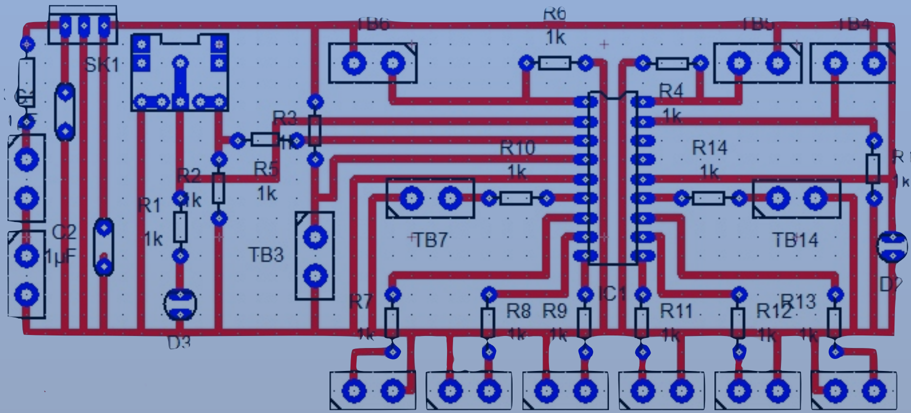
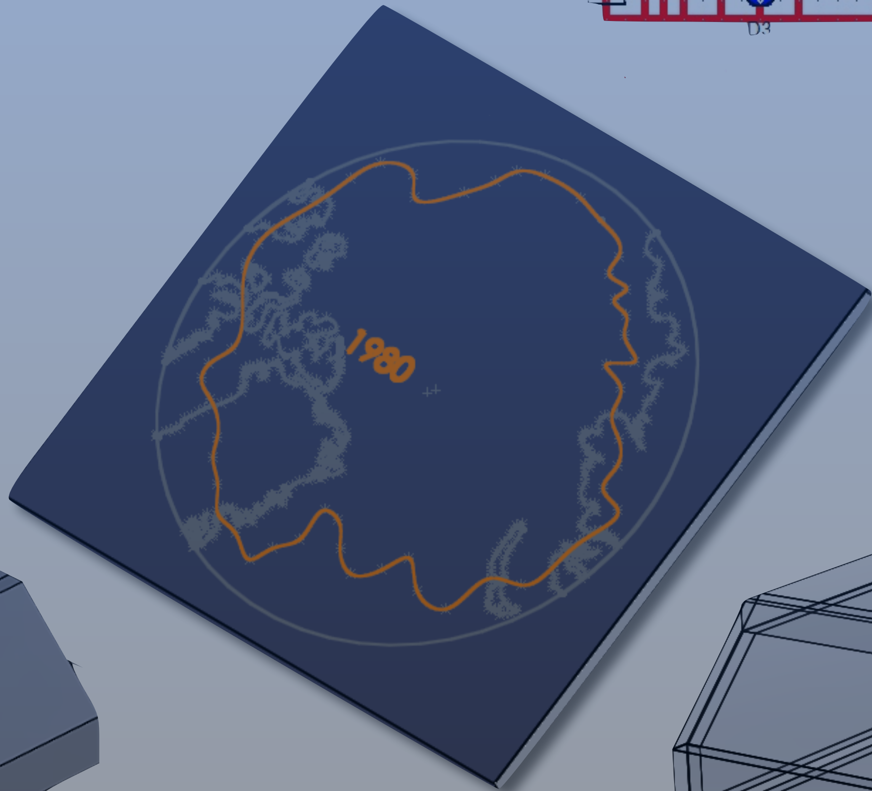
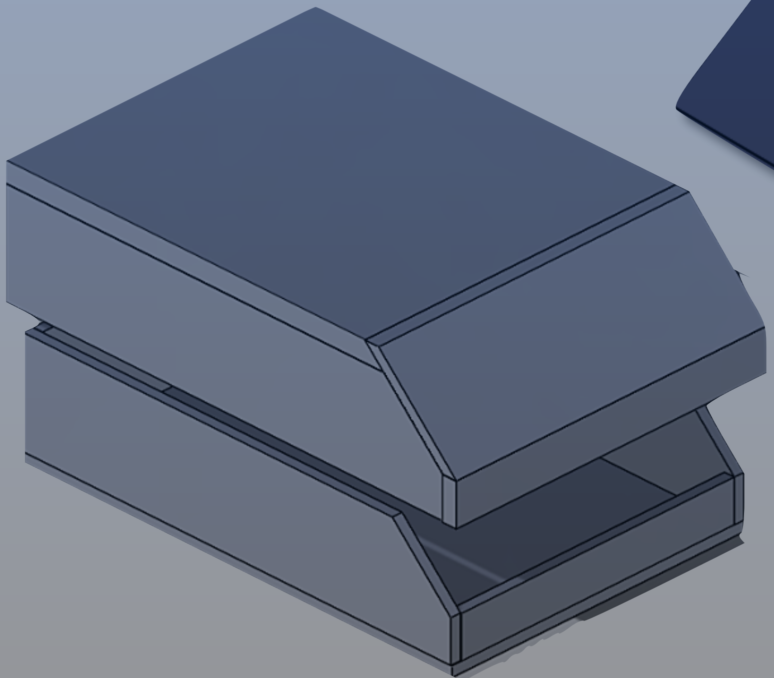
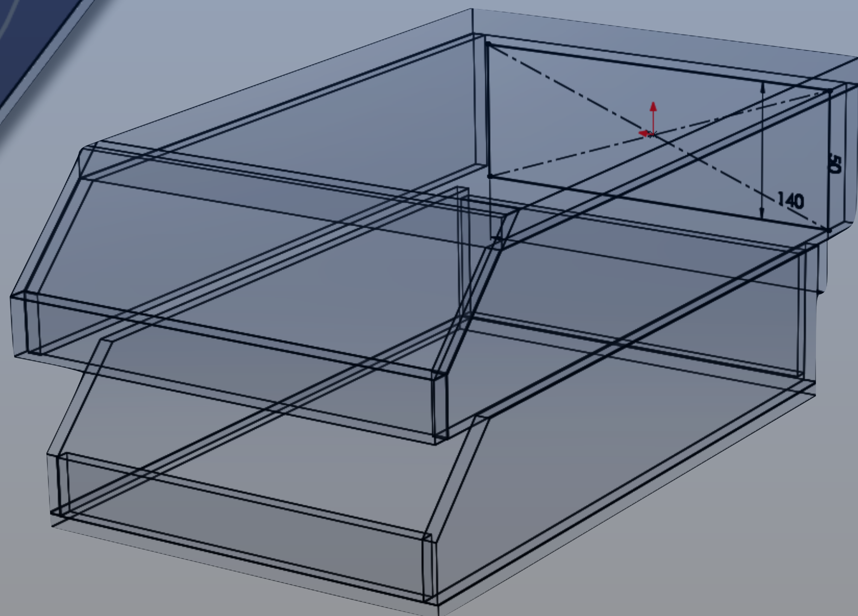
Arctic Icecap Display







