Project 3
Testing & Prototyping

DESN 30146
Interaction Design: Physical Computing

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12-12-2023

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Design Statement

Project 3 builds upon the foundational learnings and creative evolution established in Project 1 and further developed in Project 2. The overarching journey from Project 1 to Project 3 reflects a continuous exploration of interactive design principles, technological integration, and a deepening understanding of physical data sensing. As a sole designer, I recognize that prototyping goes beyond component testing; it's a dynamic methodology aimed at rigorously testing the fundamental idea.

DESIGN EVOLUTION

Beginning with Project 1, the focus was on introducing Arduino and experimenting with physical data sensing using conductive materials. The iterative weekly activities served as building blocks, laying the groundwork for the subsequent phases of the project. The transition from rudimentary light displays to the integration of Arduino showcased a commitment to hands-on learning, experimentation, and troubleshooting.

Project 2 marked a significant leap, drawing inspiration from the seamless integration of physical and digital elements. The creation of an interactive fireworks display exemplified the synergy between tangible sensors, Arduino, and dynamic visualizations. This project not only demonstrated technical prowess but also incorporated cultural symbolism, paying homage to Lunar New Year traditions. The collaboration with ChatGPT, integration of sensor inputs, and careful iteration led to the transformation of sensor data into captivating visual representations.

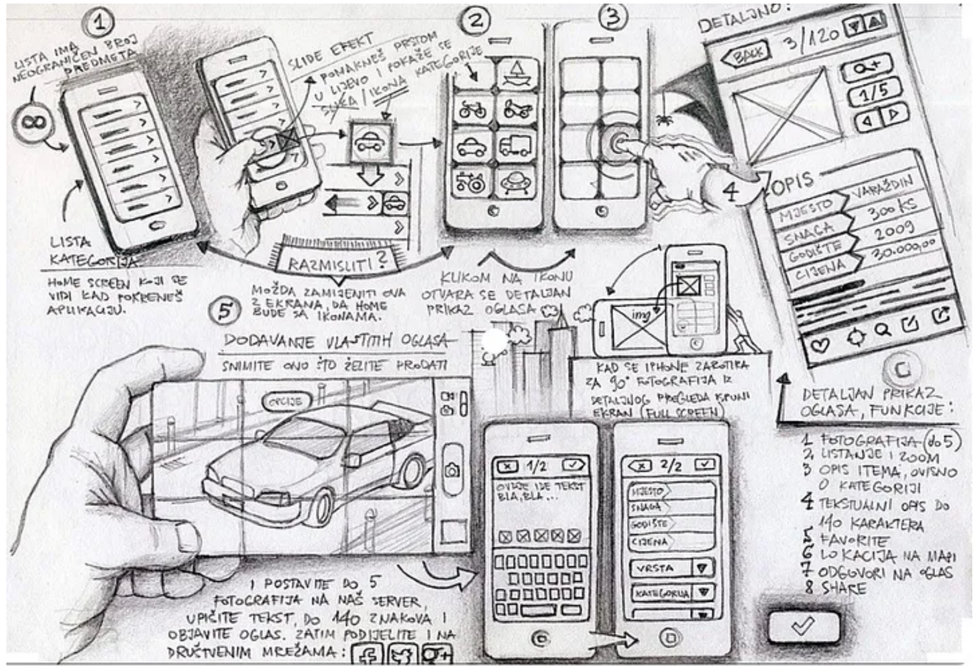
SYNTHESIS OF KNOWLEDGE

As we move into Project 3, the synthesis of knowledge from both predecessors becomes apparent. The journey encompasses the merging of newfound Arduino insights, physical computing ideas, and innovative design concepts. The transition from basic circuits to complex interactive prototypes underscores a commitment to continuous learning, adaptability, and creative exploration. By deepening the connection with cultural tradition and artistic expressions while refining the interactive experience, prototyping, in this context, becomes a bridge between technological innovation and cultural significance.

This phase is not just about iterative testing; it's a deliberate effort to push the boundaries of user-centric innovation. The emphasis on testing unanswered questions and curious results continues from the previous projects. Here, prototyping became a cost-efficient strategy, steering away from the pitfalls of developing untested solutions that may prove expensive in the realm of Physical Computing.

Research

Paper Prototype Sketching



RAPID ITERATION

Sketching allows designers to quickly iterate through design ideas. The simplicity and speed of the process enable designers to explore multiple concepts in a short amount of time, allowing for creative freedom that can convey design ideas visually and express concepts in ways that make sense to them and their audience.

