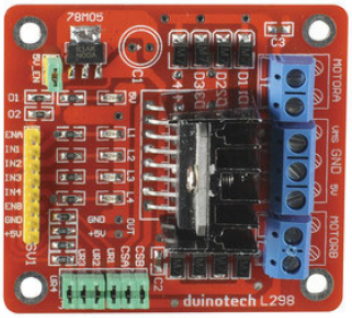
Student 5: Low Achieved

Intended for teacher use only

I now brought my components. I brought three motor controllers for a sum of $66.69. Which I think is an attractive price as the convenience of having support if they break and quick shopping outweigh cheaper models. Another benefit, in the broader sense is supporting New Zealand business and lessening the impact my purchase has on the environment due to needing less travel to travel to get to me. (2)

Stakeholder Feedback	I started by talking with my stakeholders. They gave me information on how I can improve my outcome. • Improved ease of use • Increased reliability • Weather resistance • Power supply I will use these points they highlighted to improve my design through testing and prototyping.

(4)

Selecting components	Since I am using three Servo motors, I will need three controllers these will need to be suitable for the context of my use. I will need them to be powerful (withstand high currents) and be cheap. I selected a L298 designed controller because of their superior voltage and current handling abilities, but also because of their ability to control servos. Unlike the L293D which was the second-best choice for this project.  I tried with Jaycar electronics, but they no longer stocked these. I then tried a company called Techexpress. They are selling these at the same price as Jaycar and have a similar purchase price as shown below. I ordered these and waited for them to arrive.

(3)

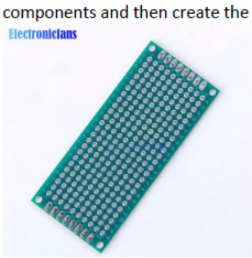
I had a look at a couple of websites and found a good method of connecting the stepper motor to a L298N driver board and running the Stepper.h library on Arduino IDE. This is a good option as I can use pre-existing code in my system to cut down on time spent creating and debugging. Especially useful in a classroom context, where time is limited. (2)

I started with the cover for my electronics. I wanted to select a cheap, strong, and easily worked with material for my cover. This led me to select three methods for the cover: 3D printing, laser cutting and metal bending. 3D printing is an uncomplicated way for me to create objects for decorative, implemented uses or prototypes. The main advantages of 3D printing are the ease of use, quick manufacturing, and cost of production. However, 3D printing is not strong and I would need a large part, meaning printing in multiple pieces or getting a larger printer. Both of which I want to avoid. This has left me wondering if metal bending is a practical choice. (3)

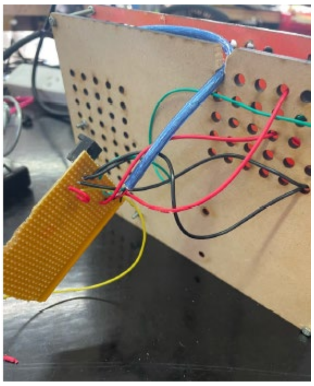
Bending metal is a desirable choice for this as the process requires thin metal and a hammer or bender. This metal is cheap, and I can source it easily. The advantage is being able to use simple construction methods and produce a high quality, resistant product. The glaring problem though, is that metal conducts electricity and if there was an issue, the metal could cause a short circuit or arc to the components if there was static electricity build up. Because of this I think a metal cover would not work well for me in this application. (1)

I now moved onto constructing the electronics I would need. I considered CNC cutting a PCB, but I do not have the experience necessary nor the time to learn now. Because of this I considered acid etching, but this was also unavailable to me as I need to make multiple versions and the chemicals needed are unsafe for me to use at school.

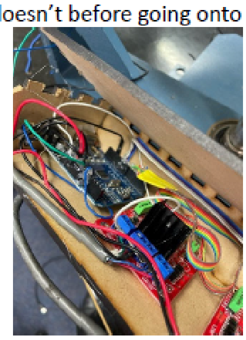
This brought me onto soldered breadboards. Which allow me to solder my components and then create the connections between them myself. (1) (3)



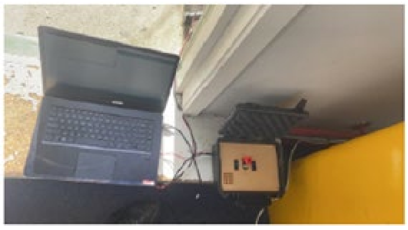
I started with the USB board, which I used to connect the USB connections through switches and other I/O. This was a good output and as a prototype I am happy with it. I need to change the way that I mounted everything and will do this by moving the components to a larger PCB to accommodate the rest of my circuitry. (1)



This new and improved version of the PCB allows for a single connection point between the USB and ethernet systems. The only issue for me being that it is not as easy to work with as a professionally constructed PCB. I had to use the Prototyping board to minimise time and in doing so have lost the ability to make it look nice and be as compact as I would like. This is fine for testing, but for a final piece, I will need to make a safer and more professional outcome for my stakeholder. I also want to make my design as efficient as I can, so that I am not wasting materials that can be used by others. (1)

Stakeholder feedback	• Do you need the rasppi for the system to work. Try to get it working then add complexity • Focus on a reliable system • Consider multiple bands that you can sense with (4) • How is the system going to be controlled?
Final adapts (4)	I want to now get the system running. I evaluated the rasppi extensively and after no avail, my stakeholder suggested that I have made my system far too complicated and that maybe I should consider simplifying the product to meet specifications first. Then I can integrate my custom PCBs and other devices. I decided to remove the rasppi, control box and the components that went with them to maximise the capability of my system in the shortest amount of time possible. I will keep these parts though as if I have time later down the line, I can re integrate them into the system. This saves me wasting my components and worst case, I will use them in another project. In context, it was a smart decision as I needed to save time and crack on. This pushed me forward weeks in the development process, saving me time and money. (6) I now focused on a single arduino system. I kept the motor controllers, signal reader, dish, and power supply. I removed everything else. Then, moved onto testing code and working on singular subsystems. This allows me to figure out what works and what doesn't before going onto a full integration. (3)  This is a first look inside the onboard electronics. I selected to laser cut a box out of MDF to give light weather and drop protection as I will need to stop the electronics from touching metal on the dish or from being wet/dusty. This does not need to be rain proof as I do not plan to use the telescope in severe weather. I selected hot glue for my electronics as I can use it to hold everything in place for transport etc. bit it will also function as an insulator, adding another layer of protection. This is useful as I have already learnt what voltage mishandling can do to my system and I want to minimise this in the future.

This is the finalised prototype control system, with upgraded insert and computer in place of the raspberry pi. By swapping to a computer, I was able to shed time in taking images with the radio telescope. Therefore, my stakeholder was in the right when giving me advice on how to simplify my system.



Prototyping being tested outside the classroom. (5)