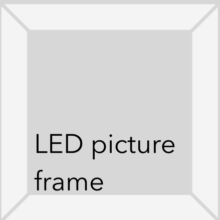


Centre No: 71526 Candidate No: 9056 Name: Adrian Escartin Project Title: Arctic Icecaps Centre: Our Lady & St. Patrick's College Knock

Project: Arctic Icecaps

Theme: A whole new world of exploration and discovery is offered at a Museum's activity centre. The wide variety of games and activities introduce young people to the joys of learning through active engagement and curiosity. Learning is fun and memorable.

Ideas:


LED picture frame


Electronic Circuit builder


Breakup of Yugoslavia


Spot the changes (Mona Lisa)

Digital device lockdown

*Ice caps over time


The Liver's Functions


String tension demonstration

Design context;

The future of arctic ice will soon be no more. By educating a new, younger generation with a product that shows the extent and magnitude of this process, it aims to give awareness to this serious issue. Big, bright infographics on a clear acrylic display will be utilised to achieve this goal. Due to this product being unique and specific, it is likely to be never made before and hence this increases the importance and probability of me going with this idea.

Design Brief; Display of arctic ice caps over time

Goal - Present information in a simple meaningful way so that young children can understand. It also has to fit a museum setting (able to be active over several hours) and be easily and intuitively used by anyone). Being in a museum, it has to be on for long periods of time and be durable so it is resistant to the wear and tear that the public (and especially young children) will give to it.

Specification

Function:

- Easily understandable by anyone of any age group
- Reliable (to ensure low chance of it breaking)
- Long uptime (to be able to be used a museum exhibit all day)
- Information could be seen at a glance
- Easily used by young people

Ergonomics:

- Inputs are easily seen and actuated (large and colourful)
- Able to be transported easily (without breaking)
- Text is naturally placed (as to be easily seen by the user)
- Power switch at the back (less chance of accidental presses)

Aesthetics:

- Large area lit up to be easily seen
- Design language is appropriate to a museum
- To or near scale representation of the information
- Modern and sleek
- Device's function is able to be figured out by the end user - even without prior instructions
- Blue & white colour scheme to match arctic ice cap theme

Size and Materials:

- Base no larger than an a3 page
- Glass (more scratch resistant) and Plastic (clear acrylic-cheaper)
- Electronic's housing should be easily machined or manufactured (eg, made of wood or plastic)

Electronics:

- Large LED array to immunity's a large display.
- 12v battery or mains supply for 24/7 operation
- Large input switches
- Genie E18 Micro-controller

Research

***Function* -** Showcase a long list of names of people.
***Ergonomics* -** Display is of human height, making all test large and easy to see for many people.
***Aesthetics* -** Transparent glass with clear white LED sidelight
***Size and Materials* -** Human height. Glass used for high quality premium look.
***Electronics* -** Strong white LEDs mounted on the bottom of the frame. Switch to turn on and off. micro controller likely used to control the brightness.