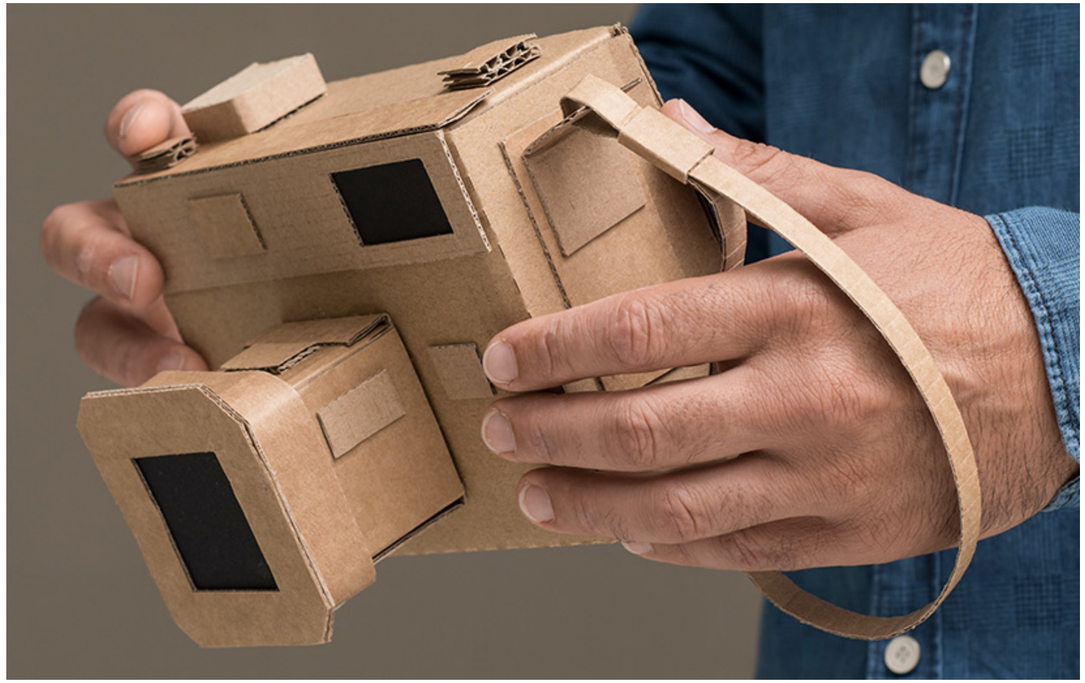
EFFICIENT VISUALIZATION

Sketching helps designers visualize their ideas in a straightforward manner. It serves as a quick and efficient way to communicate design concepts, layouts, and structures without getting bogged down by intricate details. Paper-prototyping serves as a means to validate and communicate design ideas efficiently. When implemented correctly, these sketches provide maximum benefits with minimal time and effort.

COLLABORATION AND COMMUNICATION

Paper prototypes facilitate collaborative efforts among design teams. They serve as a tangible and shareable medium that fosters effective communication between designers, developers, and other stakeholders. Through simulation and interactions, it can provide valuable insights into how users would navigate through the interface, revealing potential usability issues.

Cardboard Prototyping



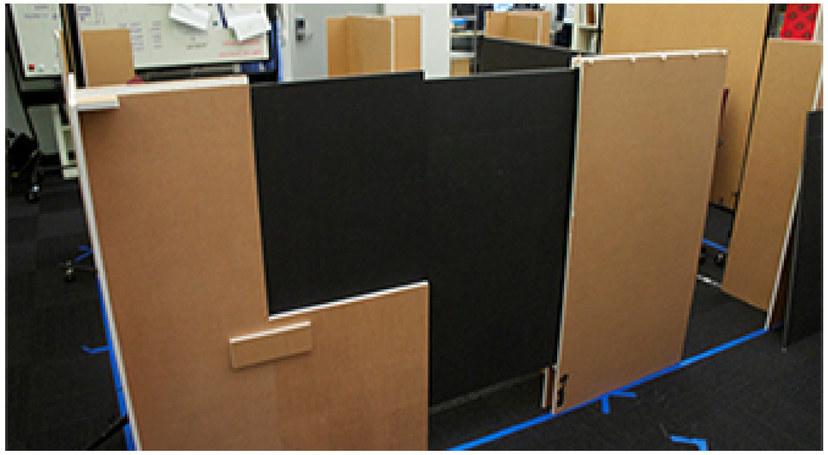
RAPID PROTOTYPING

Cardboard prototypes can be quickly and easily created, allowing for a swift exploration of design concepts. The process facilitates the generation of multiple small-scale versions before transitioning to full-sized models, promoting speed and efficiency.

LOW COST & EASE OF CONSTRUCTION

The method is user-friendly, cost-effective, and has one of the lowest entry barriers among prototyping techniques. Almost anyone can engage in cardboard prototyping, whether as a child or an adult helping children. It requires only basic materials like corrugated cardboard or foam board, X-ACTO knives, scissors, tape, and hot glue guns.





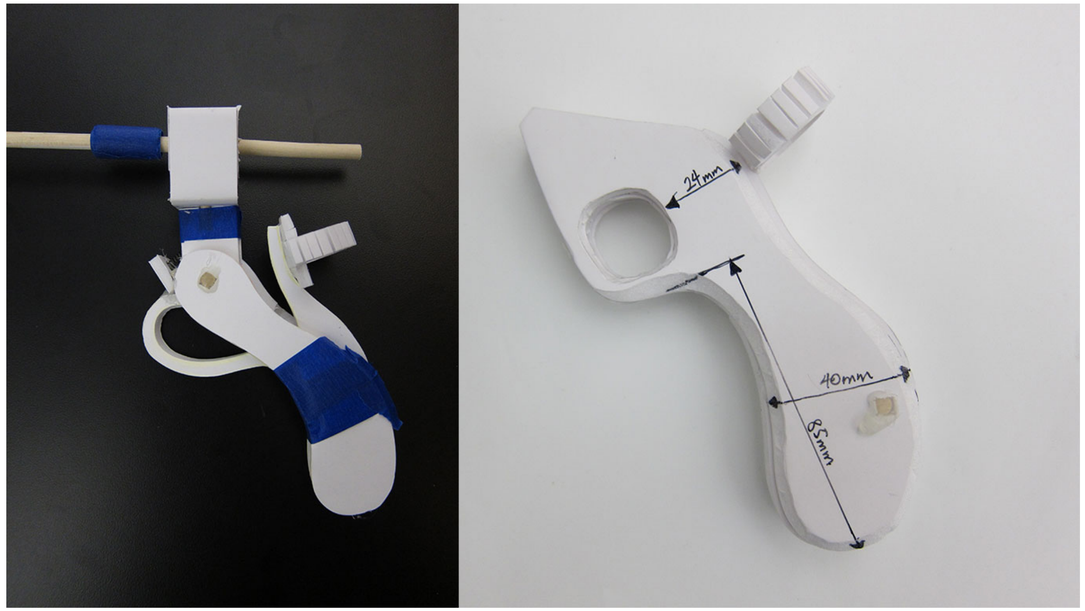
Mock-up of interior airline seating using office chairs and foam core panels, to evaluate divider concepts.

