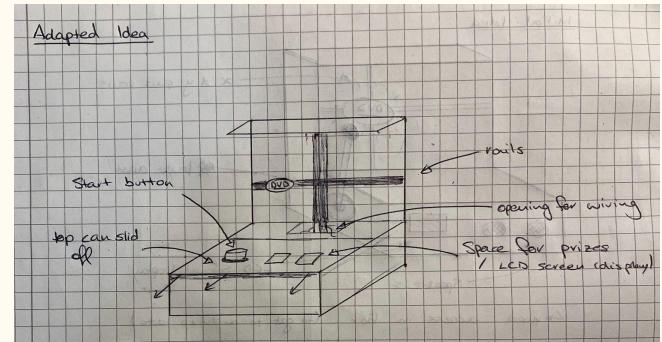
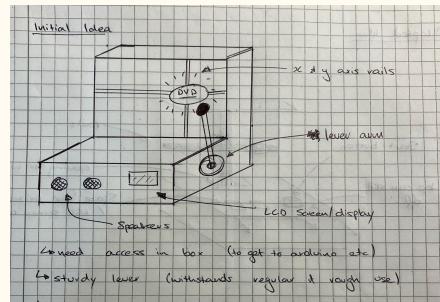


The DVD Screen

Hamish Towers, Harrison Coren, Gabriel Landa, Clémence Sutherland

Initial Concept Generation

Initial Idea:

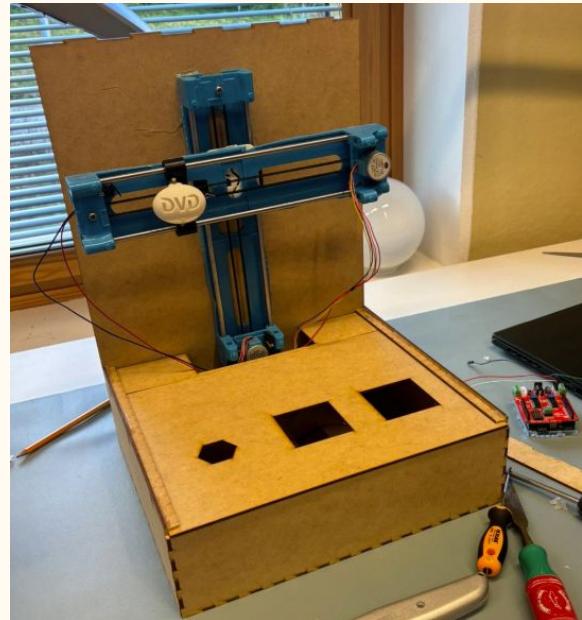
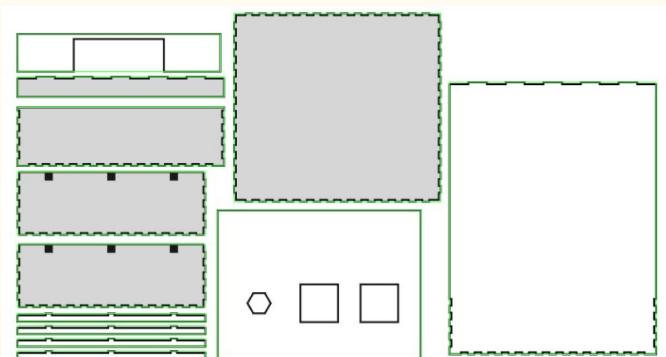


