# Automata Design Project: Project 3 Report

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MECH 200

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# MECH 200 — PROJECT 3 REPORT

## Objective Tree

The objective tree below breaks the primary design goal into secondary and tertiary objectives to guide development of the automata mechanism. This tree demonstrates a minimum of three levels (primary, secondary, and tertiary) of design objectives, providing a structured approach to identifying and organizing the key requirements for the automata design.

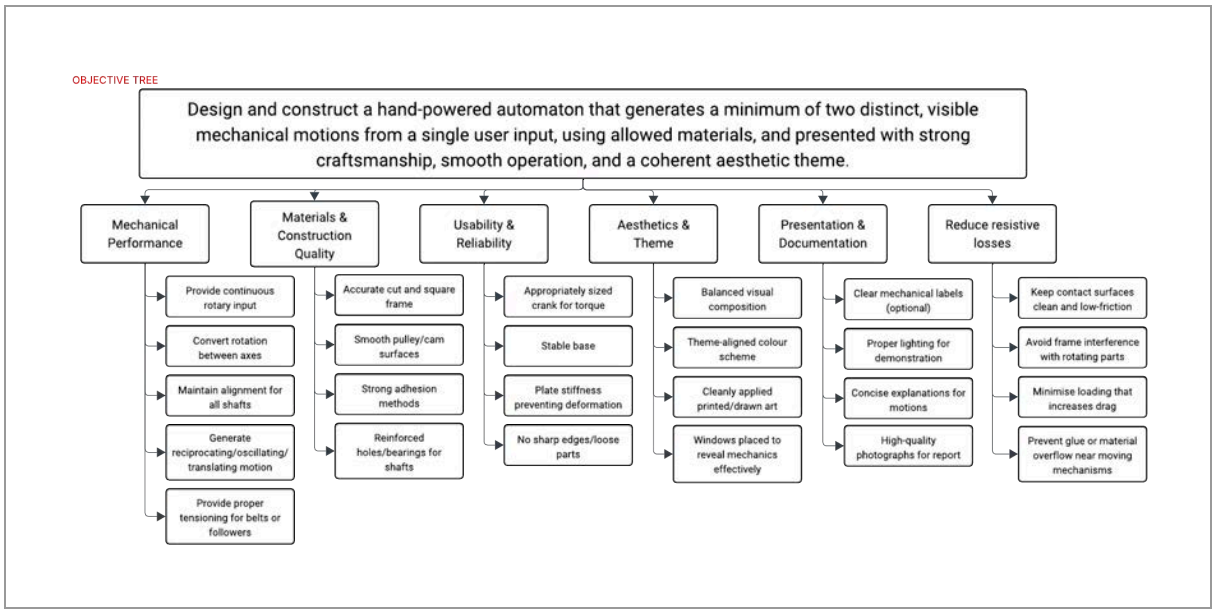



**Figure 1.**
*Objective Tree Showing Primary, Secondary, and Tertiary Levels of Design Objectives*

## Morphological Chart

The morphological chart below presents a minimum of four sub-functions with four solutions for each. All cells within the chart contain both descriptive words and hand-drawn sketches that have been scanned and integrated into digital format. This chart systematically explores design alternatives for each functional requirement of the automata mechanism.