ITERATIVE PROCESS

The iterative nature of cardboard prototyping allows for the exploration of details, strengths, and weaknesses of the initial concept. This iterative approach is particularly valuable for refining designs and addressing issues promptly. Changes to cardboard prototypes can be made easily and quickly, allowing for on-the-fly adjustments during testing sessions. This adaptability contributes to a dynamic and responsive prototyping process.

IMMERSIVE EXPERIENCES

Full-size cardboard models set the stage for immersive experiences, like investigative rehearsals or process walkthroughs. They facilitate a deeper exploration and iteration of designs, helping teams test and refine setups, flow, and overall experiences. It provides a tangible basis for these techniques, enabling the creation of spaces and artifacts to enhance the walkthrough experience.



Mock-up of a Laparoscopic instrument handle using tape, wooden dowels, and foam core.

VERSATILITY IN SIZE

Cardboard prototypes can vary in size, accommodating small-scale models, actual-size representations, or even larger-than-life constructions. This versatility allows for the exploration of different scopes and scales based on the prototyping goals.

DOCUMENTATION AND PRESENTATION

The method encourages documentation through photos, videos, and key interactions. It offers a storytelling approach for presenting iterations and key learnings, facilitating effective communication and feedback.

Prototyping

Updating Firework Visualization

The visualization for project 2 employs a particle system to simulate a firework display. While it was straightforward, it didn't effectively capture the essence or appearance of a true fireworks show. My inspiration for improvement came from Chris J Mears' Interactive Fireworks Animations. In his work, he designed 8 distinct firework shells that randomly launch in an infinite loop, complemented by audio sound effects for each firework.



Terminal Help — SerialP5_Firework

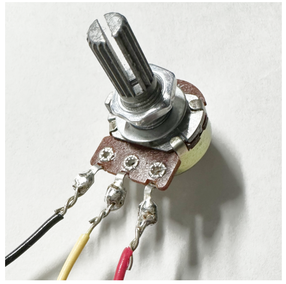
sketch.js | sketch4.js

sketch4.js > serialEvent

```
80
81    /* Draw the shells and sparks */
82    for (let shell of shells) shell.draw();
83    for (let spark of sparks) spark.draw();
84
85    /* Generate new shell with small probability */
86    if (random() < 0.03) {
87      let s = new Shell();
88      shells.push(s);
89    }
90  }
91
92
93  function serialEvent() {
94    let data = serial.readStringUntil('\n');
95    if (data) {
96      console.log("Arduino Data Received: " + data); // Log received data to console
97   // a callback functtion that gets called whenever new data is available from the serial port.
98   // It reads the data until a newline character is encountered and processes the received data
99   // to update the 'fsrPressed' and 'potTurned' variables based on the sensor values received
100  // from the Arduino board.
101
102     let values = data.split(',');
103     if (values.length >= 2) {
104       let fsrVal = int(values[0]);
105       let potVal = float(values[1]);
106       console.log("FSR Value: " + fsrVal);
107       console.log("Potentiometer Value: " + potVal);
108
109       // Check FSR value to determine if it's pressed
110       if (fsrVal > 100) {
111         console.log("FSR Pressed");
112         fsrPressed = true;
113       } else {
114         console.log("FSR Not Pressed");
115         fsrPressed = false;
116       }
117
118       // Check Potentiometer value to determine if it's turned
119       if (potVal > 100) {
120         console.log("Potentiometer Turned");
121         potTurned = true;
122       } else {
123         console.log("Potentiometer Not Turned");
124         potTurned = false;
125       }
126     }
127   }
128 }
```

I forked Chris J Mears code and seamlessly integrated it with my P5 firework code from project 2 to enable activation with Arduino. Bridging the two code sets required assistance from ChatGPT, as I appreciated Mear's original firework code, particularly for its inclusion of sound effects.