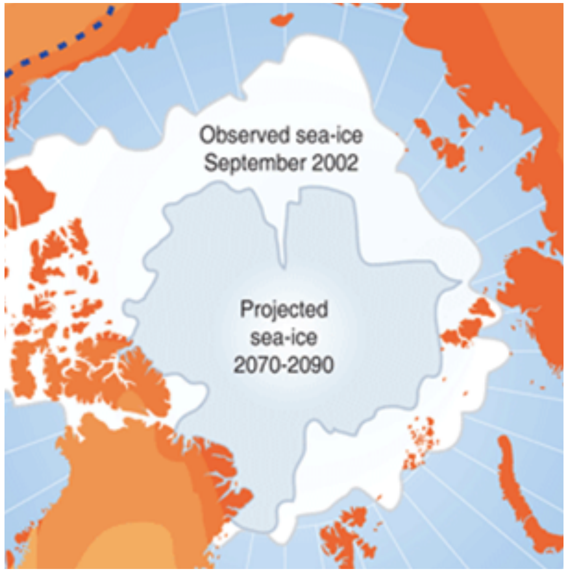
***Function* -** Decorative piece.
***Ergonomics* -** Able to be fit onto a table and switch accessible on top for easy access.
***Aesthetics* -** Highly detailed engraving to catch attention. Curved base for a smoother sleeker look.
***Size and Materials* -** Appropriate for desk use. Glass display and wooden casing.
***Electronics* -** LEDs, switch and battery

For my product, I am aiming for something similar to the glass display above however my product will have information etched on the glass and hence this could replace a non interactive information display - great for a museum. This can keep young people engaged in learning new information about artic ice caps.

***Function* -** Illuminates a drink.
***Ergonomics* -** Able to fit inside a normal glass cup's base.
***Aesthetics* -** Looks like a normal cup however
***Size and Materials* -** Standard dimensions for a glass cup.
***Electronics* -** Battery, switch, strong blue LED,

This product excellently displays the aesthetics that an LED under-lit engraved glass product can delivery. Knowing this, I will aim for this lighting configuration.

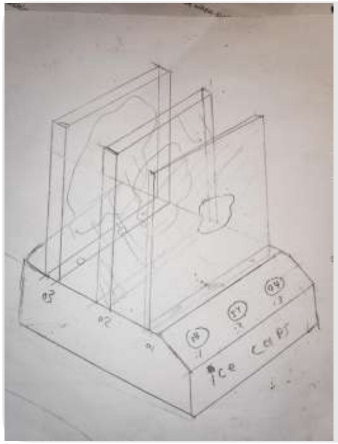
The name display above demonstrates how eye catching a design like this can be to the user. Hence, a smaller display similar to this would be perfect for a museum.



For my project I need data on the volume of arctic ice screen over time and in addition to this how they would actually look. Doing this makes sure my product is truly representative of the real world issue.

When finding an already existing interactive museum display on arctic icecaps, I have found no relevant results. As a result, this increases the importance of my product as it is positioned as a unique and new way for children to interact and learn new things about the melting arctic ice caps.

Concepts



Concept 1

Having a glass/clear acrylic display illuminated by LEDs shows a clear presentation of arctic ice caps over time.
Using this simple design gives me flexibility; it is relatively easy to make and the displays can be swapped out and repurposed to display other information.

PTM buttons
Input

Genie E18
Control

LED array
Output

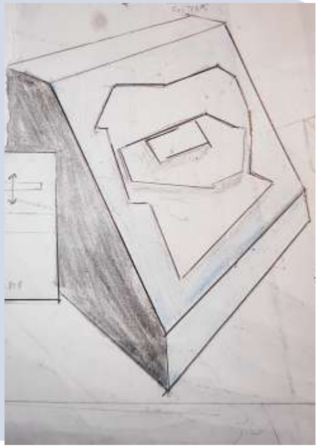
Thyristor
Input

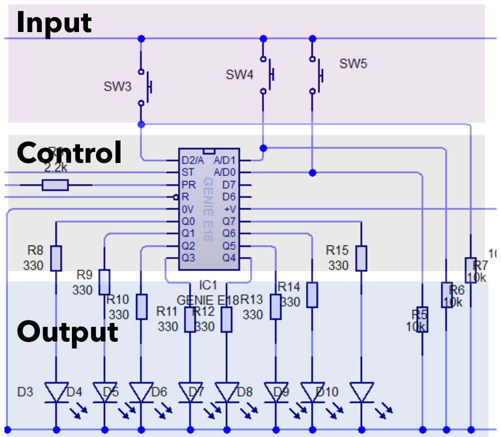
Genie E18
Control

Solenoid
Output

Concept 2

An more ambitious design where acrylic plates representing ice caps can elevate or descend.
Also, it would instead be activated by a thyristor sensing the heat of the user's hand.
Compared to the other idea, it is more interactive however much harder to manufacture and design.





