Team 508: Drone Payload Sample Collection
Virtual Design Review 5

Team Introductions

Dominic Bellocchio
Design Engineer

Tauben Brenner
Manufacturing Engineer

Roberto Lacasa
Programming Engineer

Matthew Lancaster
Control Systems Engineer

Dylan Ma
Mechatronics Engineer

Sponsors and Advisor

Engineering Mentor
Alicia Washington
M&A Senior Project Manager
Dow Chemical

Engineering Mentor
Marcus Rideaux
Global Implementation Leader
Dow Chemical

Academic Advisor
Camilo Ordóñez, Ph.D.
ME Teaching Faculty
Florida State University

Objective

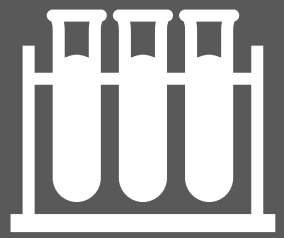
The payload should collect liquid samples, prevent contamination, and store the samples safely.

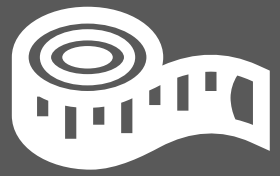
Harmful algae blooms are on the rise

Devastated ecosystems

The benefit of using a drone

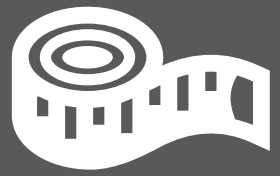
Project Requirements





Project Requirements

Collect and Store Multiple Samples



Project Requirements

Collect and Store Multiple Samples

Compact and Universal

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Collect and Store Multiple Samples

Compact and Universal

Does not impede drone

Project Requirements

- Collect and Store Multiple Samples
- Compact and Universal
- Does not impede drone
- Light & Balanced