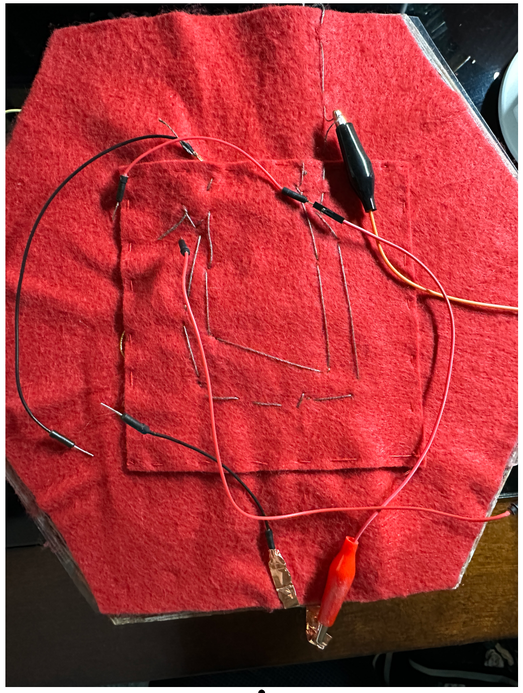
Prototyping

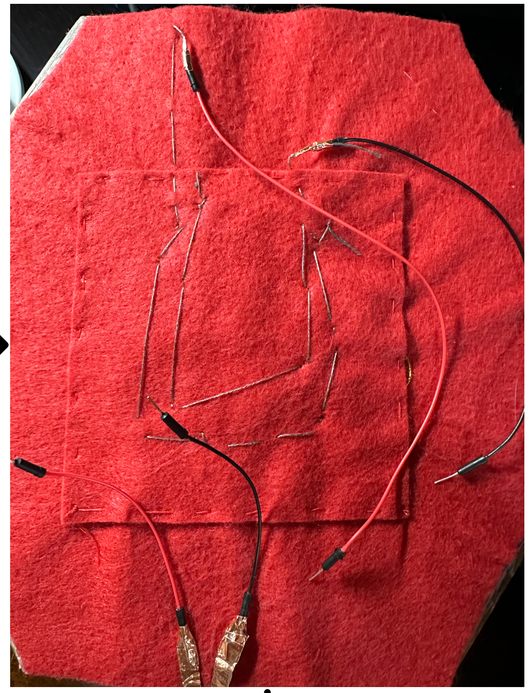


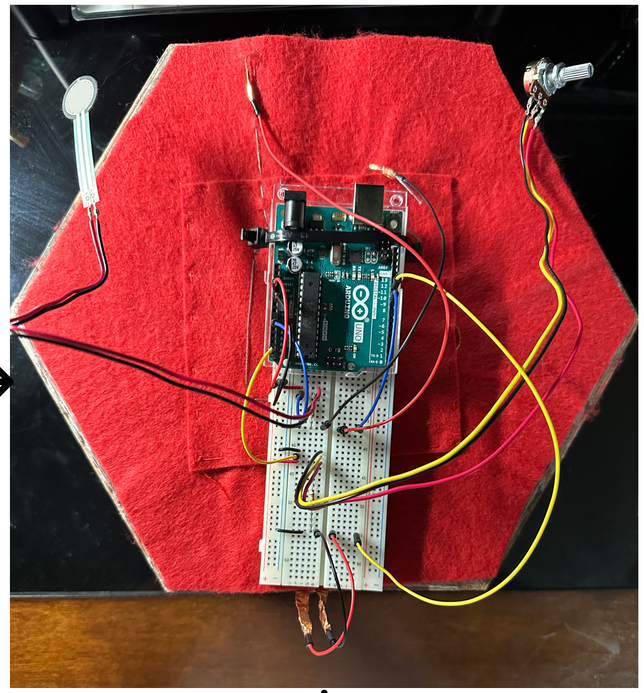


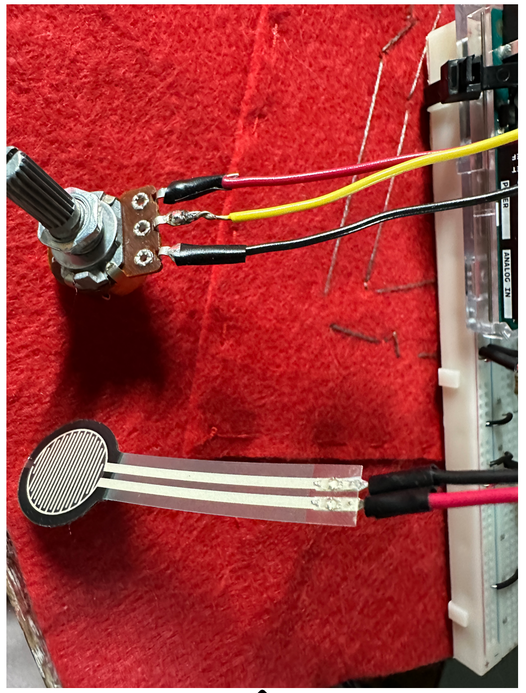


After successfully configuring the code to my specifications and testing it with the connected Arduino, my focus shifted to creating a model capable of housing all the controllers and sensors. I aimed for a swift prototyping process, exploring various iterations due to time and material constraints.