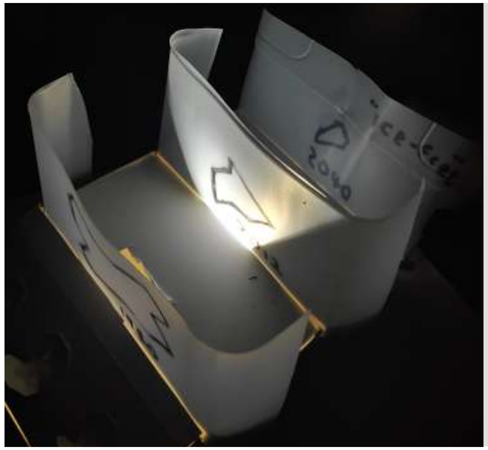
System

For my project, I'm using 3 input switches as more display choices would make the product more complicated for the user.
The Genie E18 allows me to program how the inputs interact with the outputs (-how long it would be on).
The output will be an 8 LED array, this would give more display lighting options.

Model

For my model, to represent the transparent material, I used High Density Polyethylene from used milk jugs. Easy to work with and translucent, it was suitable for the model.

The dimensions are almost to scale however not taking into account of the diagonal length, I had to make it shorter. Knowing this, for my prototype I may opt to remove the diagonal to simplify the manufacturing process.



Here a demonstration of a lighting simulation in the dark. Having lighting on a certain panel definitely makes it contrast and stand out.

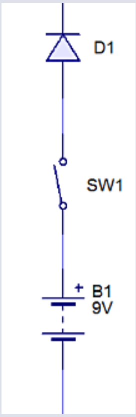
Disappointingly the plastic was not transparent enough therefore no information could be seen as intended from the front.

For the actual manufacture, thicker plastic (5mm acrylic) for the display would allow light to more easily illuminate the inside of the glass (giving a better effect).

With the mock displays removed we could see a cutout whereby they can slot in; utilising this can make them easily removed, stored and swapped which can be another feature of the final project. A larger cutout has the purpose of letting light through to backlight the display with the flash of a mobile phone.

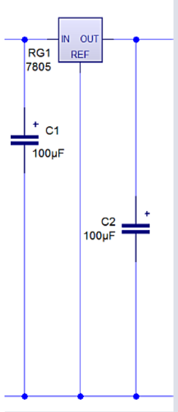
As a lesson, this model has been beneficial as it has given me a general feel on how the project will turn out.

Genie Circuit



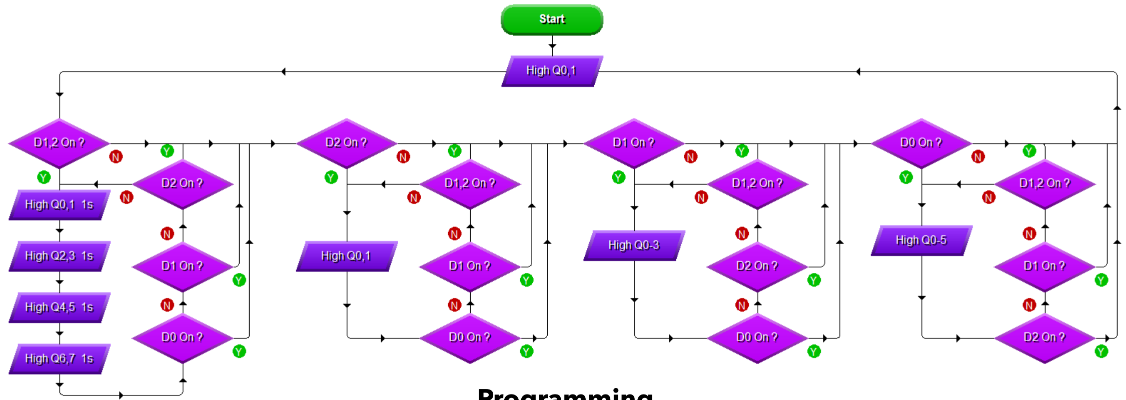
Power Supply

Diode - ensures current flows in one direction.
Switch - cuts power to whole circuit.
Battery - 9v PP3 (low cost)