First Prototype



Prototyping - Box Design

Laser Cutting Template and Assembly



Prototyping - Box Design

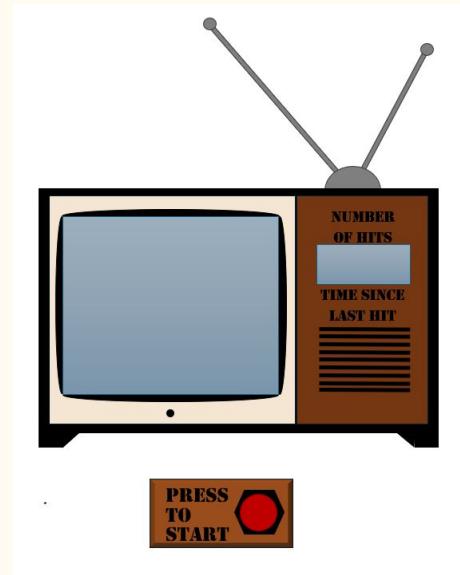
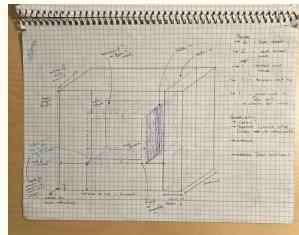
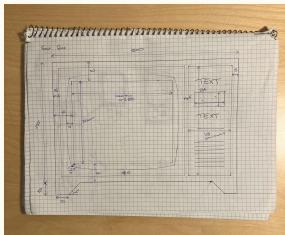
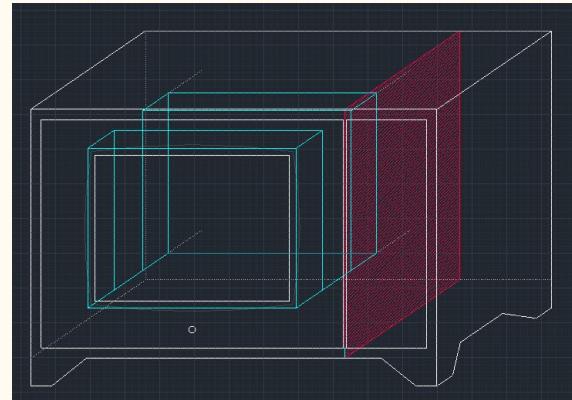
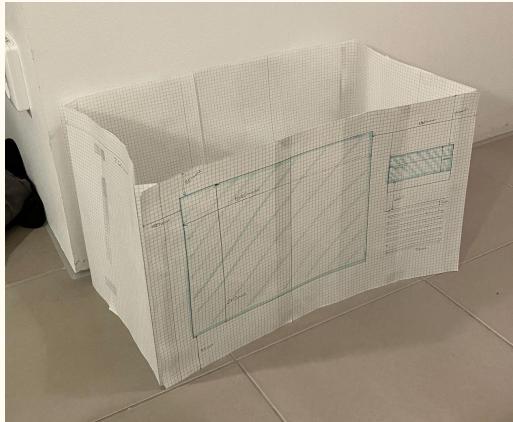
Adjustments:

- Easier access inside the box
- More iconic/
recognisable
appearance
 - More
attractive
for users
- Bring back the
nostalgic
feeling



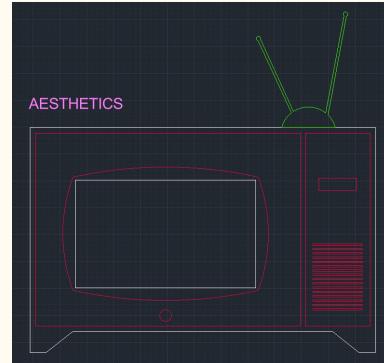
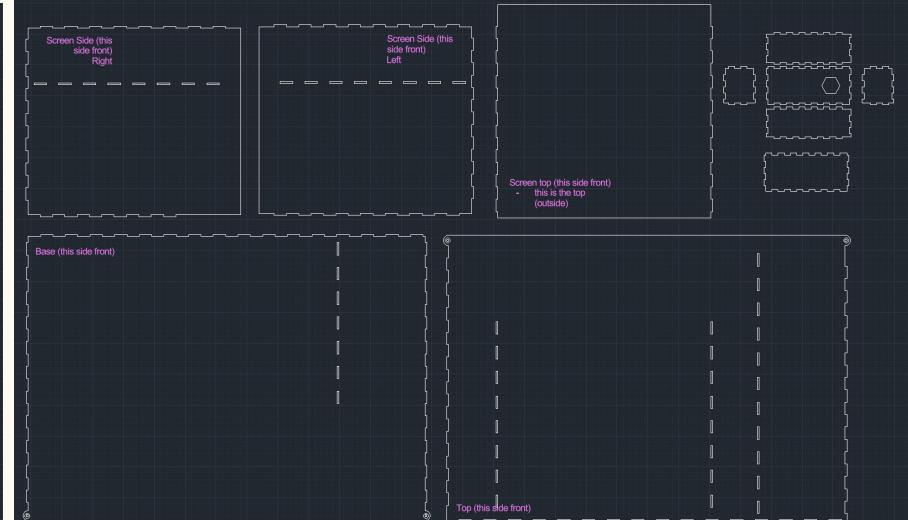
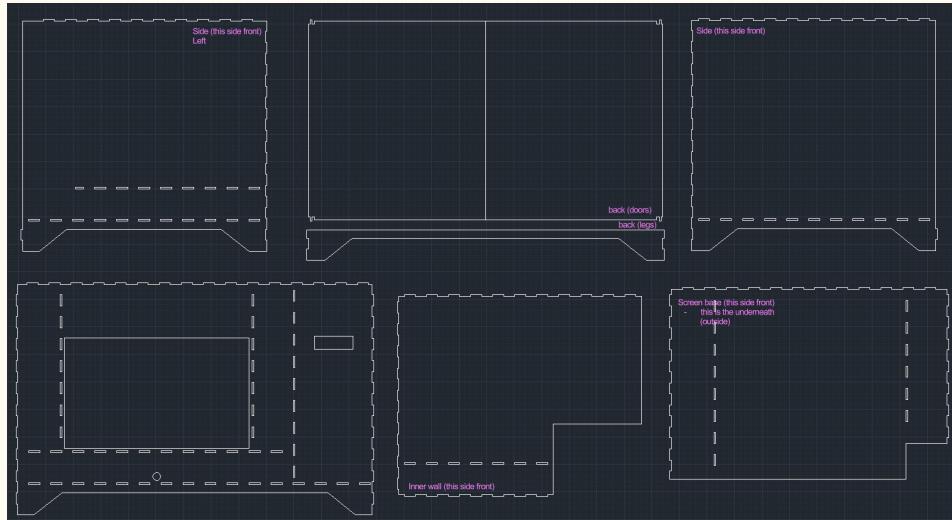
Final Prototype - Box Design

