Rotokawa Speed

Technical Design Report

Section 1. Abstract

This abstract is going to explain how Rotokawa Team Speed went on a journey with the team's Aquabot. This writing is going to explain how the team copied and practiced different tasks like the marine reserve monitoring in the Rotokawa pool. The team will explain the trials and tests and the changes that were made with the results. While the team was doing this they had lots of reflections on what worked, what they learnt and what did not work. The team had lots of challenges too. All of their challenges would not have been possible to fix without the help and support that they got from different people.

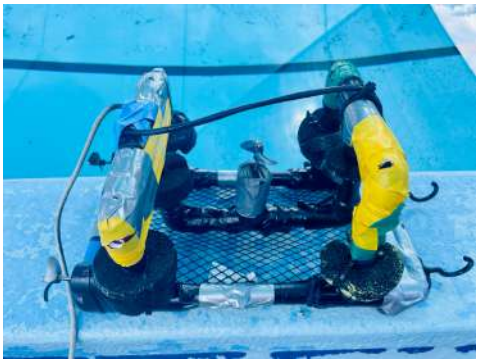


Image 1. Team Speed Aquabot

Section 2. Task Overview

Task One: Obstacle Course

The obstacle course is made up of five different hoops that are all at different angles. Going through requires you to have thrust as well as use the control to guide you through the hoops. So you do need to be efficient and quick with your movements and then go back the same way you came. This ensures that your Aquabot doesn't get stuck and that you do the task in the time limit.

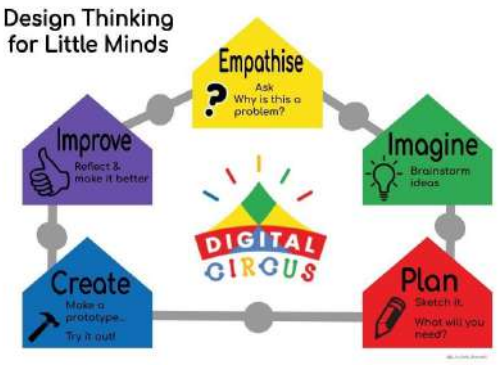
Task two: Goat Island Marine Reserve

To be successful at the Goat Island Marine reserve task first you have to be aware of circumnavigating around and driving around a structure or the coral reef. Once you get to the location you will need to use your hook to lift a lid box and retrieve what is in the box. You then have to deliver what you collect back to the start.

Task Three: Goat Island Marine Reserve Monitoring

For the Goat Island Marine Reserve Monitoring you need to practice picking some toys up that have been sent to the bottom of the pool . They practiced this movement a lot by picking up sinking toys, which copied a similar scenario. You need to retrieve and collect different objects. Next, you also have to return things to copy releasing objects like in the activity. You practice moving through the water with velocity and knowing what you need to do to float and sink.

Section 3. Design Approach



The design thinking process that the team used is Design Thinking for Little Minds from Digital Circus. This process took the team through five parts. The team empathised and asked what the problem was and why, they imagined and started to think about Aquabot and brainstorm their ideas. The team planned and started to sketch their ideas and think about what their Aquabot would need. The team created and tried ideas out to see what they could make and then they analysed what they could improve to make it work in the pool.

Image 2. Design Thinking for Little Minds

Empathise

When the team first started, they didn't have an Aquabot to use for the regional competition in Rotorua in September. They knew that they all wanted to compete but they knew that a working Aquabot to help us was needed. That is the problem the team wanted to solve first and foremost.

Imagine

As the team were a new team, they weren't sure what design to pick for their Aquabot so the team looked at many others on the Internet and it gave them a lot of different ideas about Aquabots the different shapes that would be best to move in the water. They learned that certain shapes have better hydrodynamics in the water . The shape of the Aquabot is also important to allow it to move through the water.

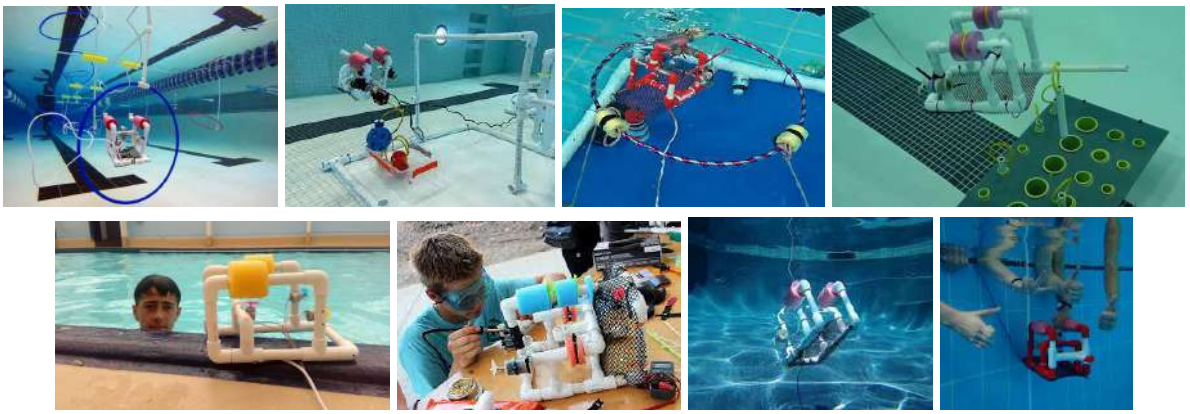


Image 3-10. Inspiration from the internet

Plan

The team drew a draft design onto paper that was not only hydrodynamic but also had everyone's ideas in. As they drew their Aquabot, the design changed because they realised that they did not have the right pieces and it would not work and fit in with the rules . They looked at it and decided to start putting pieces together to see what they could create.In the end, they decided that their Aquabot design had a rectangular bottom to help with stability in the water. It had an even base on all 4 sides. It had hooks screwed into the bottom at the front to allow for easy scooping.