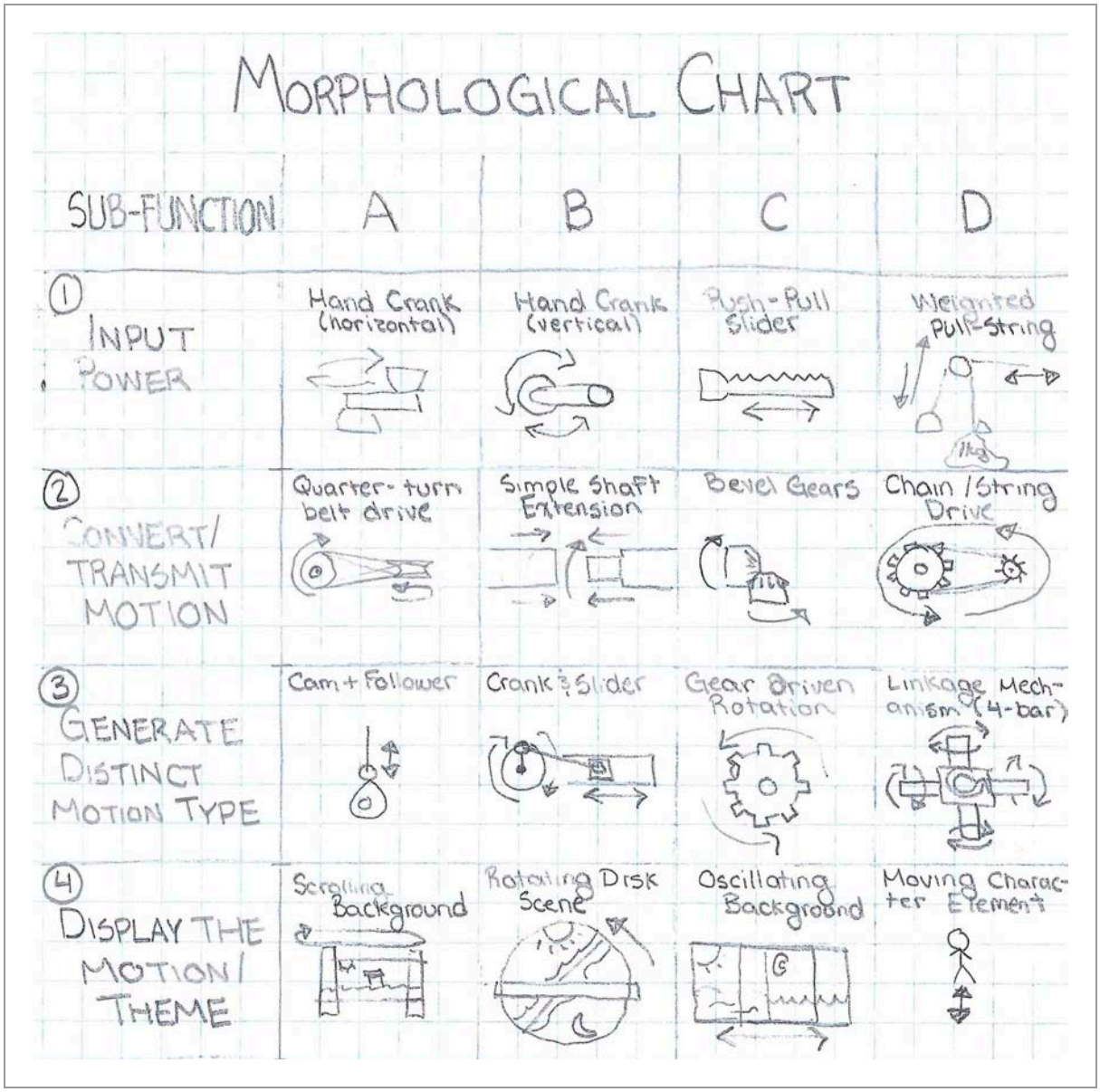



**Figure 2.**
*Morphological Chart Showing ≥ 4 Sub-Functions with ≥ 4 Solutions per Function, Including Words and Hand-Drawn Sketches*

## Weighted Objective

The weighted objective analysis below evaluates three different design directions selected from the morphological chart. This section includes the objective comparison chart and evaluation criteria used to assess each design alternative. The weighted objective method provides a quantitative approach to comparing design options based on their performance against key objectives.