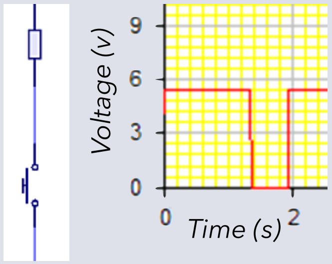
Voltage Regulator

The battery supplies 9v, the 7805 regulator (along with the capacitors to smooth the current) converts this to 5v (Genie input voltage)



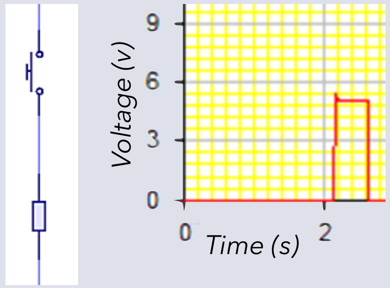
Programming

For my actual program, buttons change which set of LEDSs turn on with the 1st set open on startup. However in addition to this, I added a slideshow option - if 2 buttons are held down, it would automatically cycle through LED sets



Reset (Push to Break)

Pressing the switch shorts the Genie chip, giving it 0v. This acts as a reset signal.



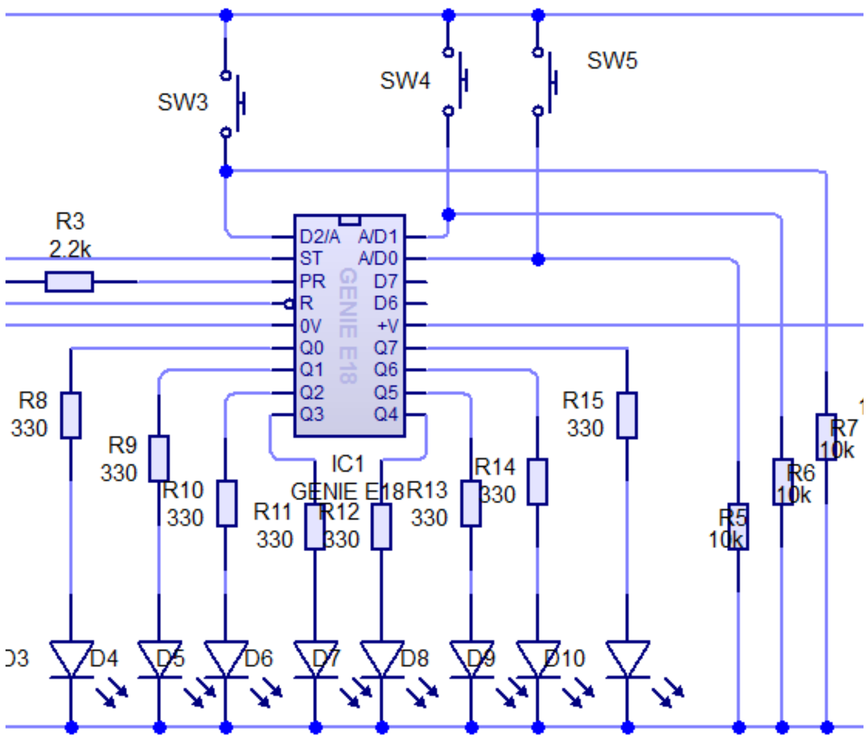
Inputs (Push to Make)

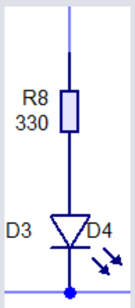
Pressing the switch allows current to flow into a Genie input.

Genie

For the whole control system, 3 input switches, 8 output LEDS are connected and in the centre of it all, a Genie E18 micro controller.

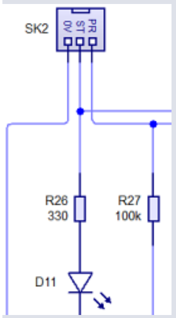
This allows my project to be flexible - different programs can be loaded to test or as shown above, be used for my finished project.