Design Idea:



Final Prototype - Box Design

Laser Cutting Template:



Explanation of the Iterations of the box

The box design was chosen for its multiple functionalities and its alignment with the retro aesthetic of our project, which centered around a DVD icon.

To complement this theme, we opted for a design resembling a vintage 'box' TV.

One key feature of the design was the placement of electronics on the right side of the box. This arrangement allowed us to securely organize the Arduinos and wiring, making it easier to manipulate and debug while preventing wires from interfering with moving parts.

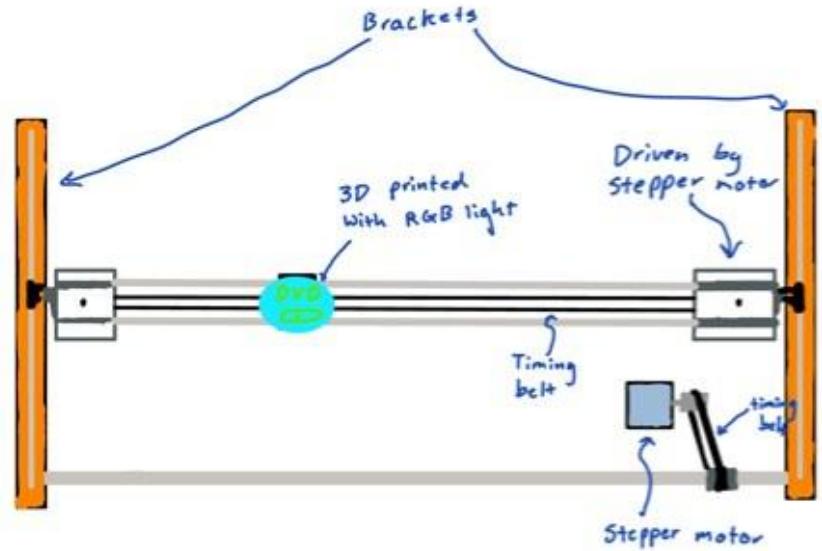
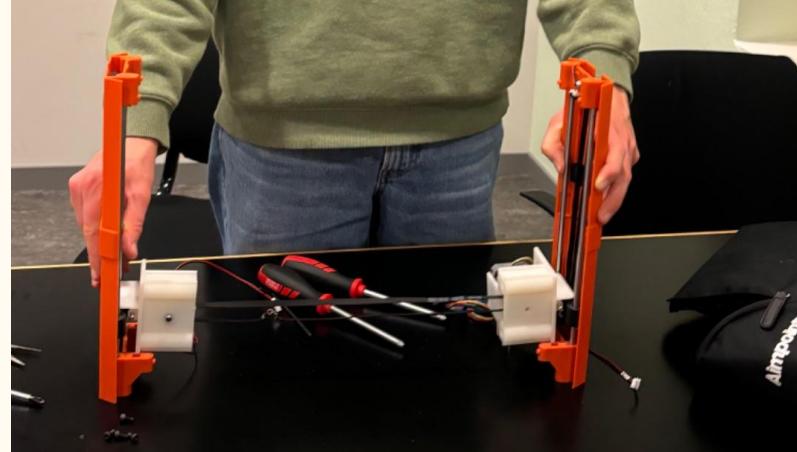
Additionally, it provided convenient access for connecting the Arduinos to a computer.