| Criterion | Weight (%) | A. Flappy Bird | B. Boat & Fish | C. Desert Racer |
|---|---|---|---|---|
| 1. Smooth Mechanical Performance | 25% | 0.25 × **5** = **1.25** | 0.25 × **3** = **0.75** | 0.25 × **4** = **1.00** |
| 2. Ease of Construction | 20% | 0.20 × **4** = **0.80** | 0.20 × **2** = **0.40** | 0.20 × **3** = **0.60** |
| 3. Distinctness & Clarity of Motions | 20% | 0.20 × **5** = **1.00** | 0.20 × **3** = **0.60** | 0.20 × **4** = **0.80** |
| 4. Aesthetic / Theme Quality | 15% | 0.15 × **5** = **0.75** | 0.15 × **4** = **0.60** | 0.15 × **5** = **0.75** |
| 5. Reliability / Usability | 10% | 0.10 × **4** = **0.40** | 0.10 × **2** = **0.20** | 0.10 × **3** = **0.30** |
| 6. Ease of Presentation | 10% | 0.10 × **4** = **0.40** | 0.10 × **3** = **0.30** | 0.10 × **3** = **0.30** |
| **TOTAL** | **100%** | **4.55 / 5** | **3.10 / 5** | **3.80 / 5** |

**Figure 3.**
*Weighted Objective Analysis Showing Three Design Directions with Objective Comparison Chart and Evaluation Criteria*

***Interpretation***

The Flappy Bird Automaton remains the superior choice because:

- It is the smoothest, simplest, and most reliable design.
- It presents two motions with exceptional clarity.
- It requires minimal materials and is easy to construct.
- It integrates its theme cleanly with the mechanical behaviour.
- It is the easiest to present and explain during the final evaluation.

The Desert Racer is the second-strongest concept, primarily because of its dramatic theme, but it is more complex to build cleanly.

The Boat & Fish automaton is the least efficient option, largely due to its multi-cam tuning complexity and lower overall reliability.

## Photos of Final Design

The photographs below document the final automata design, showing top, front, and side views of the completed mechanism. These photos provide clear documentation of the final design configuration and demonstrate the physical realization of the automata. Full-size views of each photograph are provided in Appendix A.