Design Targets

Volume

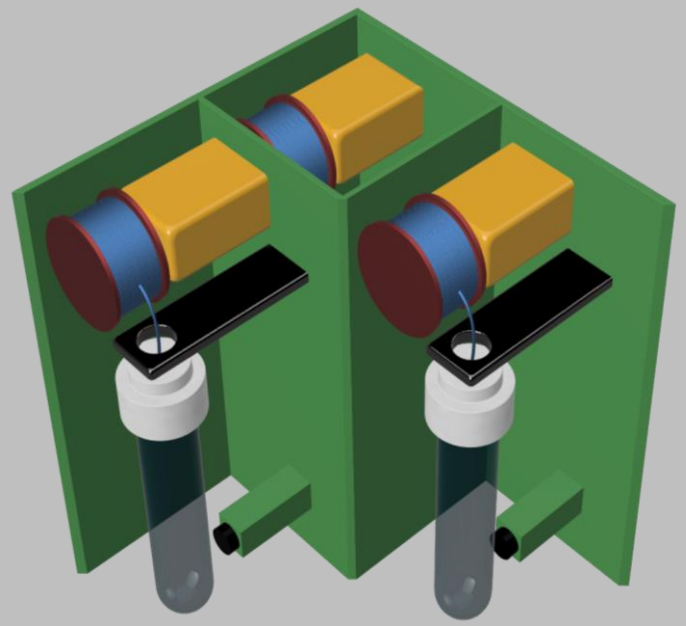
Force

Design Targets

Mounting Methods

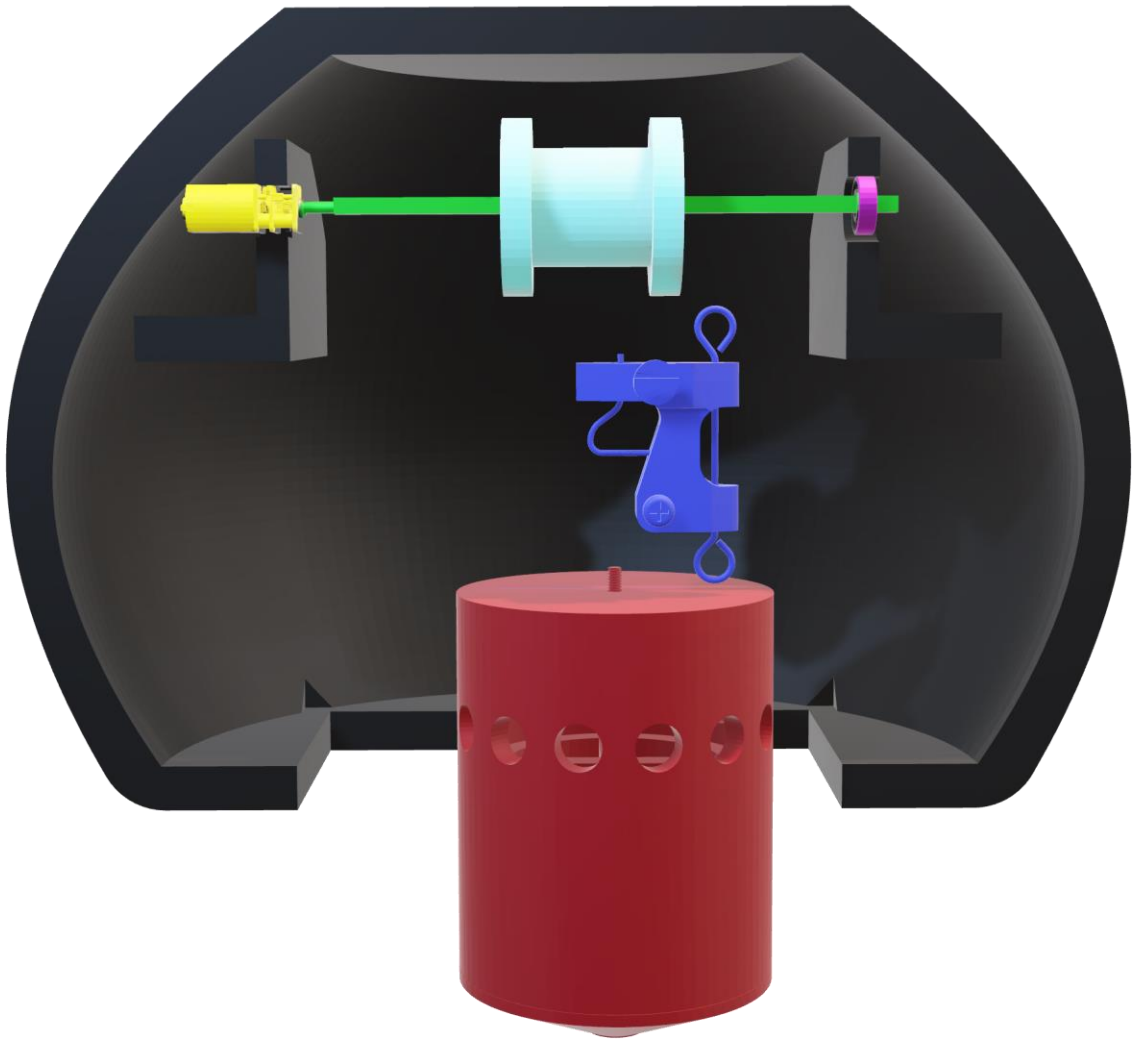
Weight Distribution

Concept Selection

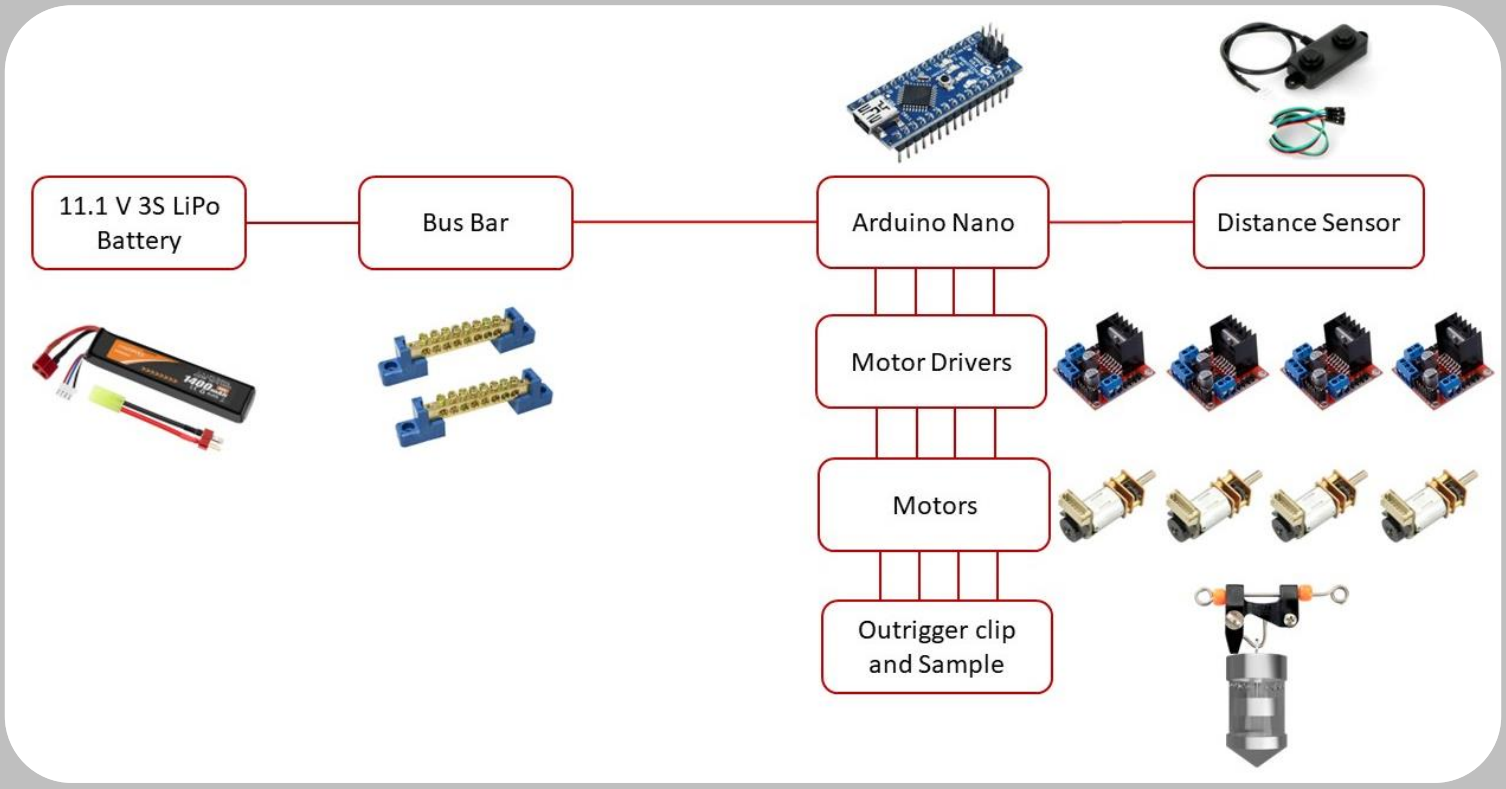


Multiple Rooms

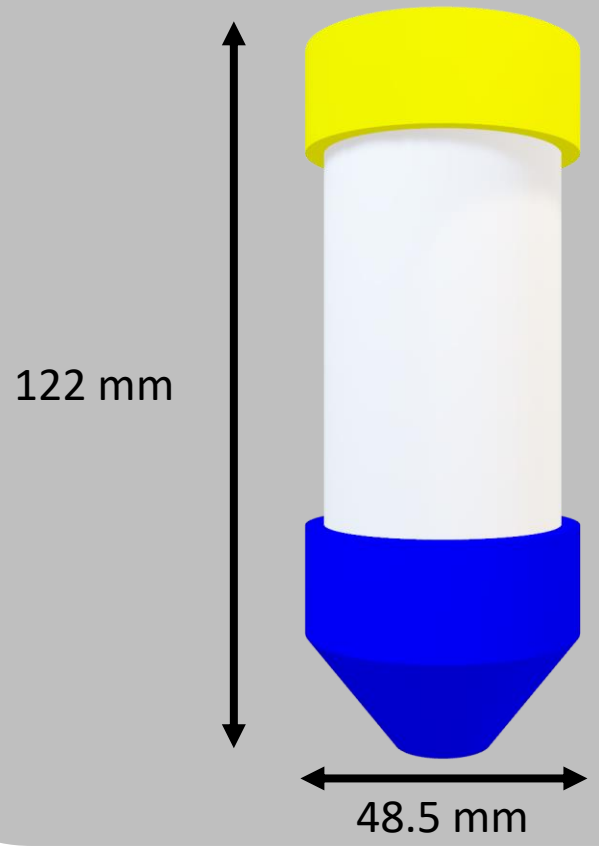
- Can collect multiple samples
- Adjustable number of rooms
- Universal drone usage



Mechatronic Diagram



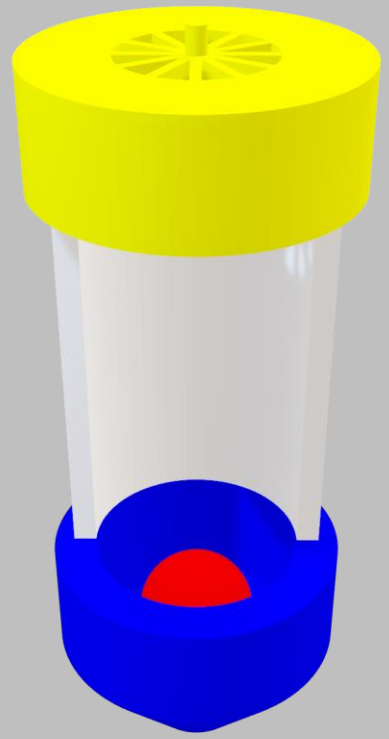
Design #1 Dimensions



Design #1 Overview

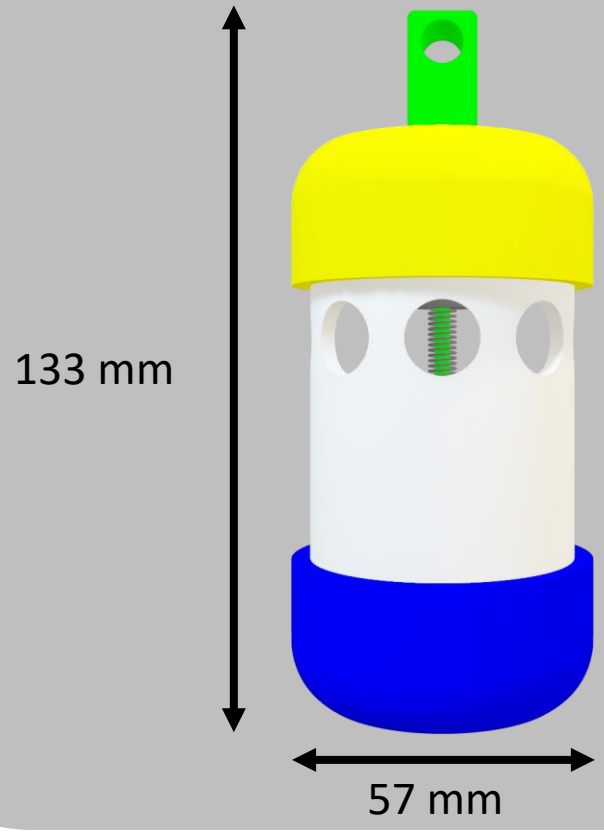
One way cap doesn't let solids in

Marble/rubber ball plugs hole



Funnel prone to leaking

Design #2 Dimensions

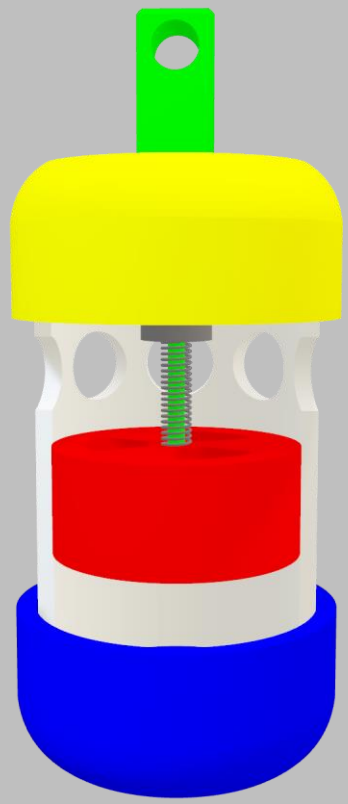


Design #2 Overview

Connects to outrigger clip

Spring compresses to seal

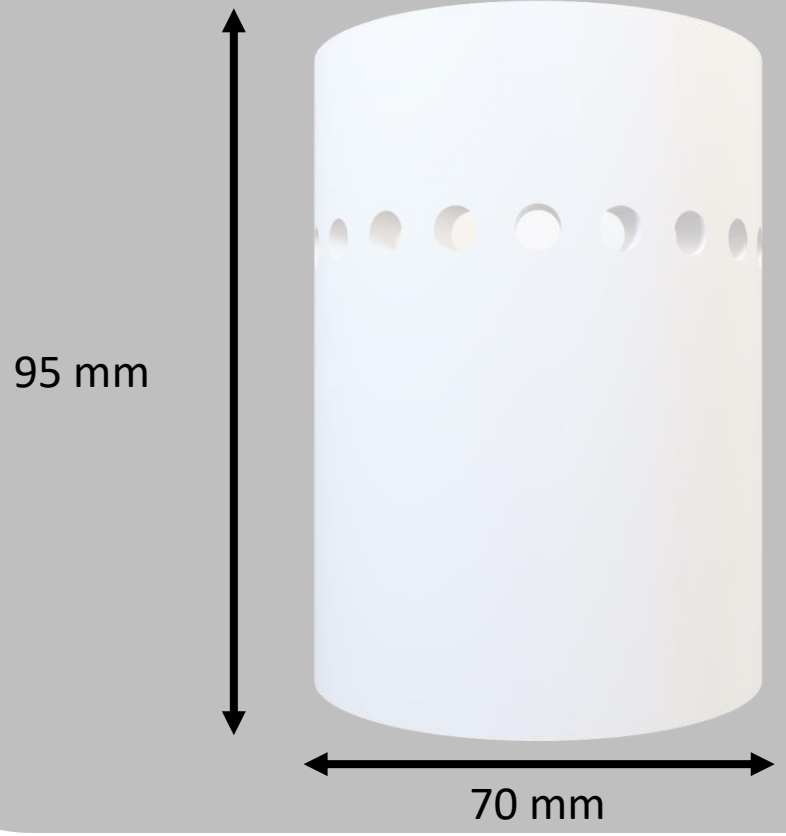
Smooth lid press fit



Holes allow water and algae inside (~80-90 mL)