Another notable aspect was the "box inside the box" feature, which created the illusion of a floating DVD icon. By concealing all the mechanics and electronics, only the DVD logo was visible to the user, significantly enhancing the illusion and overall visual impact.

Finally, we incorporated a "remote" control to give users an interactive element, further reinforcing the retro TV theme and enhancing the project's aesthetic appeal.

Mechanics

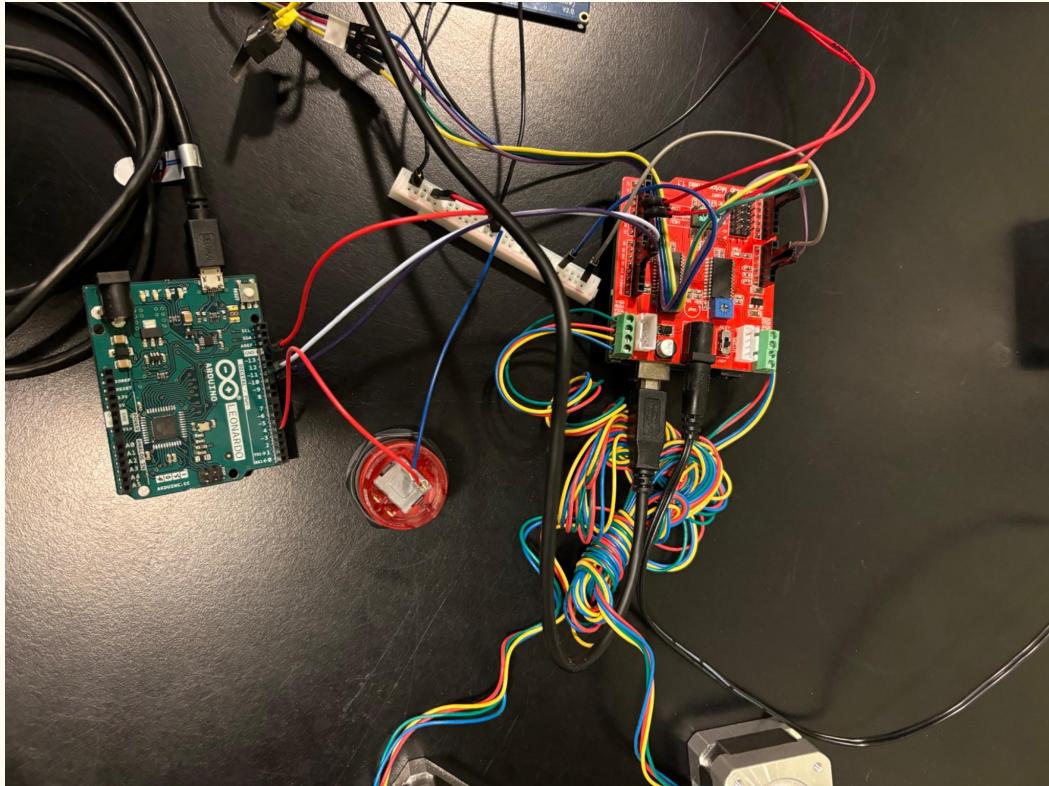
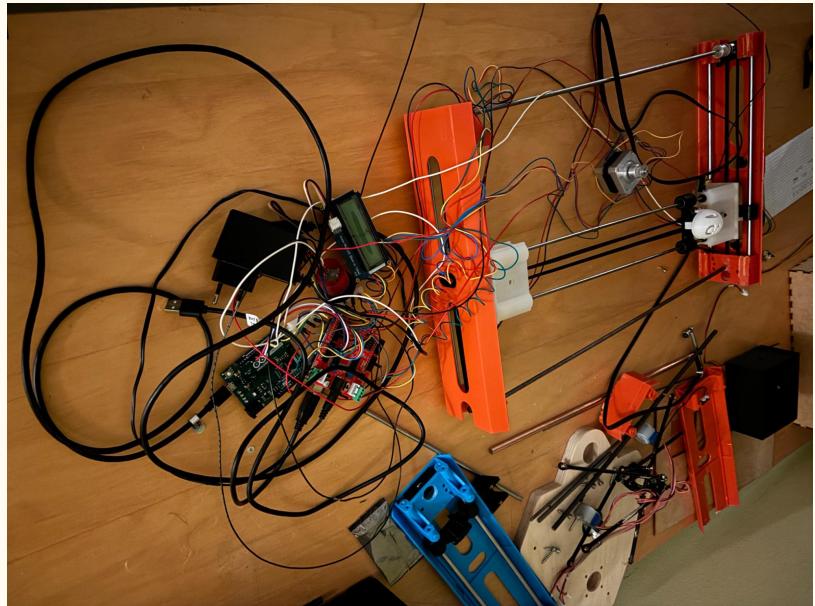
- Stepper motor connected to rod driving y axis brackets.
- Stepper motor in right rod case to drive x axis movement of DVD logo