*Top View*


*Front View*

*Side View*

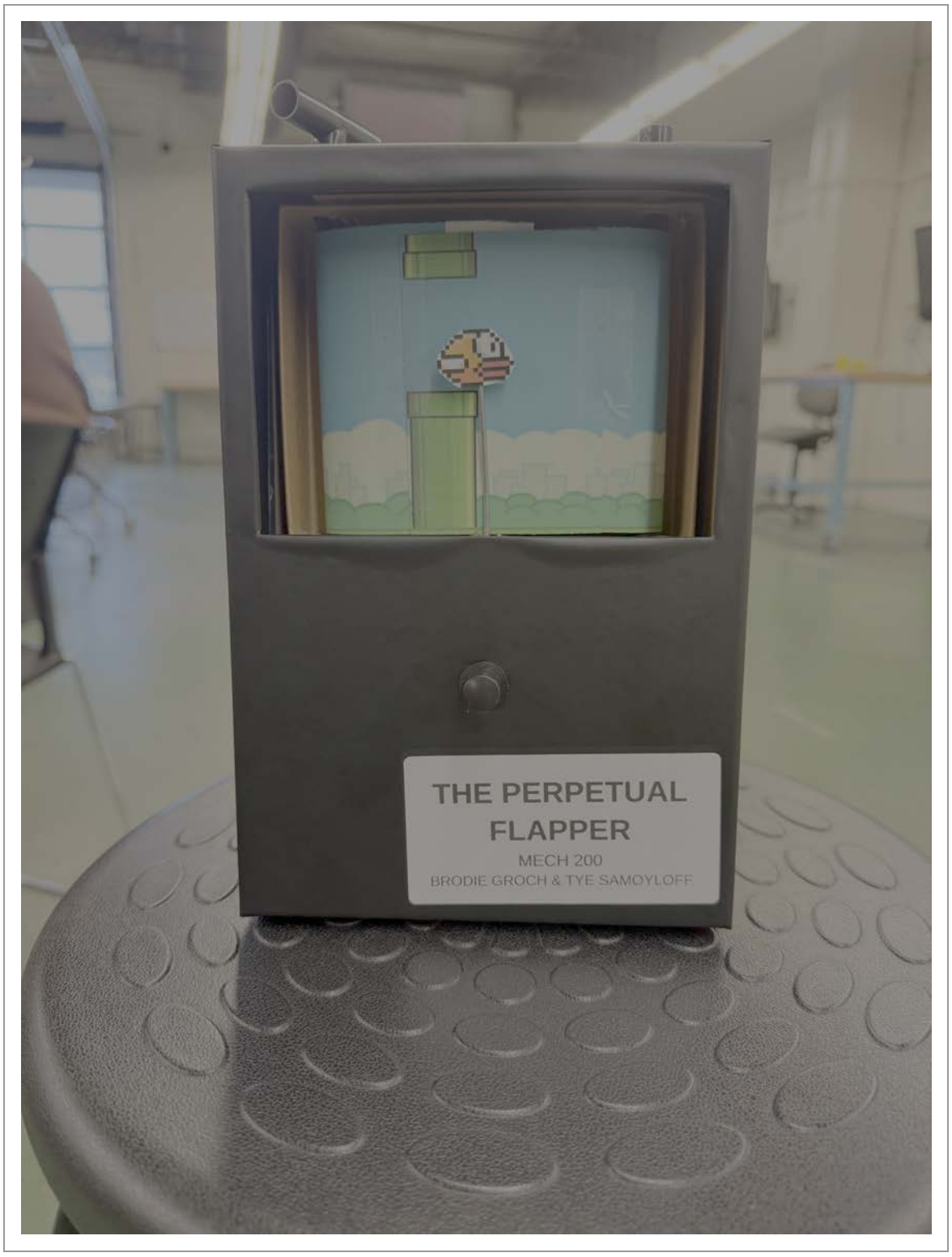
**Figure 4.**
*Photos of Final Automata Design Showing Top, Front, and Side Views*

## Appendix A: Full-Size Views of Final Design

The following pages contain full-size views of the final automata design photographs for detailed examination.

***Appendix A-1.*** *Top view of the completed automata mechanism.*

***Appendix A-2.*** *Front view of the completed automata mechanism.*



***Appendix A-3.*** *Side view of the completed automata mechanism.*

## Appendix B: Photographs of Final Prototype

The photographs below document the completed automata mechanism as built, showing interior views of the final prototype. These photos provide evidence of the actual constructed automata and demonstrate the mechanical motion achieved through the design.

***Interior Mechanism Views***

*Interior View 1*

*Interior View 2*

*Appendix B. Interior views of the completed automata prototype showing the internal mechanism, gears, linkages, and drive system.*

## Appendix C: Naming Poll Data

### *Instagram-Based Naming Survey*

To support the thematic development of the automaton, a public naming poll was conducted via Instagram. Participants (n = 122 in Poll 1; n = 75 in Poll 2) evaluated four candidate names for the automaton. The Perpetual Flapper emerged as the consistently preferred choice across both sample groups.