Plunger allows water in from top but seals side

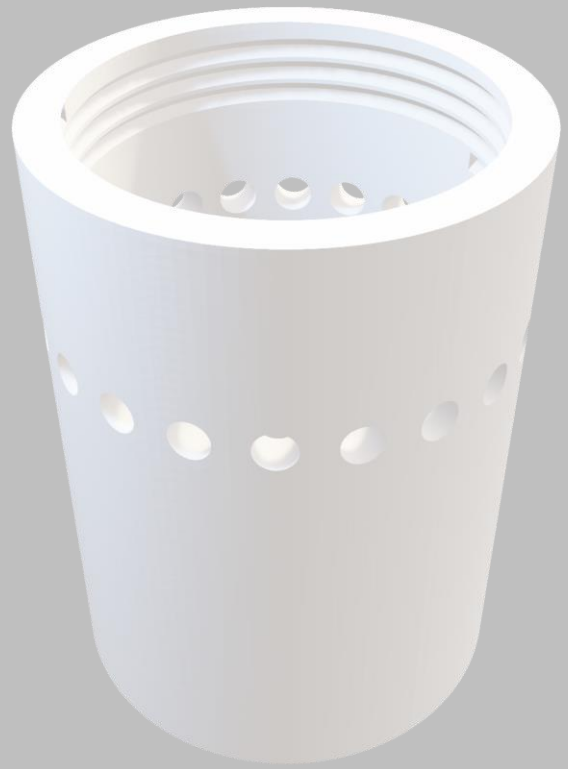
Design #3 Dimensions



Design #3 Overview

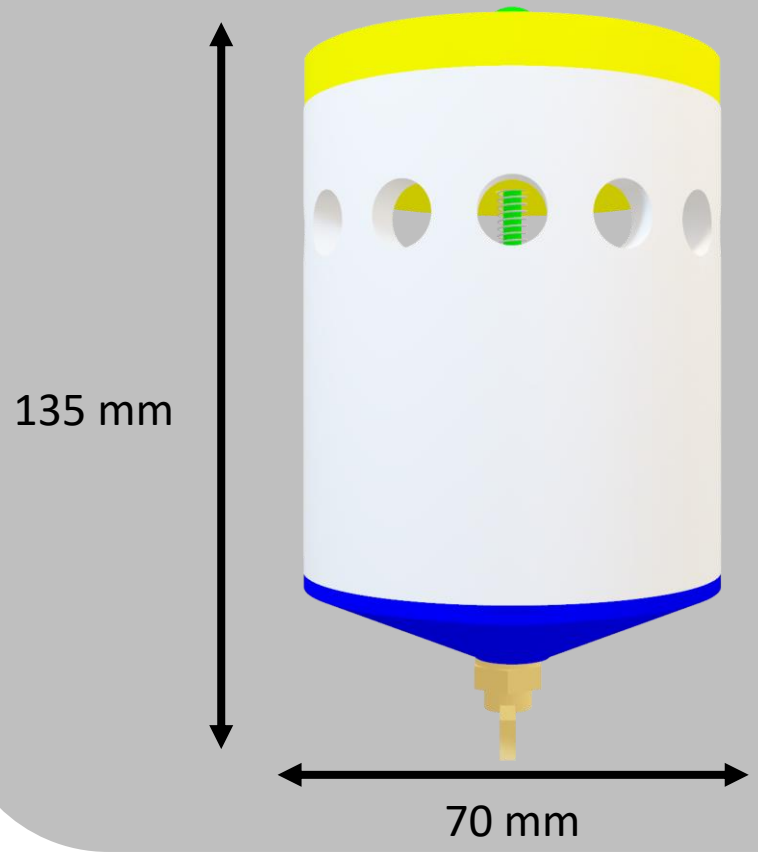
Threaded ends allow for screwed caps

Clear cast acrylic holds ~150-160 mL



Smaller holes to increase wall strength

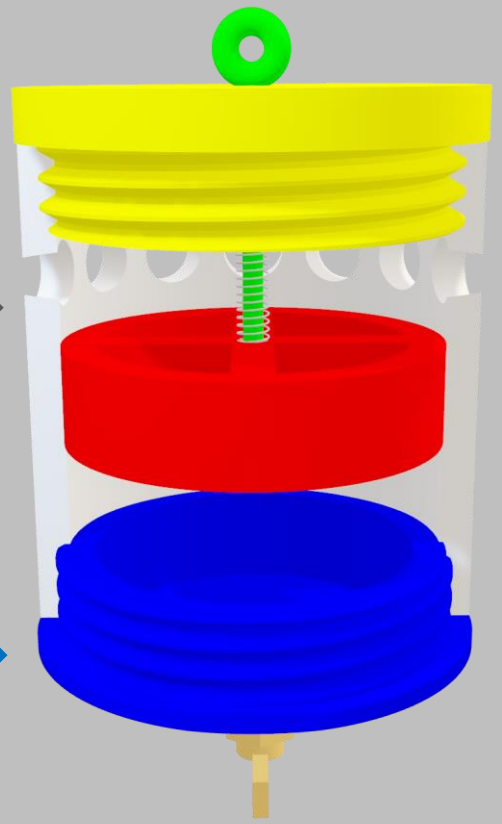
Current Design Dimensions



Current Design Overview

Corrosion-resistant with higher spring constant

Threaded caps for security

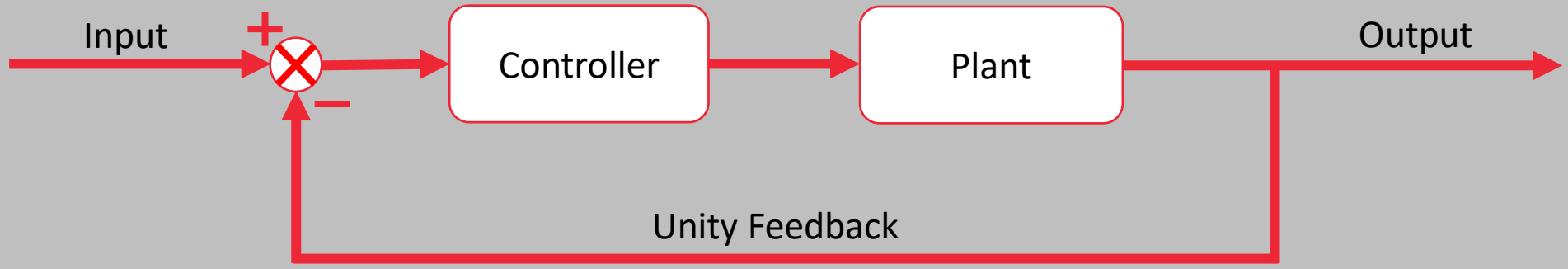


10 mm holes; Resin container holds ~160 mL

Larger holes but relative size of plunger was reduced

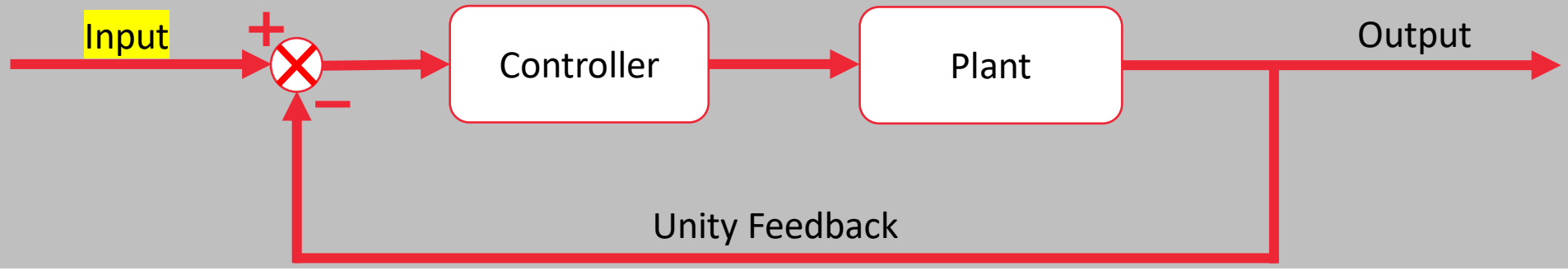
Faucet valve releases water and algae

Mechatronics and Controller



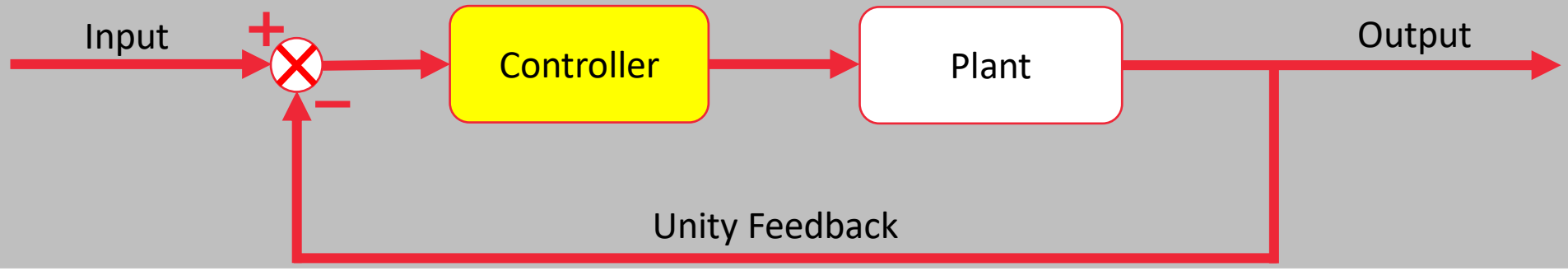
Mechatronics and Controller

- Sensors communicate distance to water
- Arduino converts distance to encoder steps