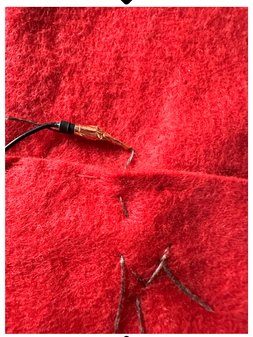




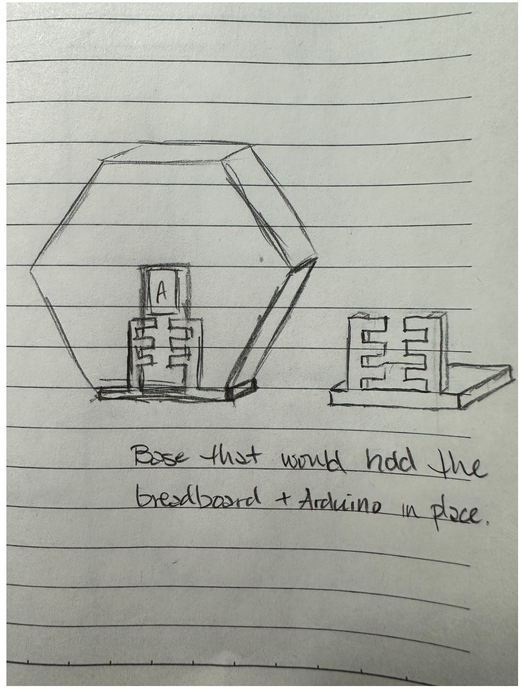


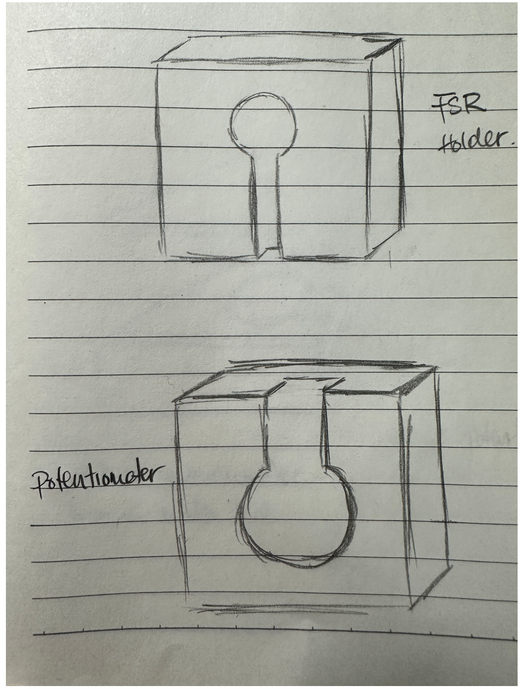


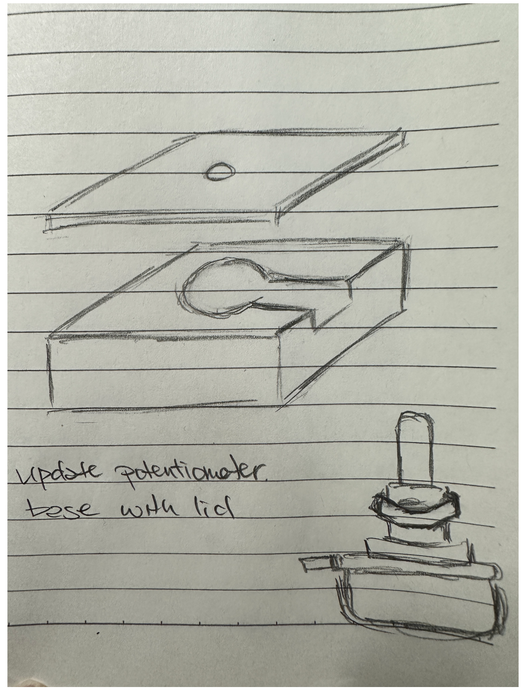




Before commencing with the prototyping phase, I had to rearrange the wiring. It was necessary to extend all the wires connected to both the wooden base and the breadboard, as they required additional length.

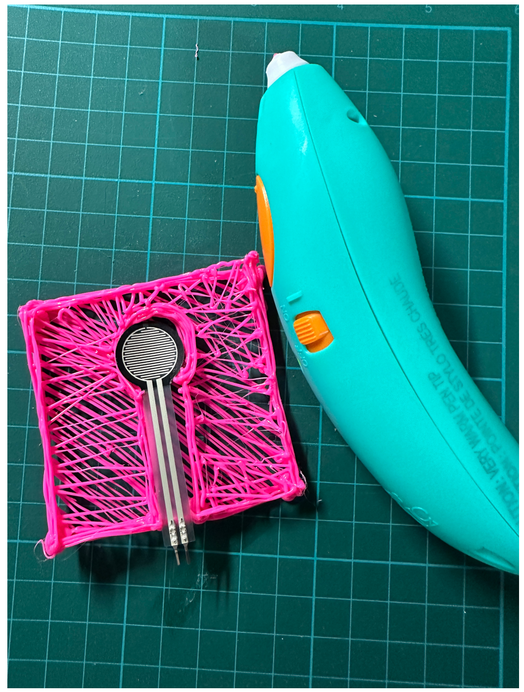






The initial stage involved sketching out designs for holders accommodating the FSR sensor, potentiometer, breadboard, and Arduino. Seeking feedback, I presented the sketches to my husband, who suggested using velcro for the breadboard instead of creating a separate holder. Acknowledging the practicality of his suggestion, I realized that the initial breadboard holder design did not effectively secure the breadboard in place. The velcro solution not only addressed this issue but also facilitated easy access for wire adjustments.