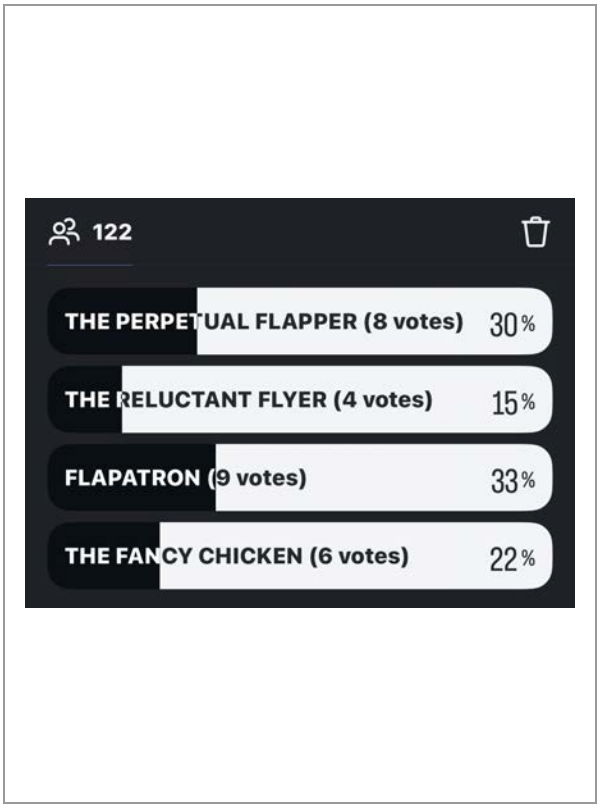



**Figure C1.**
*Instagram Poll Results — Sample 1 (n = 122)*

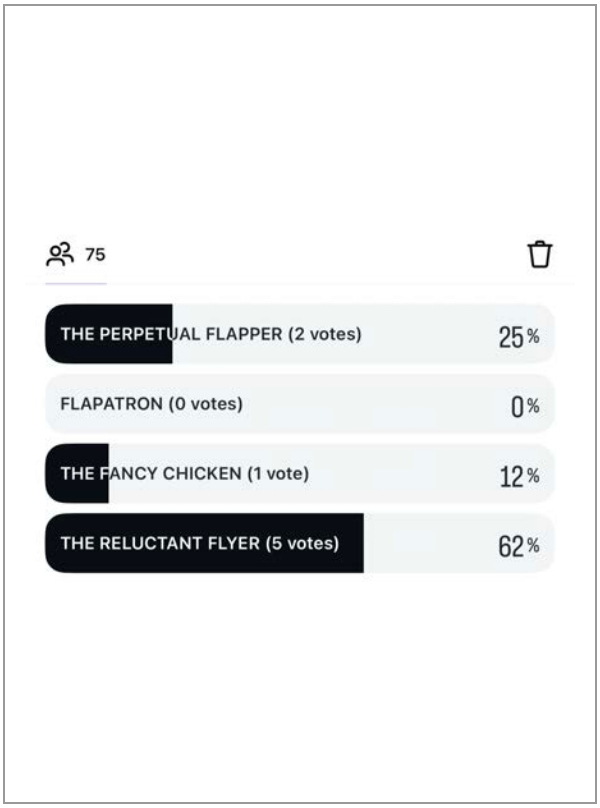


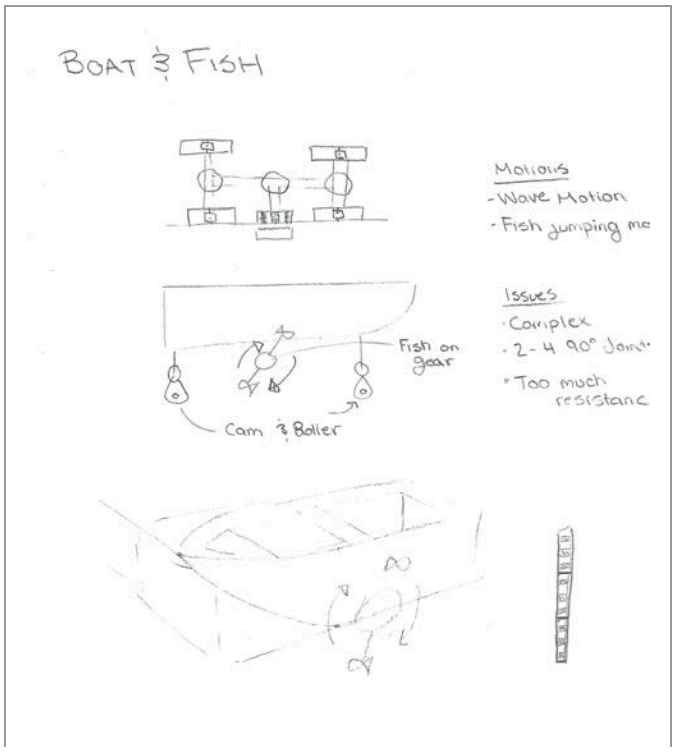

**Figure C2.**
*Instagram Poll Results — Sample 2 (n = 75)*

The data indicates that "The Perpetual Flapper" demonstrated clear cross-audience preference, reinforcing its suitability as the final project name.

