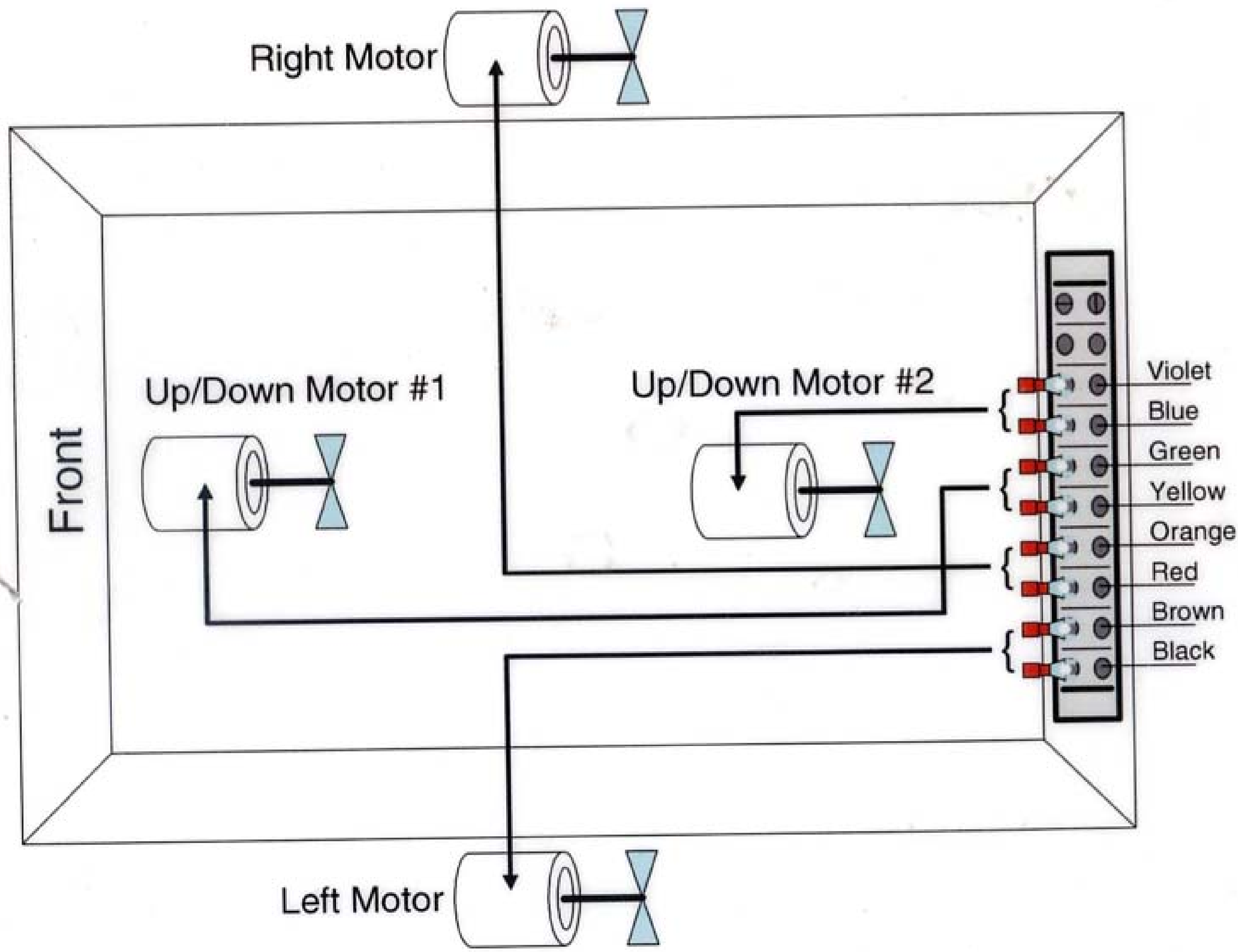
Our robot's main frame is made out of ¾" thin wall PVC pipe and fittings. The robot is large so that the team has plenty of room to add mission components to it and also to make it as stable as possible. The team has tested the size of the robot and has found that it does not limit what the robot can do.

Our control system consists of bilge pump motors directly connected to double pole - double throw switches that are connected to the battery with a fuse in the middle of the positive power supply wire.

Every member of the team gained leadership experience when it was needed and we all worked our hardest to build and design the best robot possible.

Budget			
Item	**Donated**	**Reused**	**Purchased**
.0190m PVC	$2.60		
Waterproof video camera (3)		$1,050.00	
.0190m 90 degree turn (22)	$5.50		
.0190m T's (28)	$7.00		
.0127m PVC	$7.80		
.0127m 3 side outlets w/ adapter (4)	$4.80		
Zip ties (2)			$8.99
Friction tape (5)	$7.35		
Vinyl Electrical tape (3)	$11.34		
Band clamp (3)			$6.56
Wire nuts			$8.97
Double pole-Double throw switch (6)		$419.94	
.0508m caps (6)			$12.00
Bilge pump motors (7)		$146.58	
Sea scooter motor		$80.00	
Piano wire	$2.00		
.0508m PVC	$5.42		
Totals	**$53.81**	**$1,696.52**	**$36.52**
Overall Total			**$1,786.85**

Electrical Schematic



Design Rational

Task 1 – Remove the Damaged Riser Pipe

The robot has to start off by attaching a line to the riser pipe that leads to the pool side. Then the robot has to remove a Velcro strap that will resemble the cutting of the riser pipe. After those two steps are completed, the riser pipe can be removed.