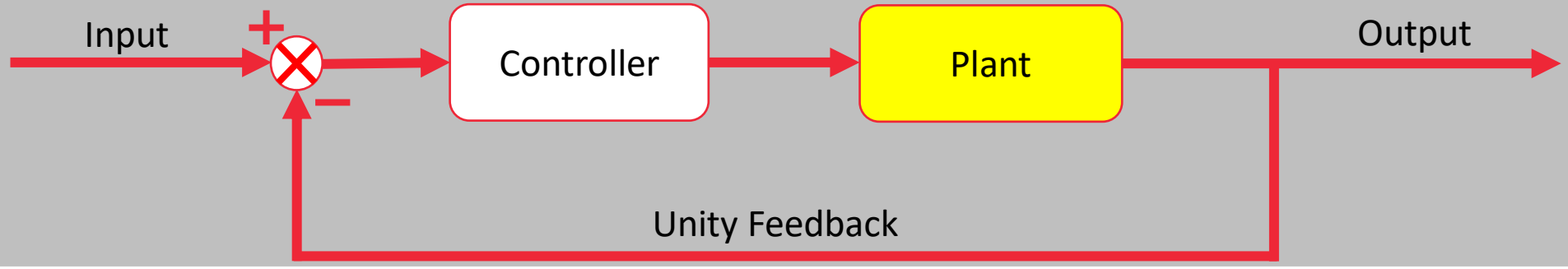
Mechatronics and Controller

- Proportional Derivative Controller
- $K_P = 1, K_D = 0.025$



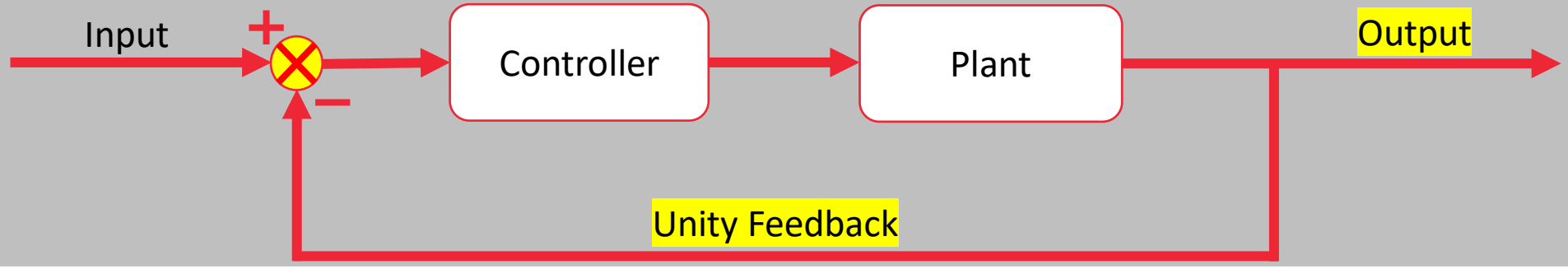
Mechatronics and Controller

- DC micro motor, GR: 236:1
- Hall effect encoder with 5320 resolution



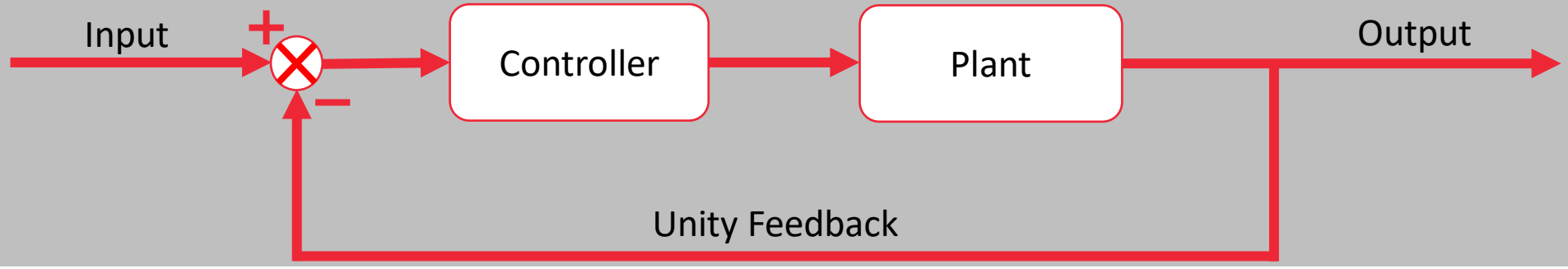
Mechatronics and Controller

- Output is duty cycle sent to motor
- Feedback is sent to summing junction
- Error is calculated and PD controller takes effect

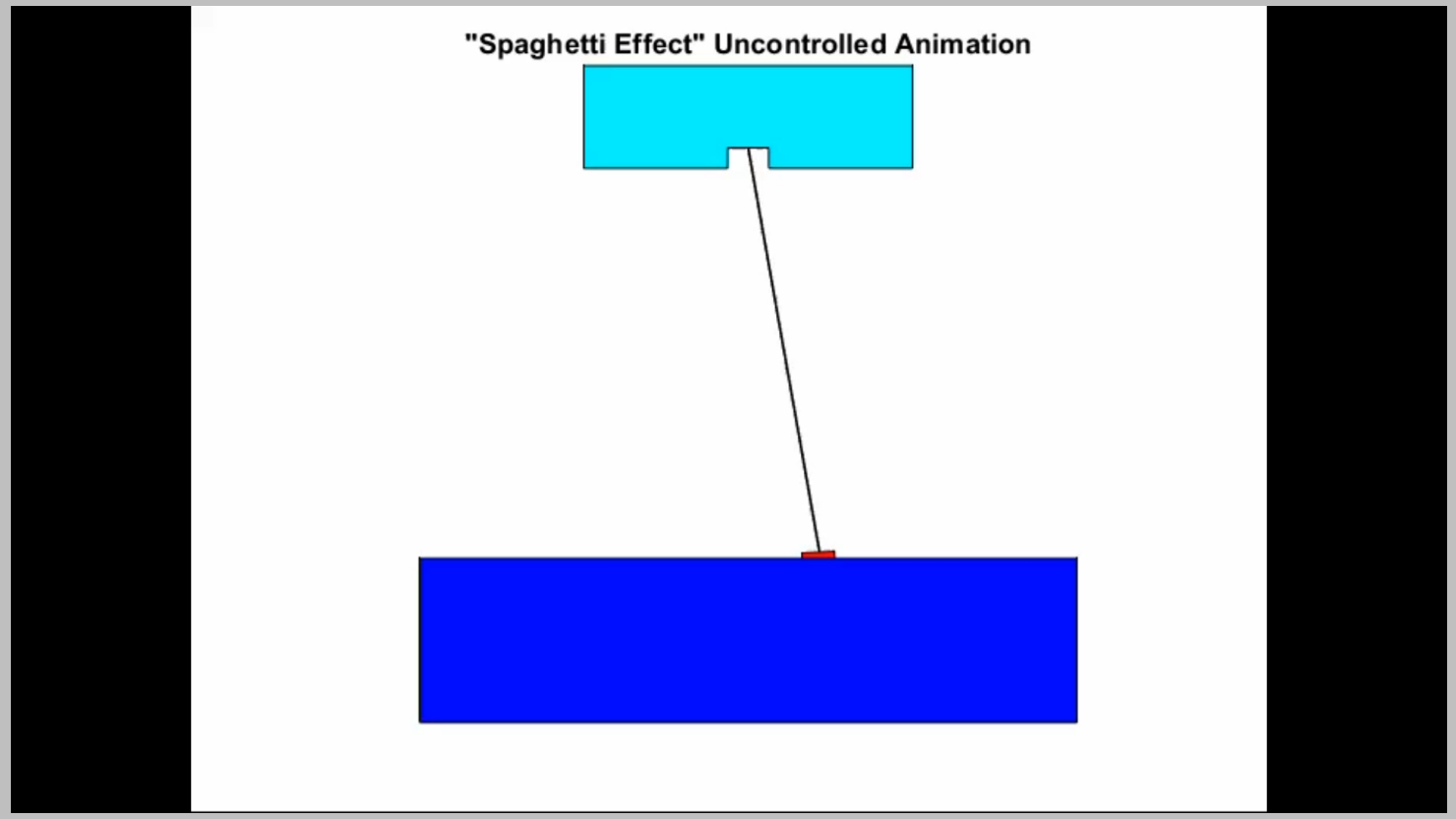


Mechatronics and Controller

- Averaging less than 1% of error
- This translates to 50 encoder steps
- With current spool diameter, the error is 1.5 mm



Simulations



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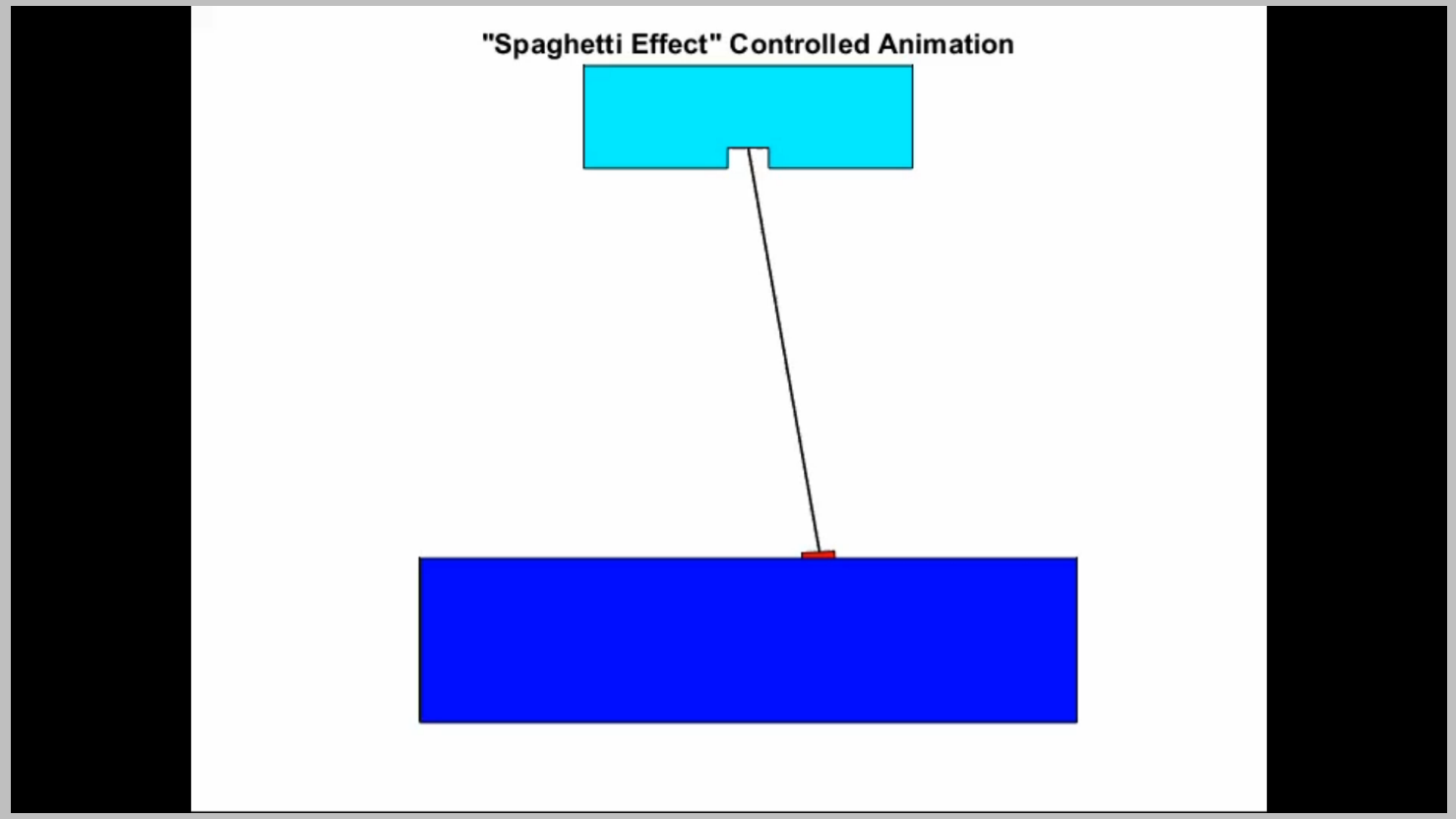


