The U-Boat

Gulf Coast ROV Consortium

Pasadena Memorial High School

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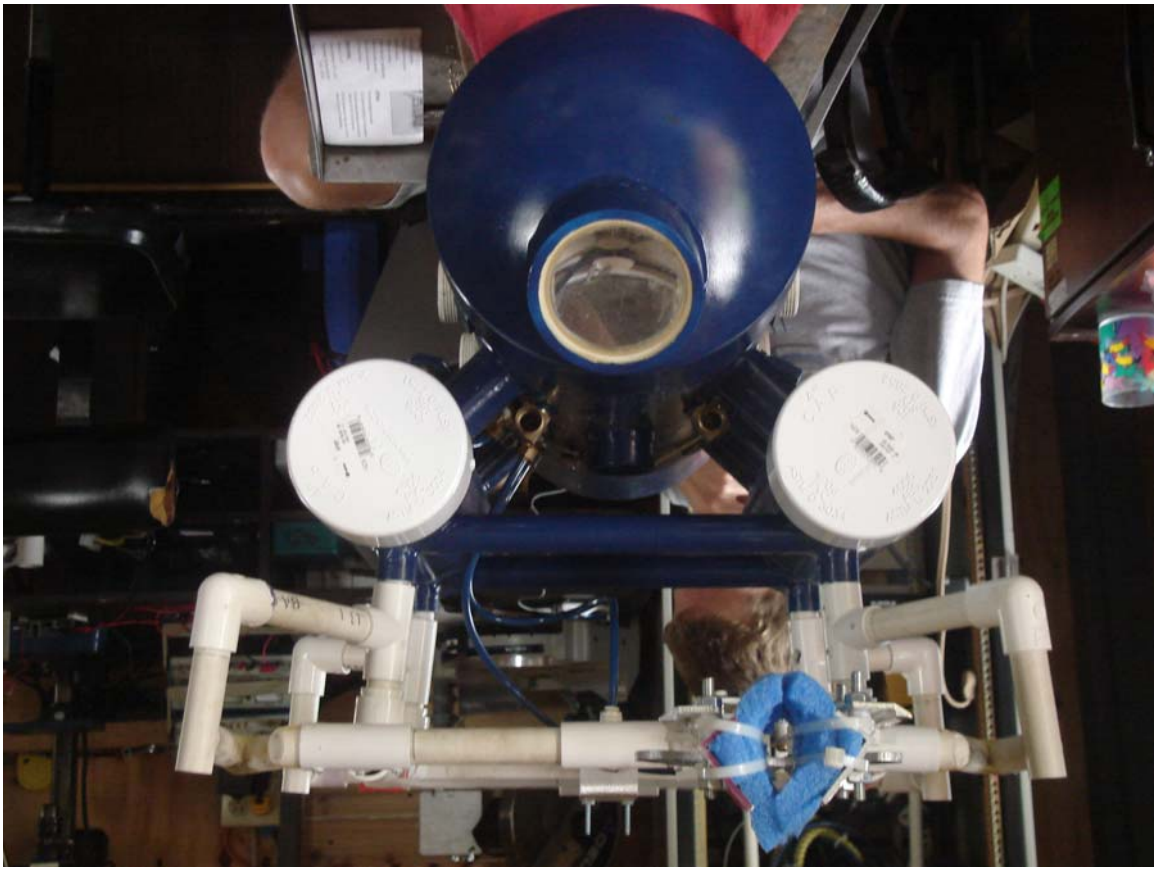
Abstract

The U-Boat is constructed mainly out of PVC plastic and various waterproof epoxies. Two lines of brass fittings allow air to be directed in and out of the hull to the various pneumatics apparatuses. The main hull houses the motor controllers and air solenoid switches which control the ROV's movement and actions. Four motor mounts allow wires to pass into the hull but also provide a water proof seal once the motors are attached. The motors are encased in PVC T's, and are water proofed with swimming pool motor seals. Two ballast tanks are attached on the underside of the ROV. These ballast tanks can be filled with air or water to affect the ROV's buoyancy. These tanks also house the two CO_2 bottles that provide the necessary air for the cylinders and fill the ballast tanks

when necessary. Attached to the bottom of these ballast tanks are four PVC mounts which the mission package is attached to. The mission package includes a box deployment device with two claws incorporated into it. It is constructed mainly of PVC pipe, and the claws are made out of aluminum and Lexan. All three apparatuses are operated by air cylinders and springs. The springs allow the air cylinders to be operated once or twice per deployment so that air is conserved. Three cameras are strategically placed around the ROV for optimal viewing capability.