Output

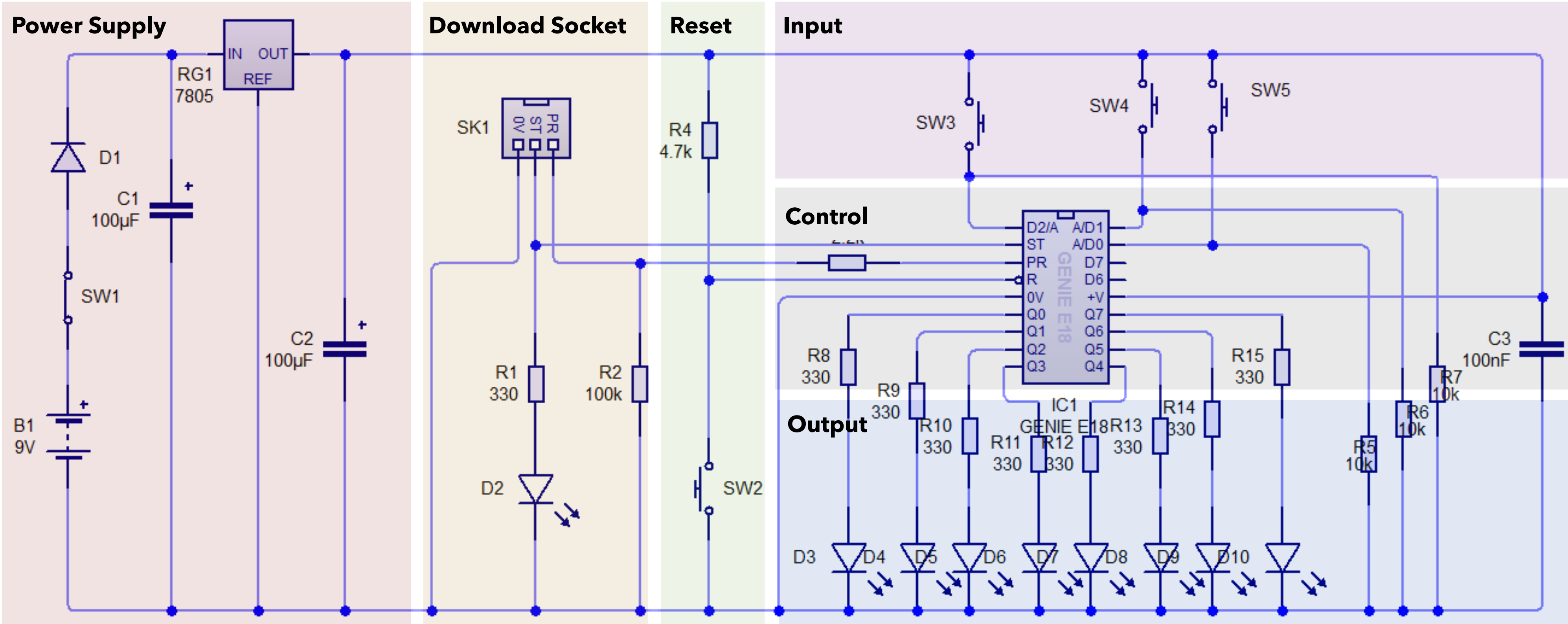
An array of 8 LEDs is used however a 330 ohm resistor is needed; 5v would blow a 5mm LED.



Download Socket

Using a 3.5mm jack, the E18 can be programmed from a PC using Circuit Wizard.

Diagram of Finished Circuit



The output voltage of the battery is 9V however the problem is the Genie E18 operates at 5V. The solution used is a 7805 voltage regulator which steps down the voltage.

Also in this section, a diode is used to prevent any current from flowing the wrong way if - for example - the battery was inserted incorrectly. This prevents any potential damage happening to the Genie micro controller.

This download socket is essential as it allows us to easily connect and install a program to the E18.

In addition to this a LED will blink to indicate if a program is being downloaded.

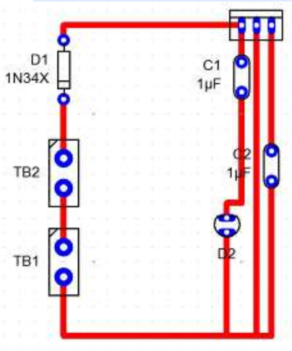
When the reset switch is pressed, it sends a reset signal to the E18.

Here 3 input switches each individually send a high signal to the E18 when pressed. Using this, the user can seamlessly toggle between the 3 displays.

At the centre of this circuit is the Genie E18 and having this enables me to program the circuit such that when a certain input is detected (from the Push to Make switches above), a flowchart (in Circuit Wizard) will decide what should be outputted.

For the outputs, an array of 8 LEDs are used to ensure the display is brightly lit. Each is protected by a 330 Ohm resistor to they are supplied by a safe, lower current.