Seek Together™

Drone Payload Sample and Collection Work Breakdown Structure

Refined Sample Prototype

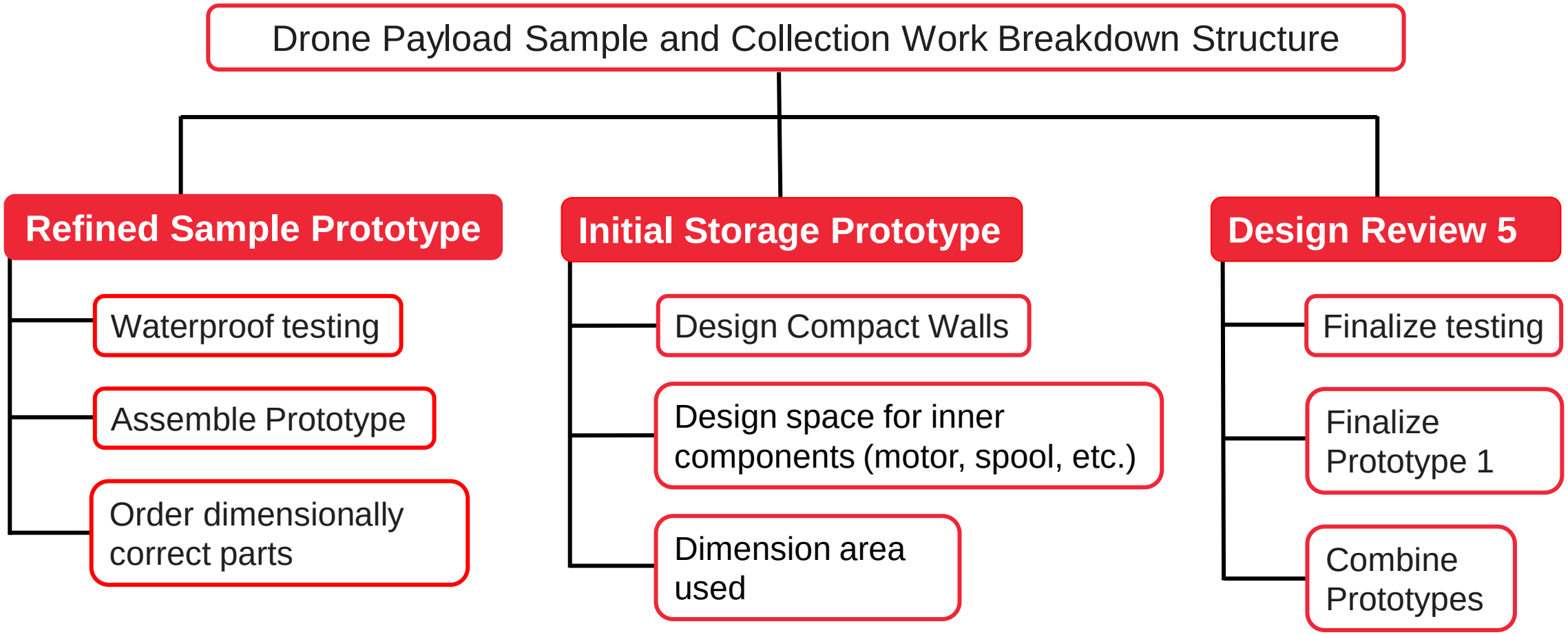
- Waterproof testing
- Assemble Prototype
- Order dimensionally correct parts

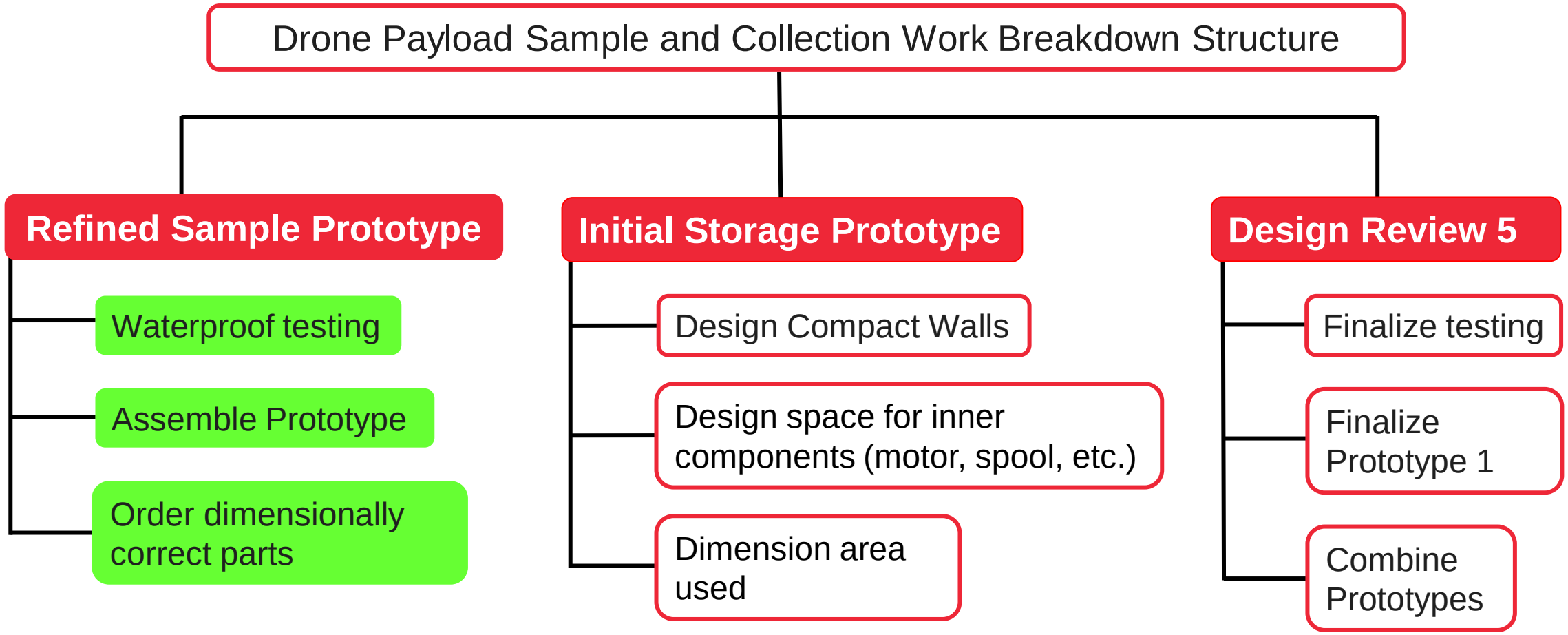
Initial Storage Prototype

- Design Compact Walls
- Design space for inner components (motor, spool, etc.)
- Dimension area used

Design Review 5

- Finalize testing
- Finalize Prototype 1
- Combine Prototypes

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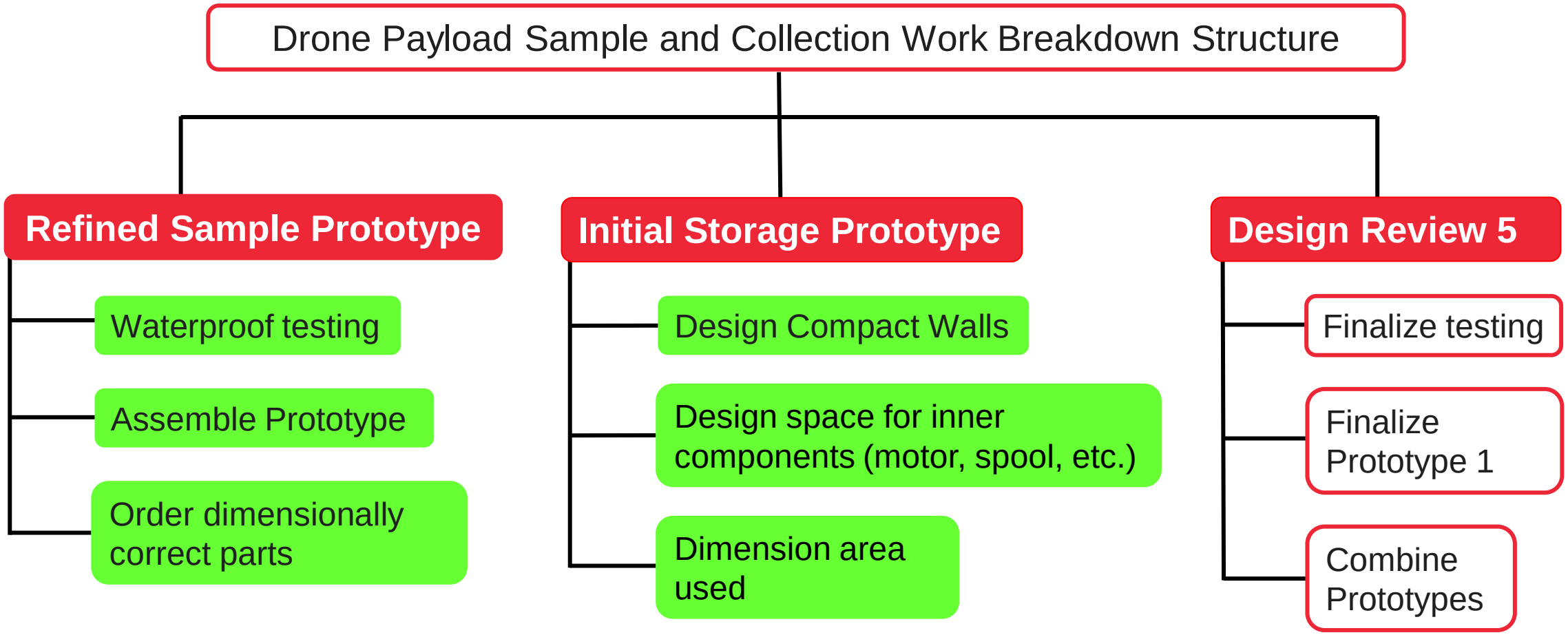