Photo



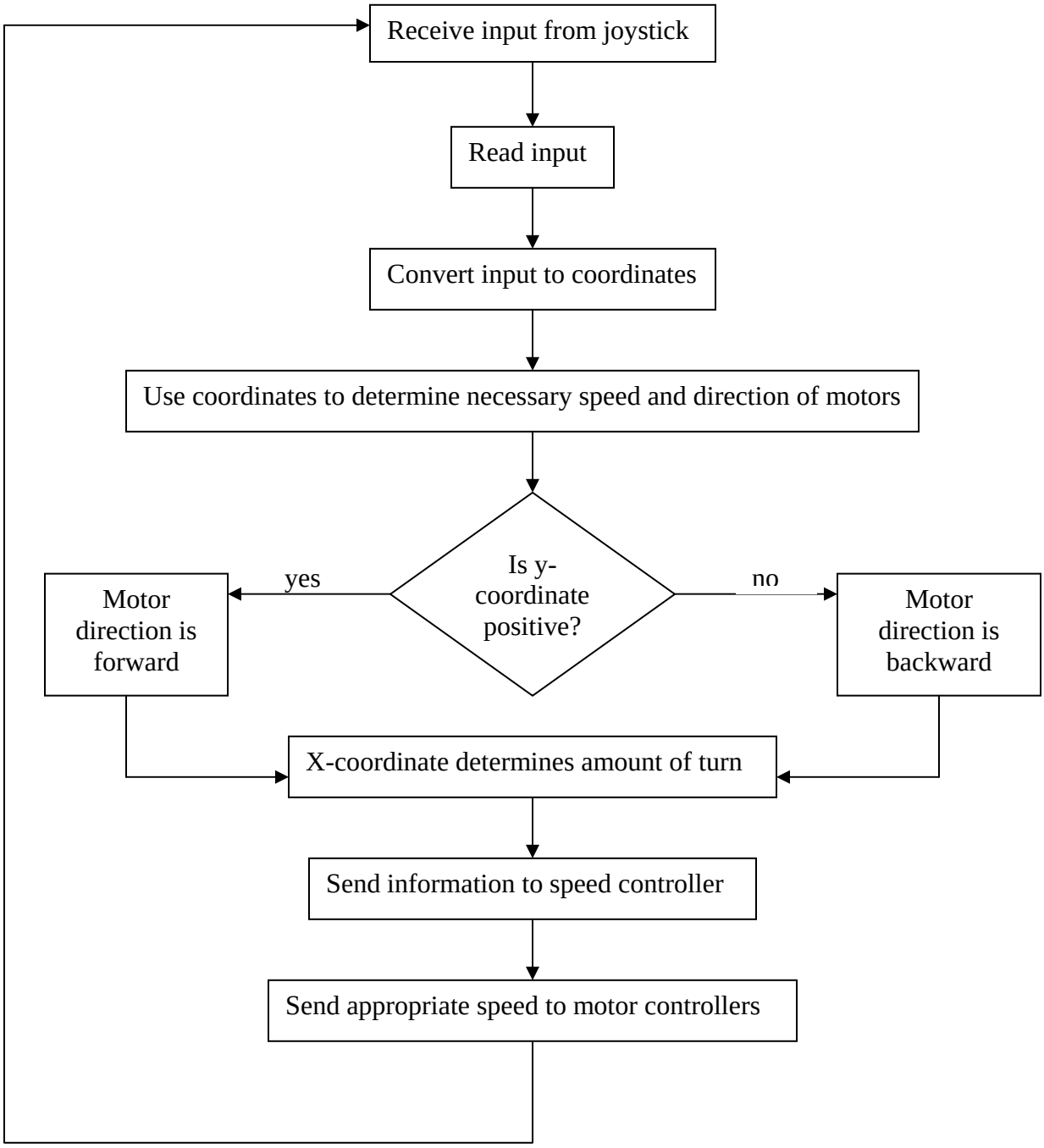
Budget + Expense Sheet

Budget $625.00

Money Spent to Date- $205.00

- Air Cylinders- est. donated $75.00
- Air Hose- est. donated $20.00
- Aluminum- $5.00, est. donated $25.00
- Batteries- est. donated $100.00
- Brass Pipe Fittings- est. donated $20.00
- Cameras- est. donated $1050.00
- Epoxies- est. donated $15.00
- Propellers- est. donated $50.00
- PVC Pipe and Fittings-$8.00, est. donated $50.00
- Lexan- est. donated $60.00
- Misc. Hardware- $10.00
- Motors- $84.00
- Motor Controllers-$30.00
- Solenoid Air Switches- $64.00
- Speaker wire (for tether)-est. donated $100.00
- Spring- $4.00

Flow chart of programming



Design Rational

The main body of our ROV was a continuation of a design from last year. The mission package from last year was designed to attach in such a way so that it may be removed to be replaced by a different mission package in future years. We made minute changes to the ballast system and stripped the main hull down so that it may be refurbished with new innovations. Our new mission package has been designed in such a way so that it is able to be secured to the original hull in one piece. We chose to use two claws so that we will be able to open the door and hold onto the mission probe at the same time. The claw that holds the mission probe was made to pick up the probe as well as hold it sturdily. All air cylinders that operate the claws and box releaser have a spring hold them in place in

the position they are more often in. An air cylinder operates these devices when the springs need to be opened or closed. The ballast tanks are open to sea and can be filled with air or released to allow the ROV to travel up or down quickly.

Description of a Challenge

A major challenge we faced was regulating the 800 psi coming from the CO2 cylinders down to a usable 60 psi while minimizing leaks and maintaining safety. The first regulator we used came from a paintball gun and a misplaced check valve caused the regulator to explode while inside the hull of the ROV. A sturdier regulator was purchased, but problems continued to arise. While attempting to test it, a metal air fitting exploded. Because of this, all further tests were conducted under a blast box. Several air hoses exploded in continued tests but higher pressure tubing was found and the air pressure was successfully regulated to 60 psi.