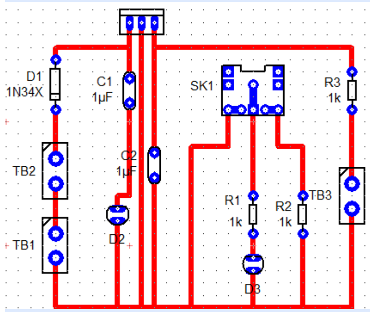
PCB Development



Stage 1

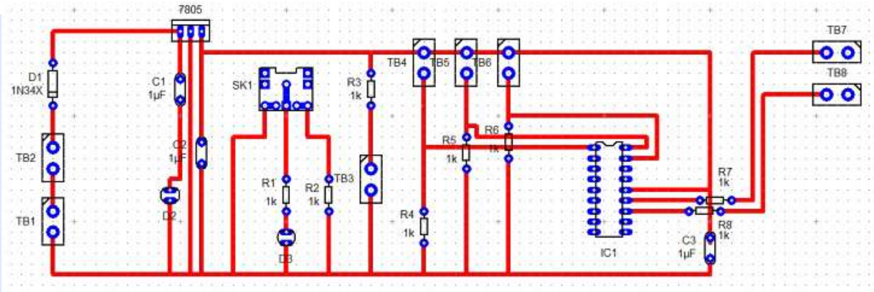
Initially, 2 terminal blocks were placed - one where a PP3 wire would be connected and another for a push switch.

After, a voltage regulator unit was added to the circuit to convert the 9v PP3 power to 5v for use in the Genie E18.



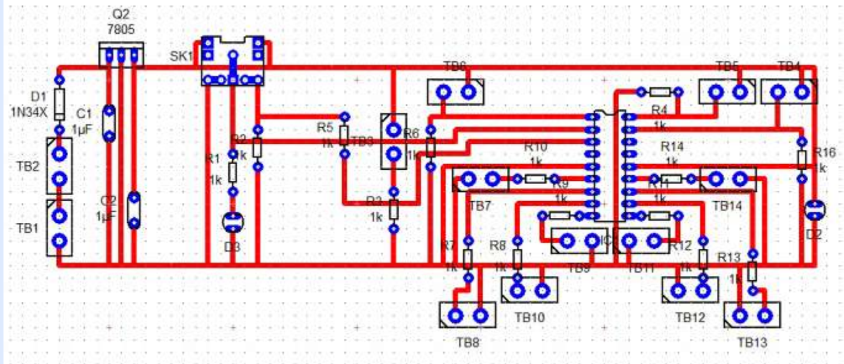
Stage 2

Next, a download socket is added with an LED and resistors to step down the power. For the reset switch, a resistor is added first then a terminal block (for the switch) to ensure it is in a push to break configuration.



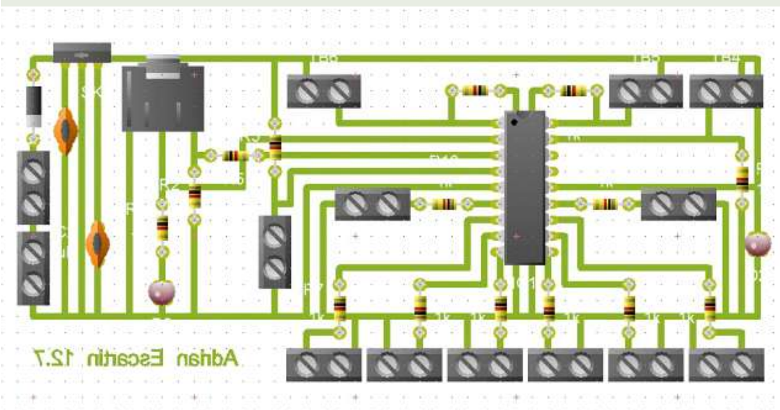
Stage 3

Next, most other electronics are loosely wires up. Doing this allows me understand how things should be connected and also how many input/outputs I need for my project.



Stage 4

To decrease the PCB size, I moved the components much closer together however I still made sure everything was wired up correctly.



Stage 5

Here, I have my final circuit design in a real world view. I have tailored the design to be small as possible whilst still being fully functional for my project.

Manufacturing

Laser cutter

This machine is capable of high levels of precision - essential for engraving the image used for my project into the clear acrylic.

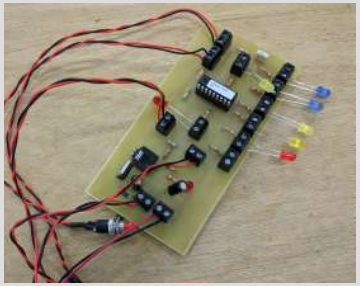
Since toxic fumes can be a byproduct of this process, the fume extraction was continuously checked to see if it was running.

Glue

After I have all the parts cut/laser cut out, since they are all acrylic plastic liquid solvent cement (LSC) is used.
Care has to be taken to ensure the LSC does not spill onto unwanted surfaces so I used a small syringe to direct the LSC to wanted joints. Safety goggles are a must to ensure none go into my eye.