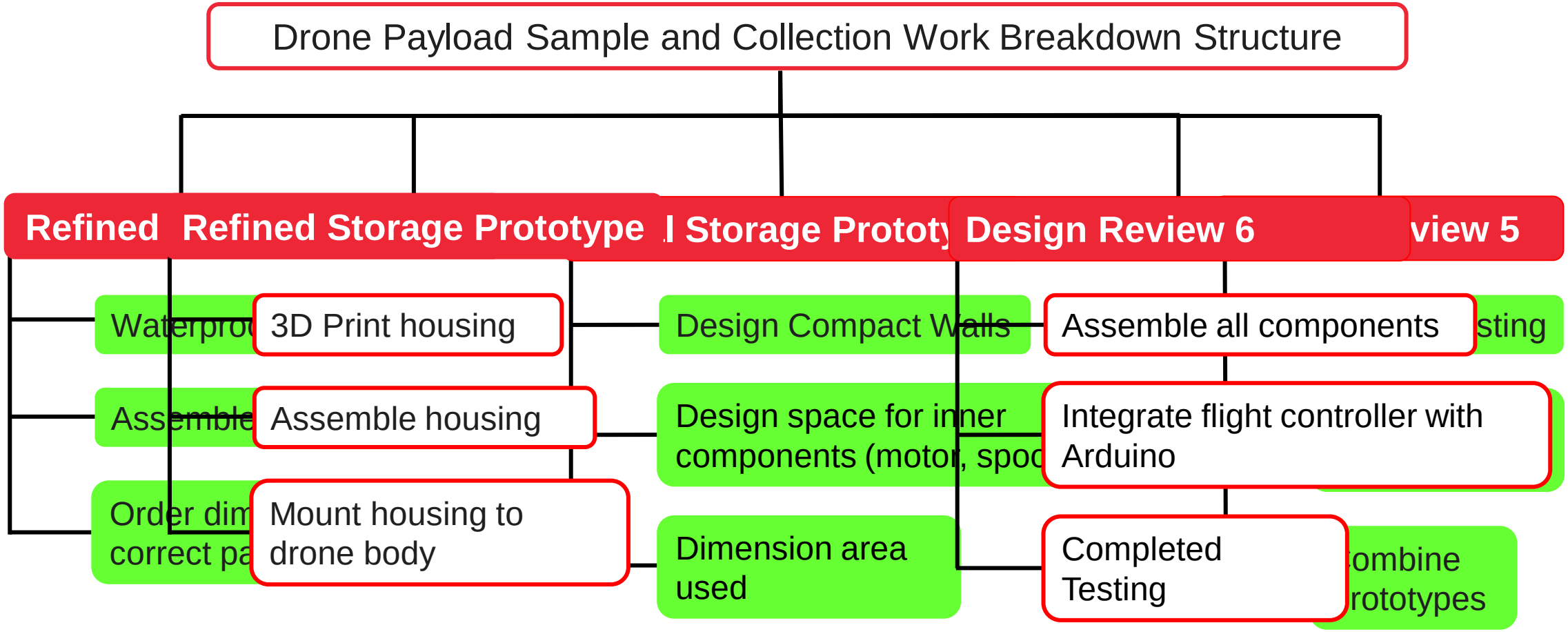
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Refined
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Dimension area used
Completed Testing
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Seek Together™

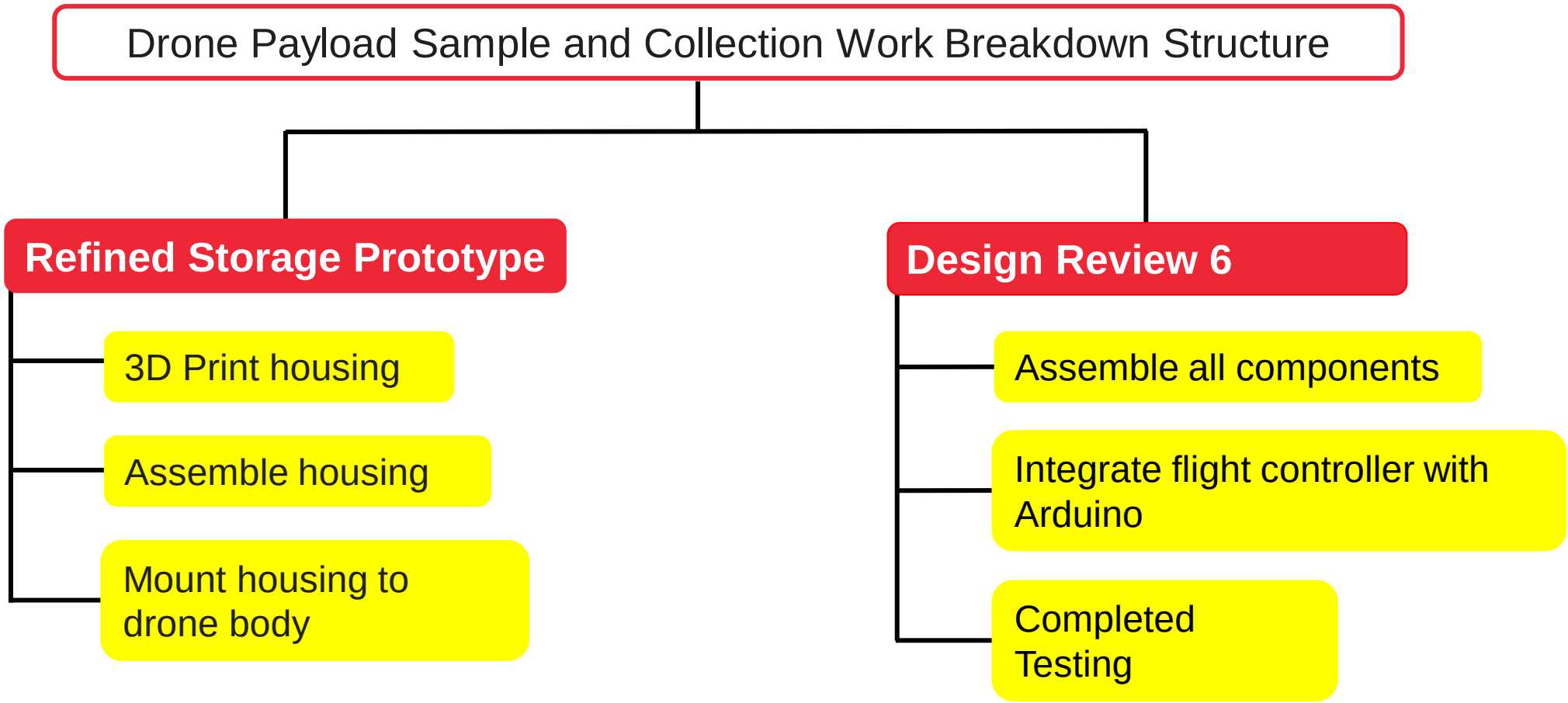
Drone Payload Sample and Collection Work Breakdown Structure

Refined Storage Prototype

- 3D Print housing
- Assemble housing
- Mount housing to drone body

Design Review 6

- Assemble all components
- Integrate flight controller with Arduino
- Completed Testing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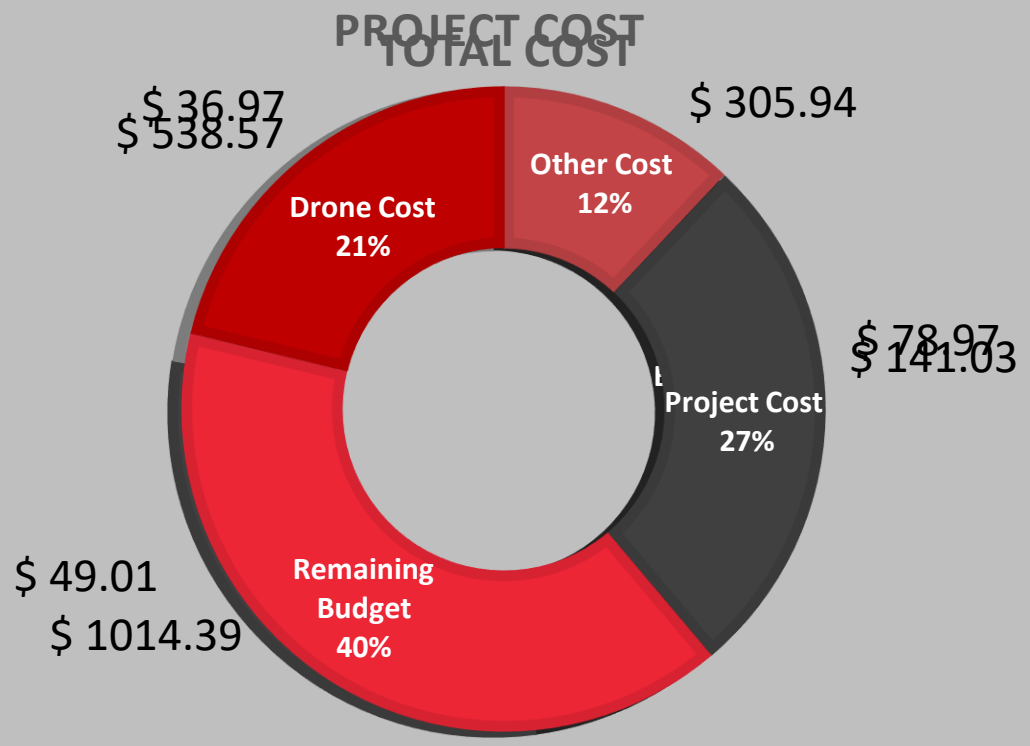
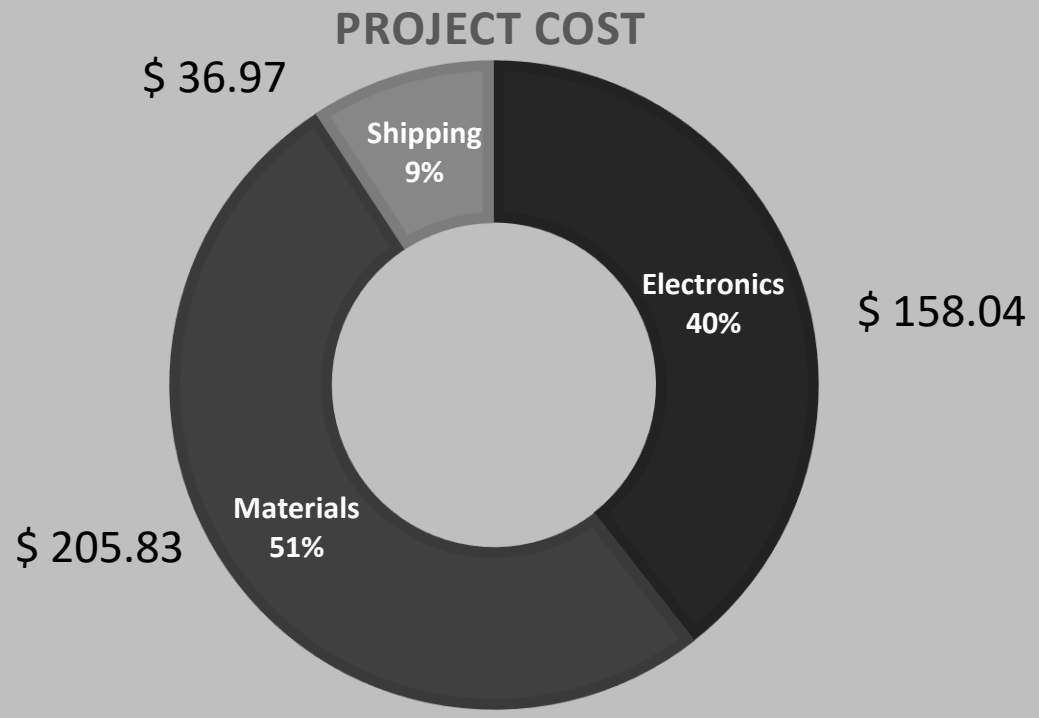
Budget Costs