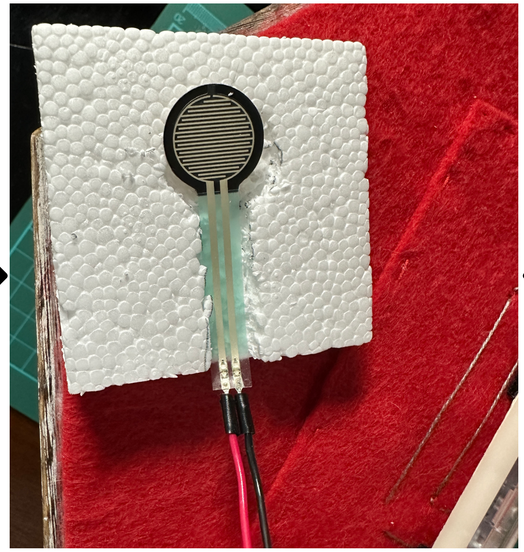


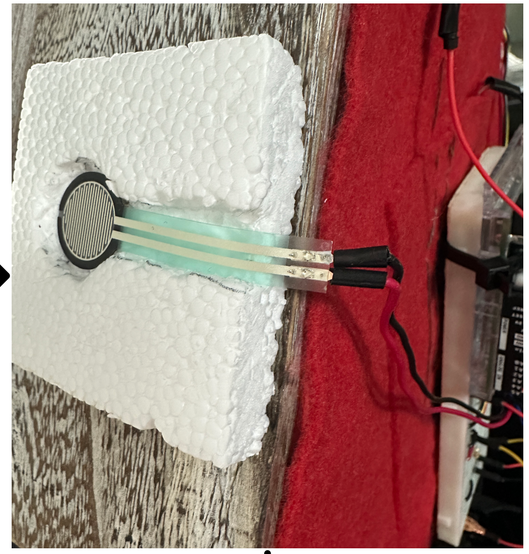


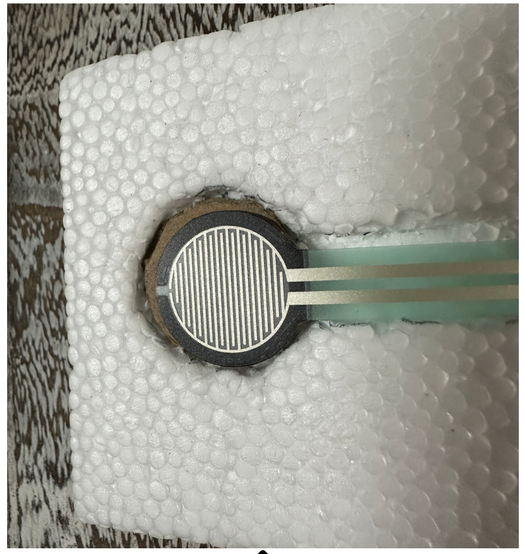
Transitioning from sketches, I attempted 3D modeling using a 3D pen from the 3Doodler kit. However, the limitations of this approach became apparent after creating a model for the FSR sensor, prompting a shift to styrofoam for better adaptability and ease of modification. This proved successful, leading to a realization that the styrofoam prototype's methods could potentially be applied to laser cutting or 3D printing.

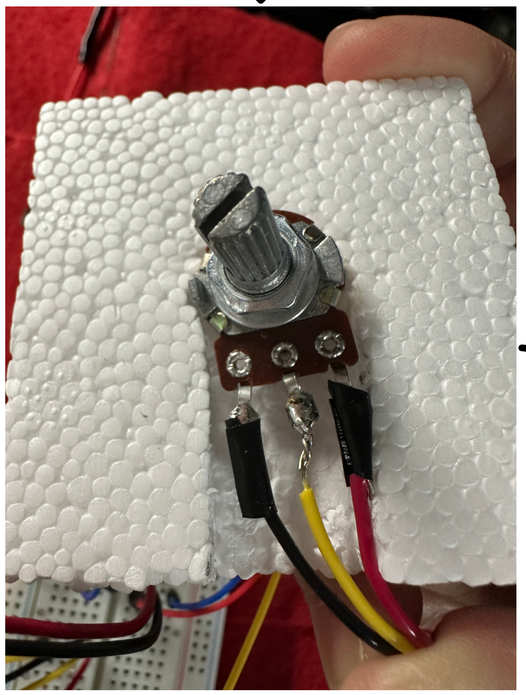
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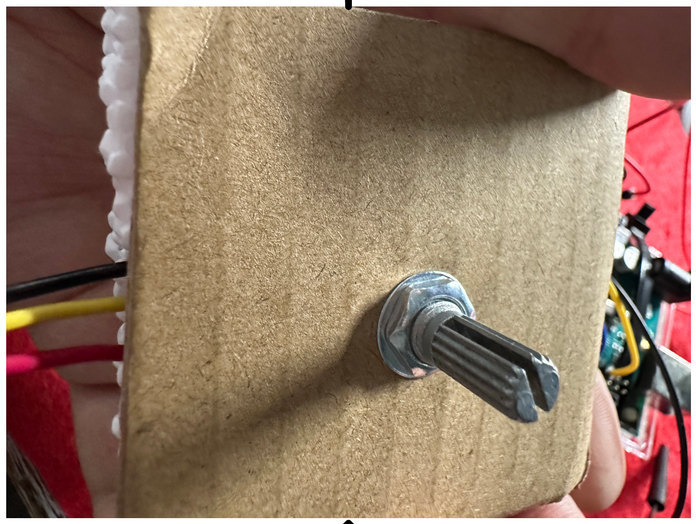