In order to pull the Velcro strip away from the riser pipe, we made a hook out of a steel rod and have attached it to the side of our robot where it will be in view of the camera. We designed a different hook that will attach to the side of the robot with magnets and we will hook onto the u bolt and pull the hook off the magnets so that the human player can pull the riser pipe up and away from the wellhead and complete task 1.

Task 2 – Cap the Oil Well

To complete task 2, the robot has to remove the hose line from the top kill manifold and has to insert it into the port on the wellhead. Then the robot has to turn the cutoff valve until the flow of oil has stopped. Finally the cap has to be picked up and placed on top of the wellhead completely sealing the well off.

The team built an interchangeable claw that is able to pick up the hose line and is able to place it in the port on the wellhead. To close the cutoff valve the team took a geared down motor and attached a four pronged hook to it that will fit in the slots on the cutoff wheel. For the final part of the task, we will use the hook, which we used to pull off the Velcro strip, to pick up the cap and place it on the wellhead.

Task 3 – Collect Water Samples and Measure Depth

Our 3rd task requires us to read and interpret a graph that will tell us at which depth we need to collect a water sample. We then need to collect a non diluted sample of colored water from a water bladder that is in a bucket.

We will complete this task by taking a large straw and attaching a 125 meter length of fish tank tubing to it that will run up to the control box along the tether. We attached the straw to the bottom of the robot in view of the cameras. We will hover over the opening in the bucket, using a funnel to help guide us down into the opening so that we can open the valve at the top and pull more than 100 milliliters of colored water out by using water pressure, not a pump.

Task 4 – Collect Biological Samples

The 4th task involves collecting biological samples consisting of a sea cucumber, a glass sponge, and a crab and returning the biological samples to the surface where a human player can pick them up.

Our team has designed and built a system, to pick up the sea creatures, that consists of a mesh box and a motor. The box is placed inside the back of the robot and the motor is placed in the front facing backward toward the box. The robot will set down on top of a sea creature and the pilot will turn the motor on that will blow the sea creature into the box. After we have collected all the creatures we will bring the robot up to the surface and the human on the pool side will collect the creatures.

Challenge and Troubleshooting Technique

Challenge

During the course of designing and building the robot, one of the biggest challenges that the team faced was finding a way to collect the water sample in task 3. We started off talking about using a big syringe attached to a motor that would be able to suck the water sample out of the bladder however it was decided that the chance of failure would be too much so we thought of other designs.

Our second design involved taking a big straw and attaching it to a fish hose that would hold the water on the robot. We then decided to run the hose to the surface of the pool with a valve on the surface that a human player can open and allow the water pressure to fill the hose up. After building and testing out the design, we found that we were only collecting about 60 mL of liquid. We then took the design back to the drawing board and worked on ways to increase the amount of fluid we could collect.

We ended up designing a bottle that is attached in the middle of the fish tank hose that will be able to allow more liquid to be collected near the robot. When we tested it at the pool we were very surprised when we managed to pull out more than 500 mL of liquid. Our biggest problem had been solved.

Troubleshooting Technique

If there is a problem on the robot we look at the most common issues that might cause that problem. If we can not find it by looking at common issues then we will work back from the problem along the chain.

For example, at our regional contest we plugged in our banana clips, red to red and black to black, and found that our cameras did not work. The most common reason was that a wire had come unconnected and the cameras were not getting power. We looked at the wires and found that they were all connected correctly. We then worked our way back all the way to the power box and found that the red and black caps on the power box were switched around, reversing polarity.

We fixed the problem and managed to make enough points to push the team into second place, getting us to internationals.

Lesson Learned and Future Improvements

Lesson Learned

One of the important lessons that we learned this year was that time needed to be managed better. We spent too much time designing and building and that caused us not to have much time to practice and troubleshoot what we had built.

We also did not manage our time working on the notebook and had to rush to finish it before the deadline to send it in.

Next year the team will be sure to finish our robot and notebook fast in order to give us plenty of time to practice and make needed adjustments.

Future Improvements

One of the problems with the frame is that is it too big and can be hard to maneuver. In the future the frame will be designed smaller for easier and faster maneuvering and performance. The reason that a big frame was used this year was to allow a whole variety of attachments to be attached to the robot and still have enough room to have good views with the cameras.

Another problem that the team encountered was the motor, being used to close the cutoff valve, had a previously undiscovered leak and was filled up with water. When we tried to use the motor, we found that it would not work. After troubleshooting and deciding that it was the water inside of it, we dumped the water out and it worked again. In the future, the team needs to make sure to reseal all waterproof broken seals and also to test out the seals very well to check for leaks in order avoid the same problem again.

Reflection

Joshua Hohne – Team Leader

I first got into Waltrips MATE robotics team last year, as a Junior, and I am the only returning member as I continue in my robotics education this year, as a Senior.

Last year, Waltrip missed out going to internationals by 8 points. Since I knew that I would be back the next year I learned all I could at the game and what problems we encountered so that I could make sure that we don't encounter the same problems again this year.

With my previous experience I was able to teach the team what problems might arise and I believe that this helped us get to internationals this year.

Acknowledgements & References

We would like to acknowledge and thank the following groups and companies for supporting Waltrip's MATE Team:

References

British Petroleum Deepwater Horizon Oil Spill links

•http://www.bp.com/bodycopyarticle.do?categoryId=1&contentId=7052055

•http://www.deepwater.com/

MATE Contest links

•http://www.materover.org/main/index.php