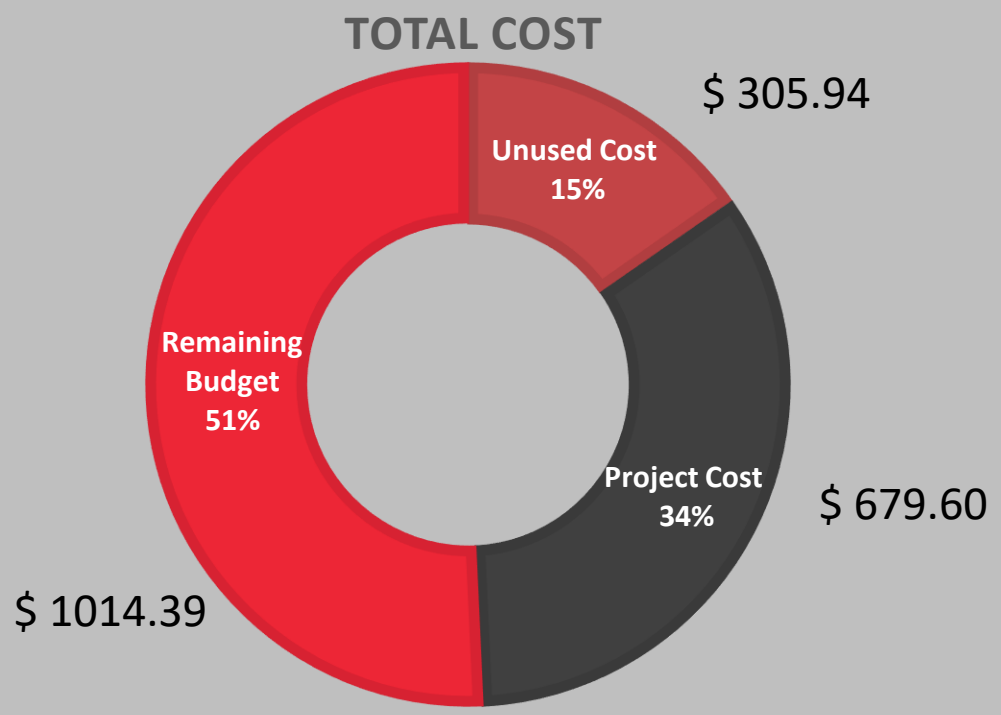
Questions?

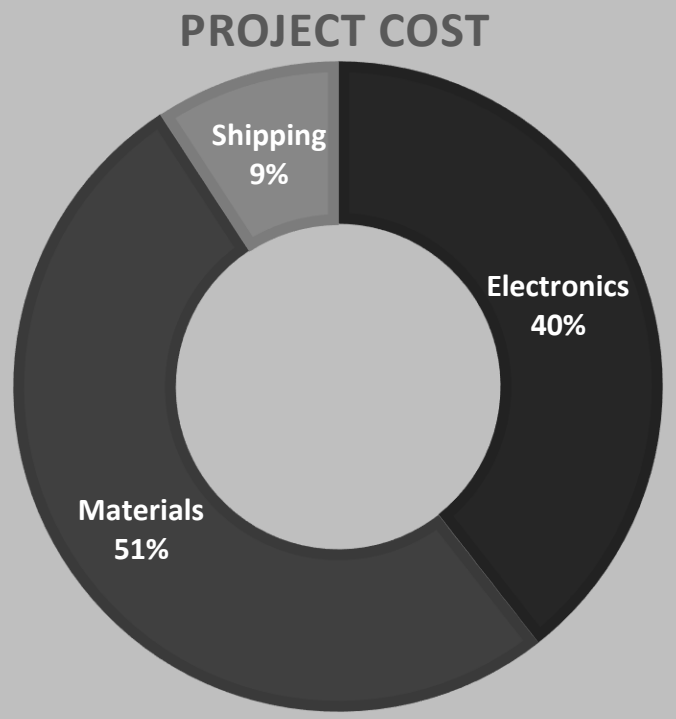
Backup Slides

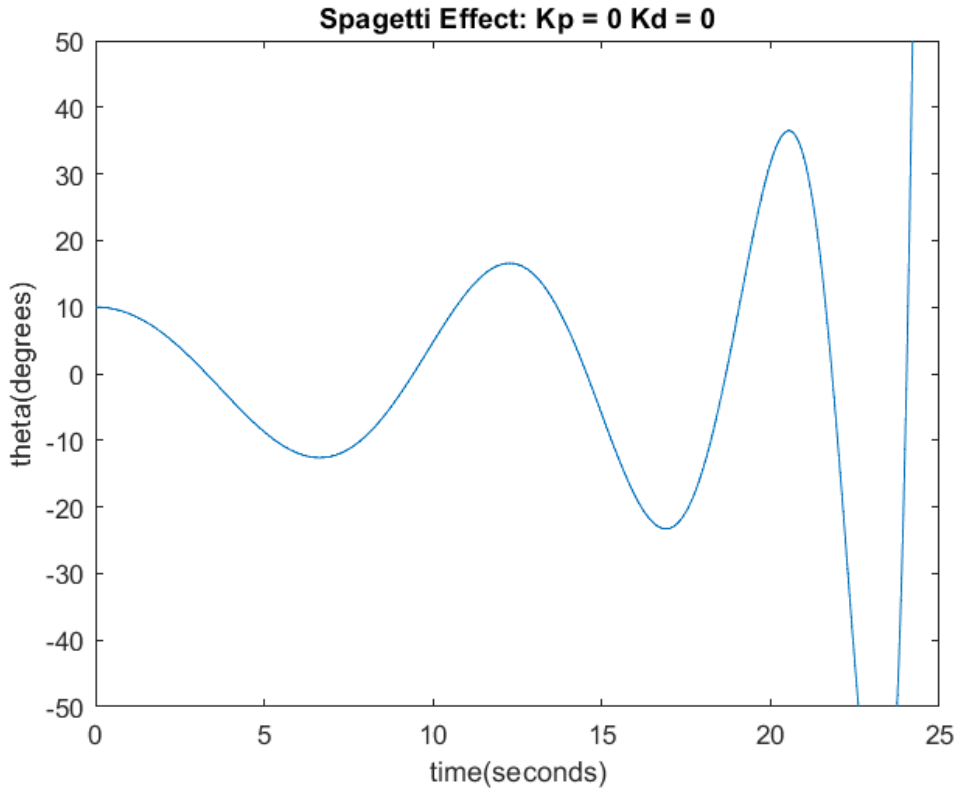
Budget Costs

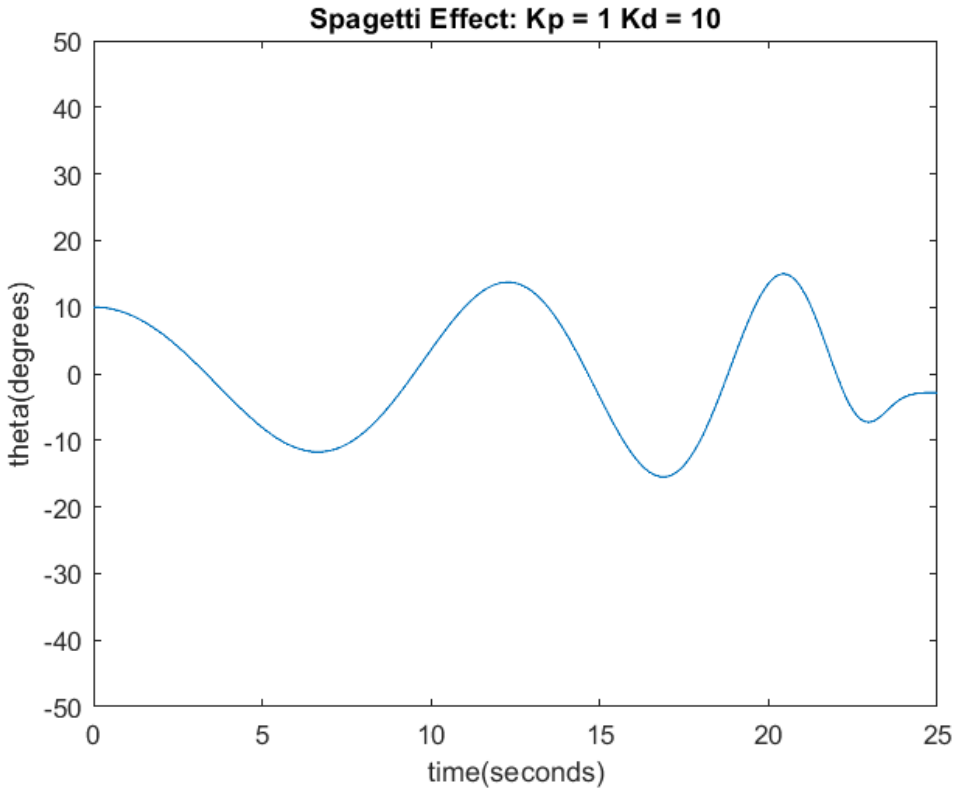


Budget Costs



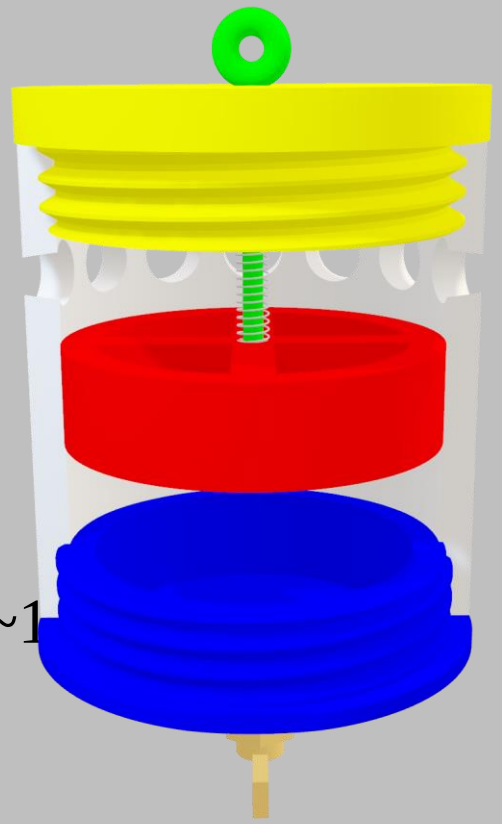



Spagetti Effect: Kp = 0 Kd = 0
theta(degrees)
time(seconds)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
5
10
15
20
25