Image 11. Planning

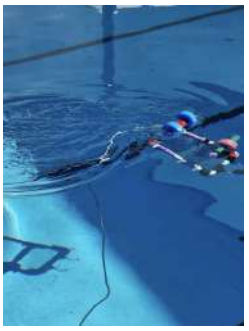
Create/Test/Improve

Version 1:

This was the team's first test so they wanted to see how much pool noodles they needed to put on their Aquabot so that they had buoyancy. When they put the Aquabot into the water, they noticed that they were about to fall off. So the team had to pull their Aquabot out of the water and zip tied the pool noodles on. They secured the pool noodles and made sure that they were in the right place. The team had to cut the remaining bits off the zip tie and put the Aquabot back in the water to retest it. They noticed that it had more neutral buoyancy, which is what they wanted.

Image 12. Creating

Version 2



In the team's next test, they wanted to see what happened with the motors when it was put into the water. They put the Aquabot in the water and it did not start when they used the controller to go forward. Rather it started to resurface. That is not what they wanted to do. The team wanted it to stay on the bottom while going forward. The team decided on moving the motors from where they were originally because it would not have effective thrust and movement in the water. In the end the motors were attached to the back of the rectangular frame on each side to give forward thrust with the other motor in the middle at the back facing up to lift or force the Aquabot upwards. This made our Aquabot have more thrust and power in the water which meant we would be more efficient in the tasks.

Image 13. Testing

Version 3

For the team's next trial, they wanted to see how well the team's Aquabot went in the water. For some reason the bot wasn't moving. When they pulled it out of the water, they realised that some wires were not connected, which broke the circuit. They knew that a full circuit was required to allow power to get from one point to the other. They decided to re-solder some of the wires and reconnected the circuit. Once the team put the bot into the water, it was able to move because the circuit was created.

Image 14. Improving

Section 4. Experimental Results

	What the team noticed	***Changes the team made***	***Results of these changes***
1 Test The first time in the water the team just wanted to test that our Aquabot was buoyant	The pool noodles were about to fall off.	The team zip tied the pool noodle.	It was more even because the pool noodles couldn't go side to side.
2 Test The team wanted to test whether or not the motors were in the right place	They needed to move the motors forward more because they wanted more thrust.	They moved the motor towards the front.	The changes made it go straight in the water with good thrust.
3 Test They wanted to test that their circuit was a full circuit	They noticed that they had to fix the wires.	They had to fix the motors because the wires were broken . They also needed to solder the wires back together.	Their circuit was no longer broken and they were able to make a full circuit from the battery to the controller to the Aquabot.

Budget

Rotokawa School

Rotokawa Team Speed

Item	Cost	Total Cost
Black Spray Paint	$17 per can The team used ⅓ of a can	$5.70
Net that was left over from last year	$6.00 The team used 1/3	$2.00
Tape - Yellow, Green, Silver	$3.00	$3.00
Hooks x 2	$2.00 each	$4.00
TOTAL COST		$14.70

Section 5. Reflection & Next Steps

The design thinking process for the team worked well overall. Some of the parts of the process were shorter than others. The imagine, empathise and plan parts of the process they did not spend much time on. They spent most of their time on the create and improve process. Looking back, they think this plan didn't work. The team thinks that instead of spending lots of time on building and improving, they realised that if they took time to do, imagine and plan more effectively, they would have made better use of their time. Next year they would take more time to do this part of the design process.

For next year, the team would start at the same time or earlier if possible so that they have as much time in the pool and with the paperwork. Having lots of time to work on this in 2026 helped the team because they don’t have to rush with carrying out the paperwork. The team felt this would be helpful again moving forward.

Section 6. Acknowledgements

- ☐ Josh from the Ministry of Inspiration - We want to thank him for coming in and helping us create our Aquabots by cutting the pieces to the right length and letting us use the tools like the soldering iron and the drill.
- ☐ Matua Blair and Whaea Sarah who are Christian’s parents - Thanks for helping to make the hoops for the obstacle course and bringing some zip ties and some tools to make Aquabot.
- ☐ Jessica from the Ministry of Inspiration - We want to thank her for the feedback and support with our paper work. We were able to use the ideas to improve what we had, make sure all the work made sense and what we were provided was clear.
- ☐ Matua Mark from Rotokawa School - Thank you for moving the Aquabots around and giving some bricks and cable ties to hold the hoops down to the bottom of the pool.
- ☐ Whaea Christina from Rotokawa School - Thank you for leading this and letting us do Aquabots. Thanks for helping us do the paperwork during class time.

Section 7. References

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