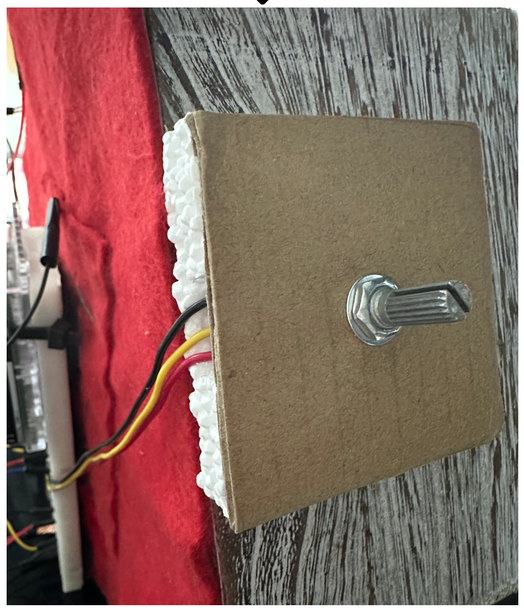


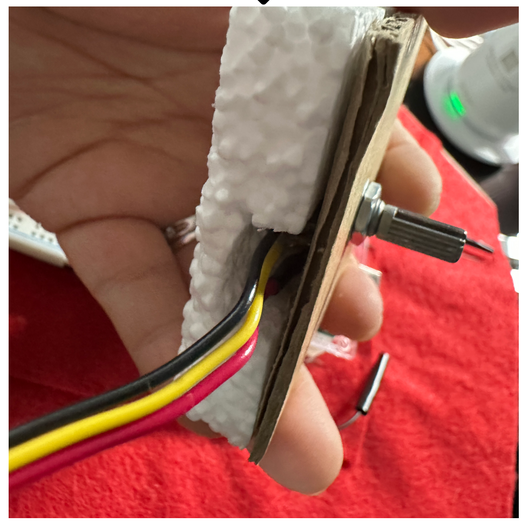


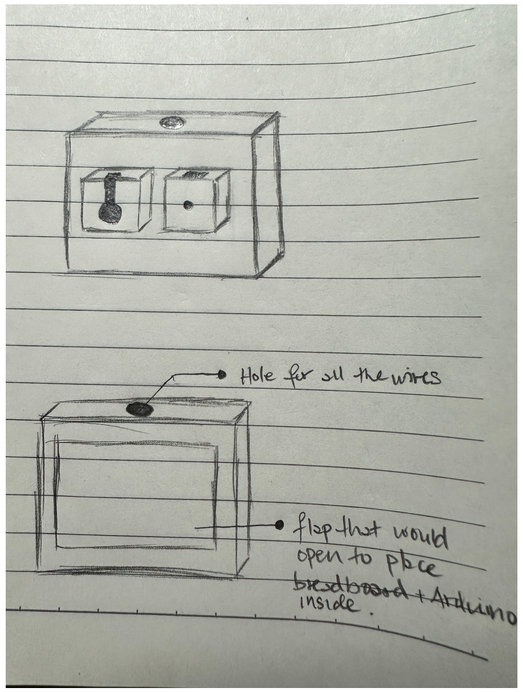


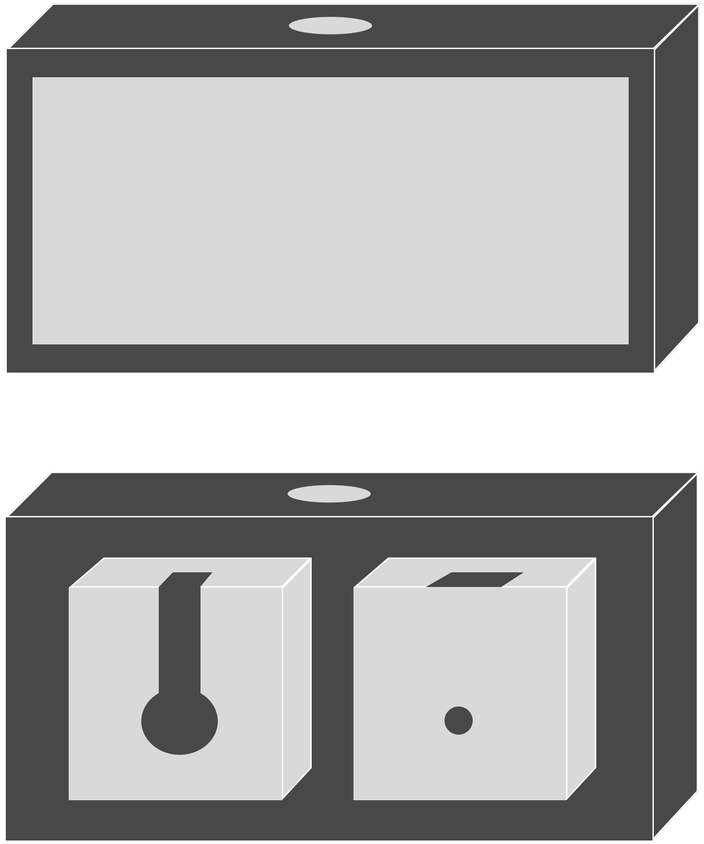


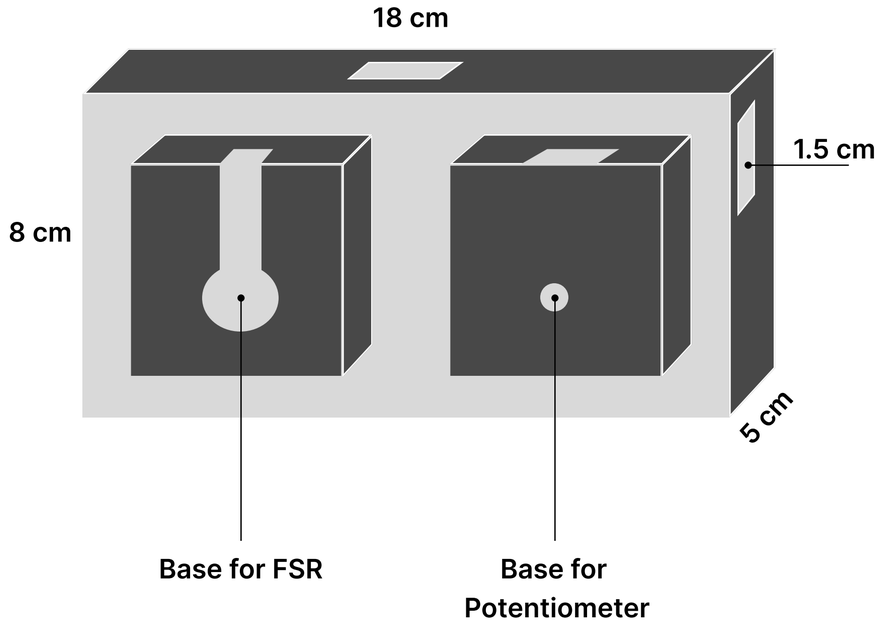




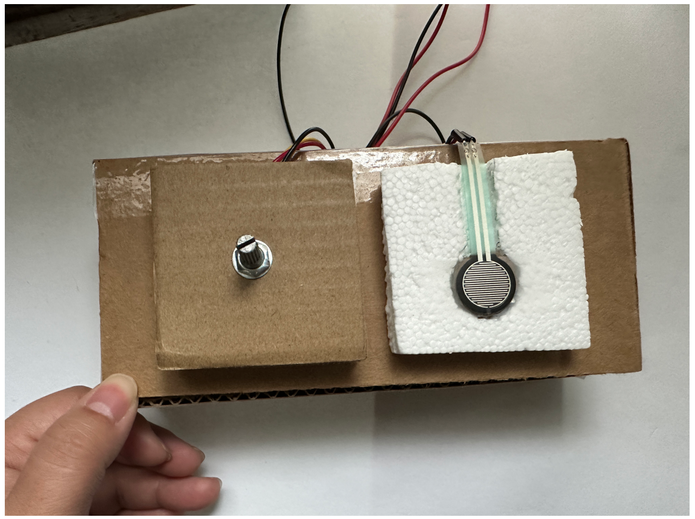


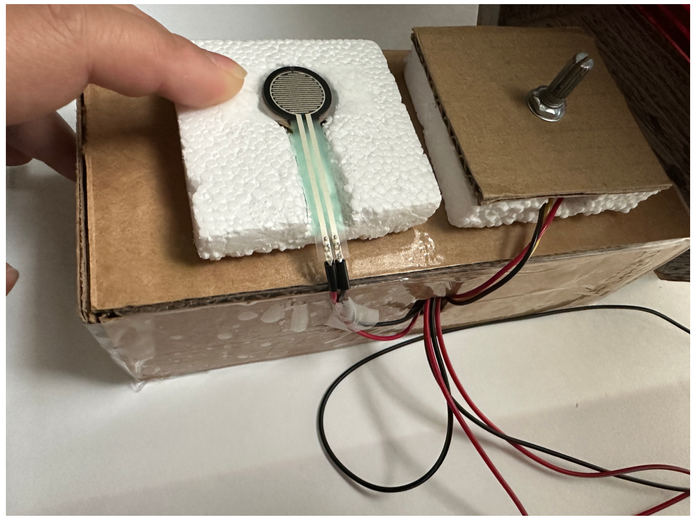


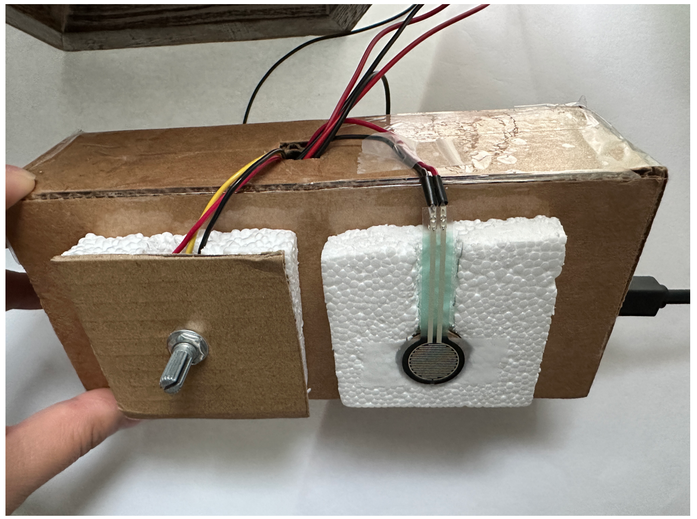


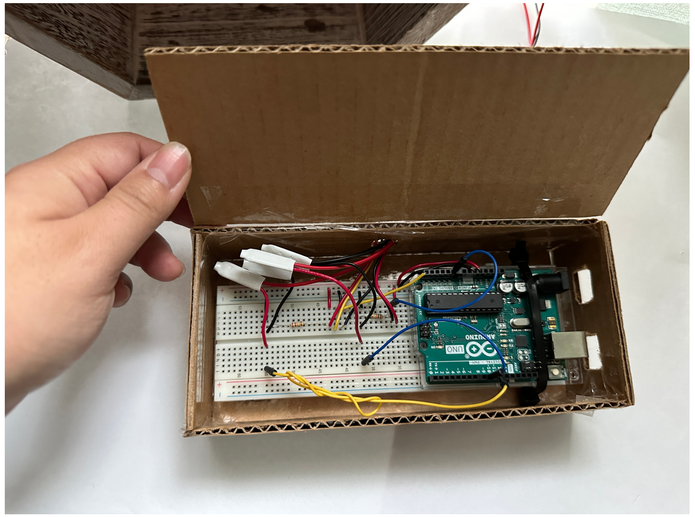


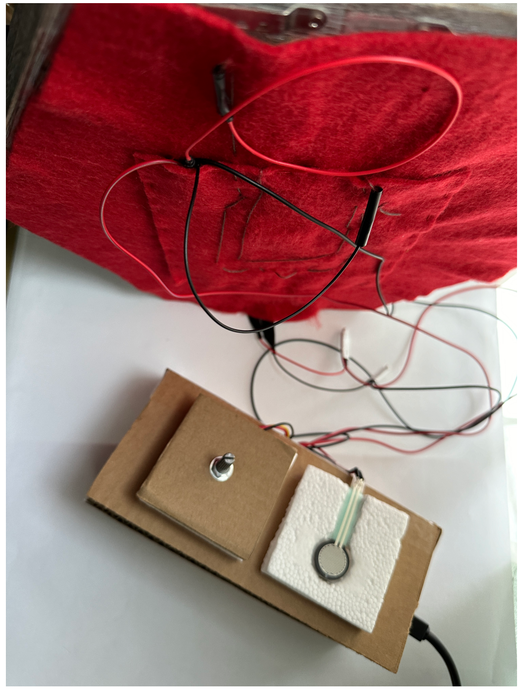
As the prototypes progressed, I contemplated the overall aesthetic and functionality. Questions arose about the placement of the breadboard and sensors, challenging the purpose of the wooden box. Considering the intended role of the FSR sensor and potentiometer as controllers, I decided to detach them from the box and redesign them with the breadboard as a wired controller. This adjustment aligned with the goal of having the sensors send signals to the wooden box and a screen, triggering LED lights in the box and generating firework visualizations and sound with P5 on the screen.











I opted to construct the enclosure for the Arduino and breadboard using cardboard. After three attempts, I successfully achieved the desired dimensions and sizes for the box. Subsequently, I relocated the sensor containers from the wooden box to the cardboard model. It dawned on me that the wires connected to the wooden box were not sufficiently long. Lacking solid wires and a soldering kit at the moment, I utilized stranded wires and a butt connector to securely join the components. This extension enabled the wires to reach the required length, enhancing the new prototype's resemblance to a controller.

Final Design



Watch the final design video HERE!

Citations

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