Trouble Shooting Techniques

Once designs were made, prototypes were constructed out of inexpensive materials such as cardboard, Lexan, and spare PVC pipe. Using such materials enabled us to work out kinks before we made a final piece out of aluminum or thicker Lexan. This method resulted in final products that worked at an optimal level.

Description of a lesson learned

Working together has helped in building a stronger bond between those on the team. Allowing all voices to be heard enables more designs and ideas to be expressed. It is important to have more than one idea because everyone is able to contribute to the ROV in original ways. When ideas are presented, it is important to weigh the pros and cons of it and test them. It is also important to give everyone on the team a chance to express their ideas, not judging them on past experience because everyone is capable of successful innovations.

Future improvements

To change the ballast system from an open to sea system to one so that water may be pumped in and out for more precise buoyancy.

Description of a Career

A career involving underwater robotics can be quite various these days. Ranging from the depths of the ocean to the oblivion of space, ROVs can be employed to serve many useful purposes that a human cannot. The underwater field of ROVs is probably at its climax, as far as pushing the limits on depth and distance. The next field is space. Although there are already several devices that are ROV in nature in space, the field is still expanding. A while back, NASA sent a large robotic arm to the space station to aid in maintenance and the care of payload. The satellites that NASA and other space agencies have sent into space are essentially large

and rather expensive ROVs. In the near future, we will probably not have men going to the moon or mars, but more of the rovers, but of bigger size. The biggest problem facing the agencies is communication between base and ROV. Maybe our generation will be the ones to solve this dilemma and continue the exploration of the unknown with the aid of ROVs.

Acknowledgements

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