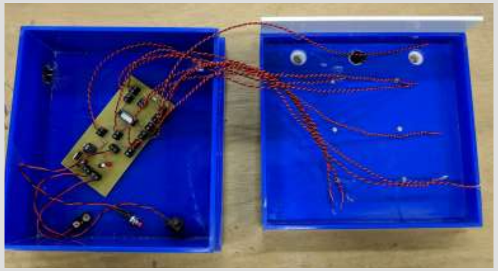
Finish

For the majority of the finish, emery paper is initially used to grind down any rough surfaces. Using a polisher, I then polished my project for an even, smooth finish.
Abiding by the safety rules, I made sure to wear safety goggles and have only one person at the polisher at a time.



PCB

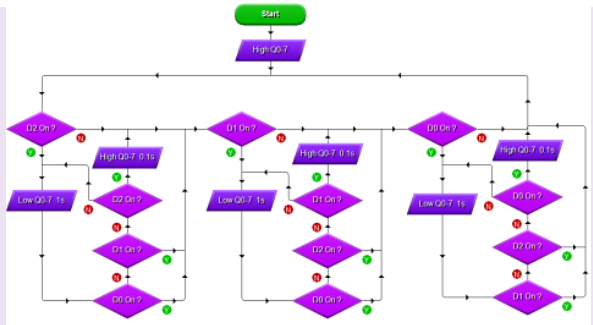
After getting it printed, I drilled holes to which the components would slot in. After this I placed said components then soldered them in place.



Electronics

Switches, LEDs, and battery's are inserted into the housing and the are wired up to the PCB.

Testing



Input/Output Test

To test if my circuit works, I made a test program. When a button is held down all 8 LEDs will blink. This checks and ensures all inputs and outputs work as intended.

Light Test

A smartphone flash is used to see if the displays can be successfully lit by an LED.

Evaluation and Potential Modifications

Against The Specification

Function: - Easily understandable - Reliable - Long uptime

1 - The buttons and text are layers out easily to be intuitive to use.
2 - No complex moving mechanisms ensures reliability.
3 - 12v battery may last hours, but if wired up to mains it could have 24/7 uptime.

Ergonomics: - Inputs are easily seen and actuated - Able to be moved easily

By putting all the text and inputs on the same face, point 1 is addressed. Being able to remove the displays significantly lowers the product's profile - making it easier to move.

Aesthetics:

- *Large area lit up to be easily seen*
- *Design language is appropriate to a museum*
- *To or near scale representation of information*
- *Modern and sleek*

As pictured, the product does look aesthetically pleasing, modern and could fit in a museum. Information is accurately represented. The box however is a bit large and could be scaled down, as seen in the *Alternate Design***.**

Size and Materials: - Base no larger than an a3 page - Glass, Plastic (acrylic)

Size is appropriate however by using clear acrylic, the display is easily scratched. By using hardened glass instead, scratches could be minimised.

Electronics: - LED array - 12v battery

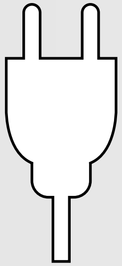
Using individual LEDs proved to be rather weak. Using an LED strip, a higher luminance output could be achieved and by using lithium ion batteries or mains power, the lighting could last longer and be brighter.

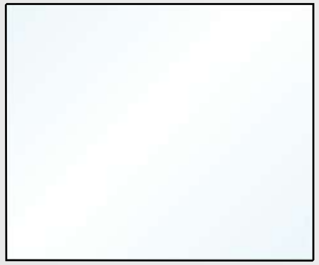
Evaluation

The final product does fit the design brief and several aspects of the specification making it useable by children in a museum setting. They would be able to easily use it and learn the size and scale of how quickly arctic glaciers are melting.

After putting my final product against the specification, I am able to come up with several design improvements as noted below.

Modifications

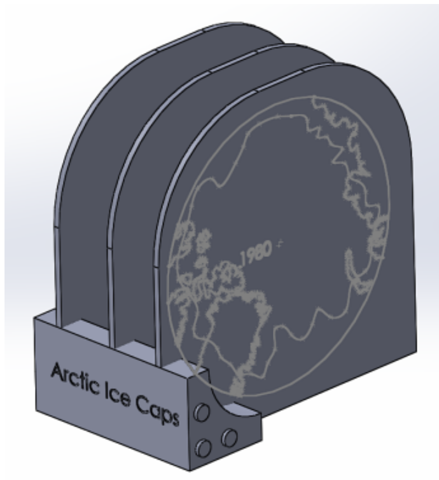




Mains Supply;
24/7 operation and would eliminate battery switching.

Glass;
Due to it being harder than plastic, it is less prone to scratches

LED Strip;
Simpler to wire up and can have a higher output compared to single LEDs.



Alternate Design

After the evaluation, I have came up with a much more elegant - but similar design. It takes the aspects which makes my current design good and maximises them: more display, less bulky electronic housing, easier to use and simpler to manufacture. The housing section could be extruded or injection moulded for mass production purposes.