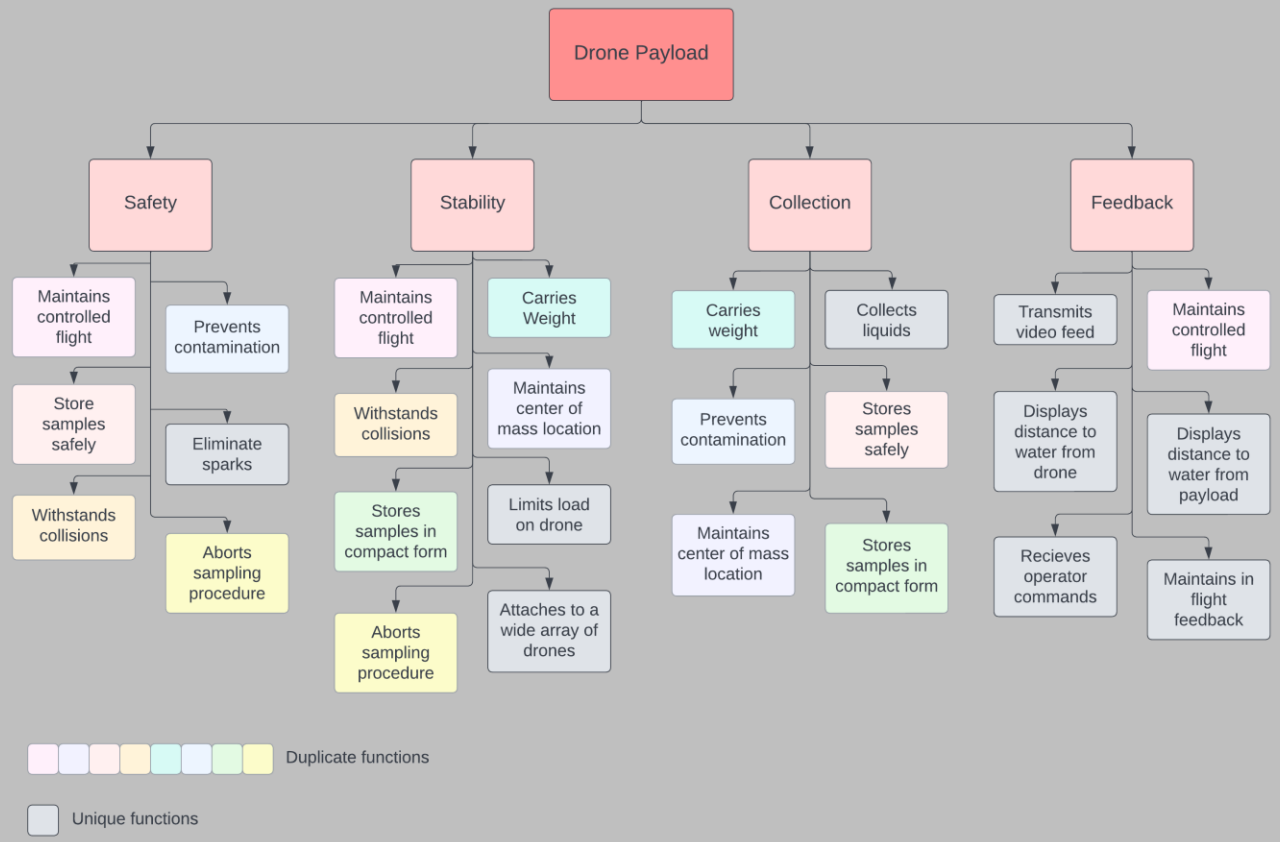

Spagetti Effect: Kp = 1 Kd = 10
theta(degrees)
time(seconds)
50
40
30
20
10
0
-10
-20
-30
-40
-50
0
5
10
15
20
25

Current Design Overview

- Material: Resin
- New Features:
  - 0.4 inch diameter holes
  - Faucet valve
  - Functional threading
  - Stronger spring constant
- Weight: 240 g (empty)
- Collection Capacity: 160 mL (~1



Functional Decomposition



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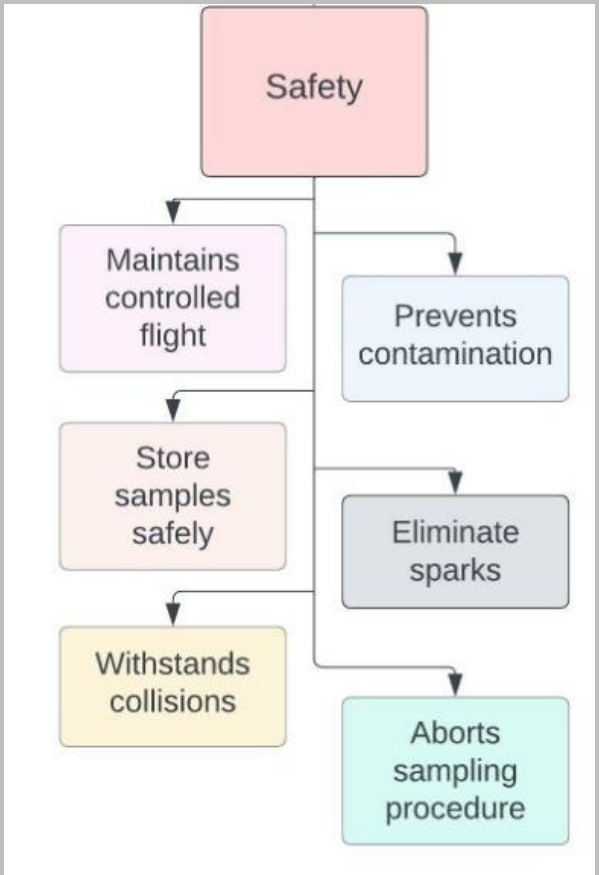

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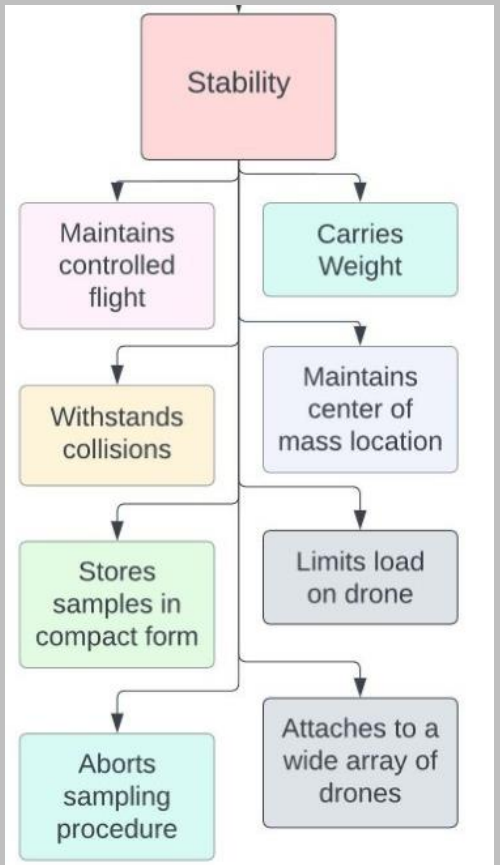

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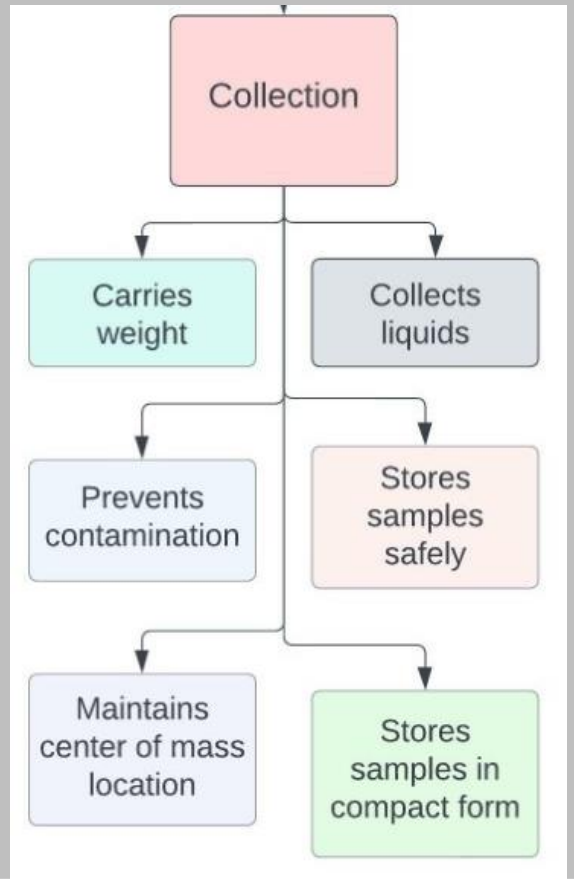
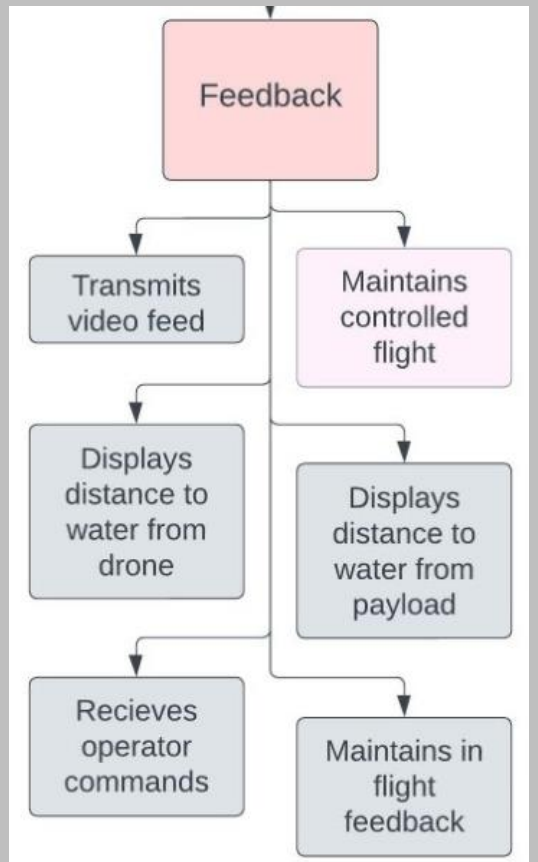
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