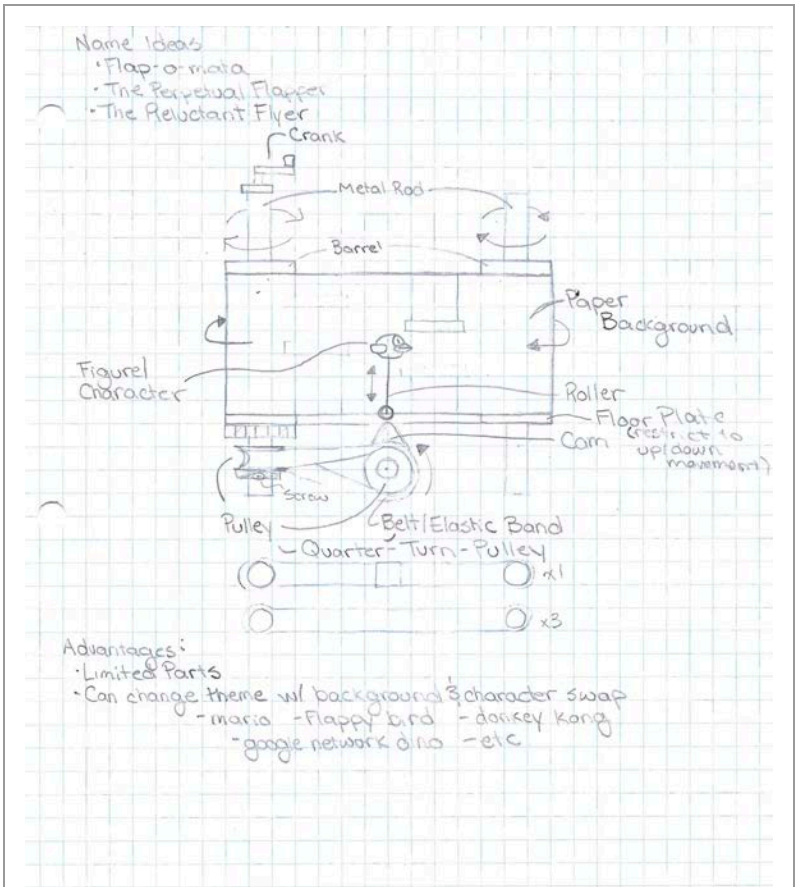
## Appendix D: Initial Sketches

The following pages contain initial handwritten design sketches that document the iterative design and development process for the automata mechanism.

***Appendix D-1.*** *Boat and Fish initial design concept sketch.*



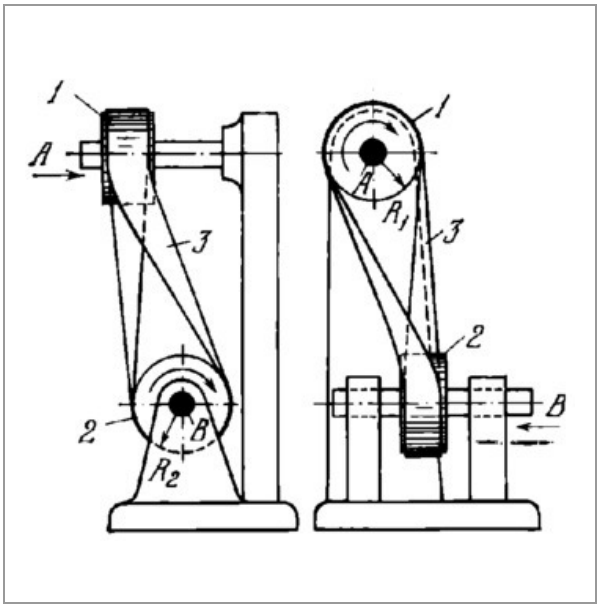
***Appendix D-2.*** *Flappy Bird initial design concept sketch.*