Challenges Faced

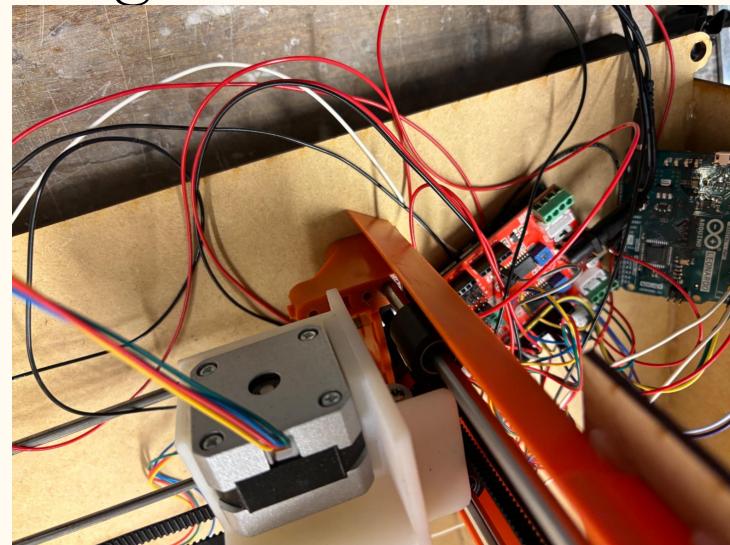
- Sizing issues with rods for logo bearing sliding in the x-axis.
- Had to manipulate one of the side brackets in order to move both brackets in the same direction as both were driven by a single rod.
- Securing the brackets while keeping tension in the x-axis timing belt.
- Wrong sizes and angles for printed bevel gears, needed to be switched with just a timing belt.

Electronics



Electronics Used in Final Design

- WAV Trigger
- Sound System
- NEMA stepper motors
- 16 x 2 LCD I2C Screen
- Limit Switches
- Push Button
- Stepper Motor Shield
- RGB LED
- Arduino Leonardo
- Arduino Uno



Code Logic

The structure of the code underwent multiple modifications and iterations. The primary challenge was achieving synchronized control of two stepper motors while providing real-time feedback for events such as wall hits, corner hits, and button presses. This was accomplished through serial communication between two Arduino boards. One Arduino managed the stepper motors and limit switches, while the other controlled the RGB light, sound effects, button interactions, game duration, and the LCD screen.

Code Logic

The code is structured into distinct phases or states, each with specific functionality:

1. Calibration Phase:

- The motors calibrate by moving until they hit the limit switches, determining the bottom-left corner of the box. This ensures distances and positions are properly set for subsequent operations.

2. Playing Phase (occurs when push button is pushed):

- The motors drive the system, detecting wall hits and corner hits in real-time.
- The game runs for a random duration between 20 and 50 seconds.
- Upon a wall hit:
 - The DVD logo changes to a random color.
- Upon a corner hit:
 - The game state changes to ‘Winning Phase’
- The LCD screen dynamically updates to display:
 - Time elapsed since the last hit.
 - Total number of hits.

Code Logic

3. Game Over Phase:

- Once the random time duration ends:
 - The motors stop.
 - The DVD logo turns red.
 - “Game Over” flashes on the LCD screen.
 - A different sound is played to signal the game has ended.

4. Winning Phase:

- The DVD logo continues moving.
- Music changes to signify a win state.
- The corner hit counter increments
- The LCD screen updates the time since the last corner hit.

5. Idle Phase (runs until push button is pushed):

- The DVD logo moves at a slower speed.
- Idle music loops in the background.
- Corner hits are still counted but do not trigger new music.

Final Prototype

Assembly:



Future Improvements

- The motors ran very loud in reality, especially in Idle mode so future research into quieter motors or investigating the natural harmonics of the motors would be beneficial.
- The DVD logo was also embedded too far into the box, at times it made it hard to see the whole effect and as a result some user interaction was foregone.
- More user interaction could be implemented, such as a ‘turbo’ button where holding the button could lead to faster movement to offer more interaction than one button.