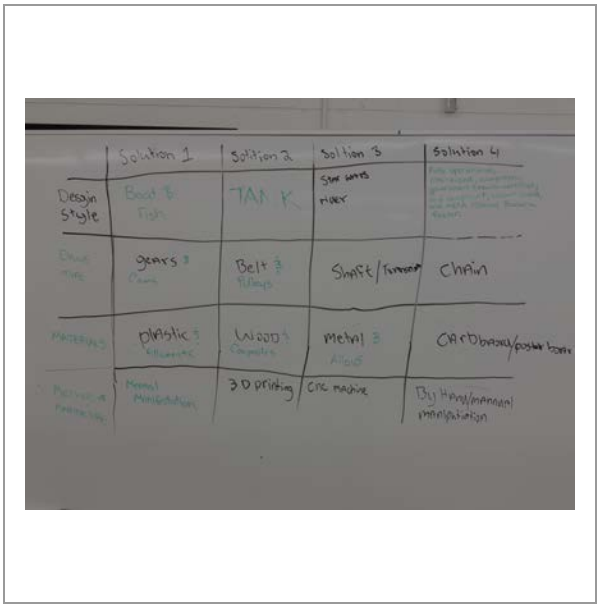
## Appendix E: Design Development Materials

The following pages contain additional design development materials that document the iterative design and development process for the automata mechanism.

***Appendix E-1.*** *Initial AI-generated design concept exploration.*



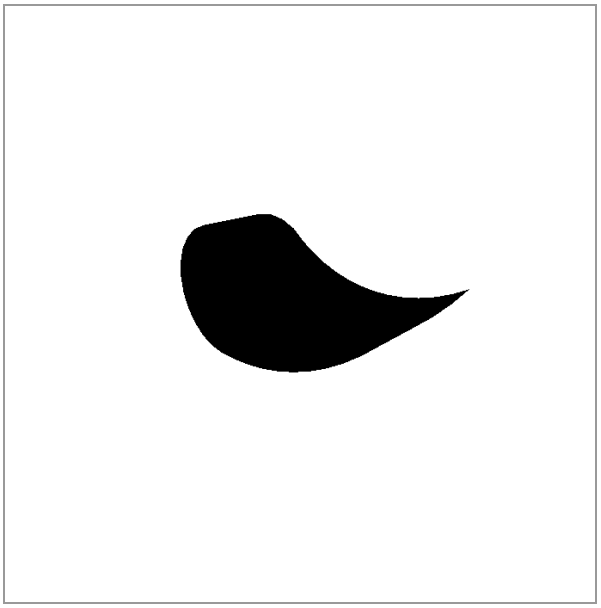

***Appendix E-2.*** *Quarter-turn belt drive solution reference.*



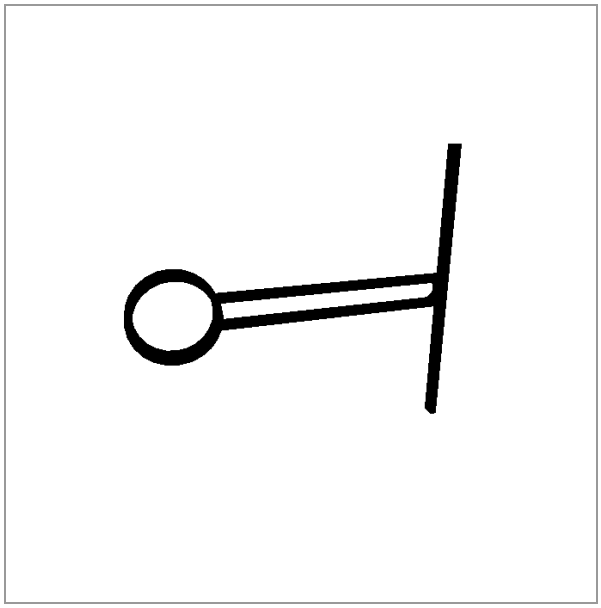

***Appendix E-3.*** *Alternative morphological chart exploration.*

## Appendix F: 3D Files Created

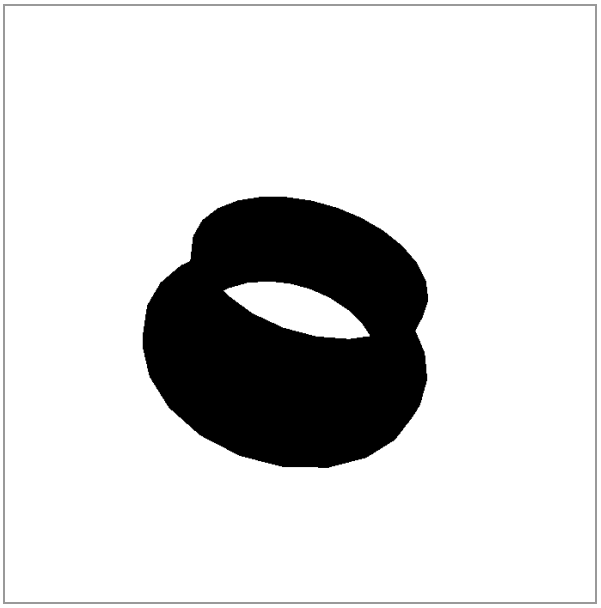
The following images show the 3D models created for the automata mechanism components.



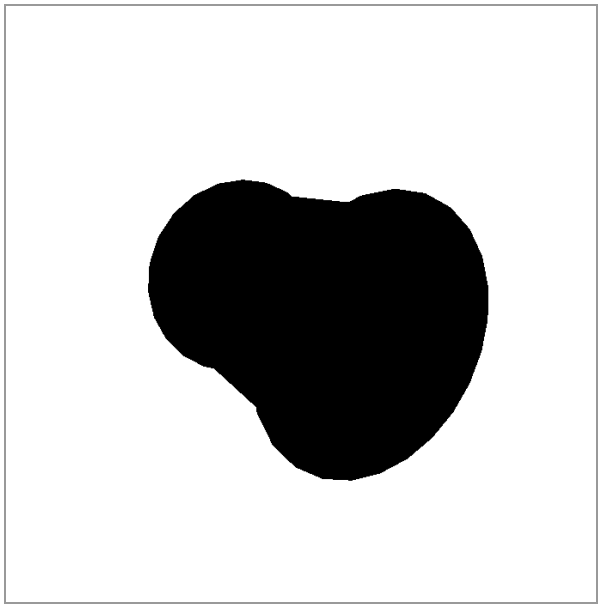
***Appendix F-1.*** *Cam 2.*



***Appendix F-2.*** *Cam Support Vert.*



***Appendix F-3.*** *Hole Guide.*



***Appendix F-4.*** *Roller.*

## References

[1] I. Law, *Gears & Gear Cutting: For Home Machinists*, Revised and updated ed., G. Bulliss, Ed. East Petersburg, PA: Fox Chapel Publishing, 2018.

[2] Engineezy, "I Built a Mechanical Flappy Bird Game," YouTube. [Online Video]. Available: https://www.youtube.com/watch?v=qcKArylBdE0. Accessed: 2 Dec. 2025.

[3] "Play Flappy Bird," flappybird.io. [Online]. Available: https://flappybird.io/. Accessed: 2 Dec. 2025.