

CONCEPTUAL DESIGN

GNG1103, Section # F, Team # F3

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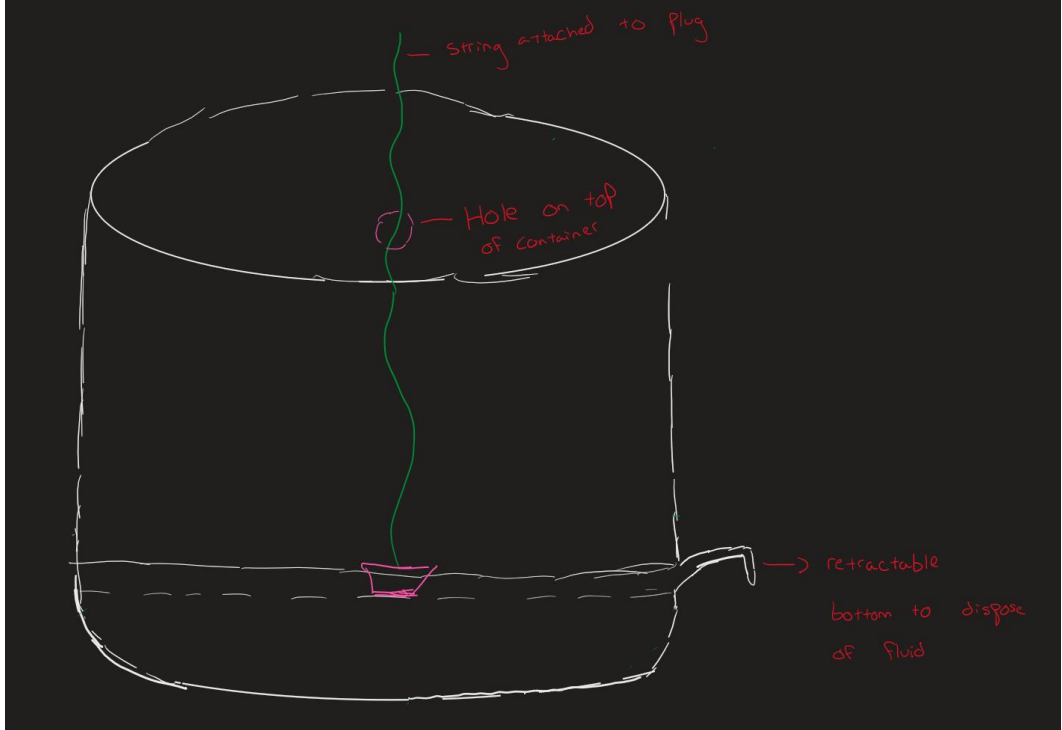
February 11, 2024

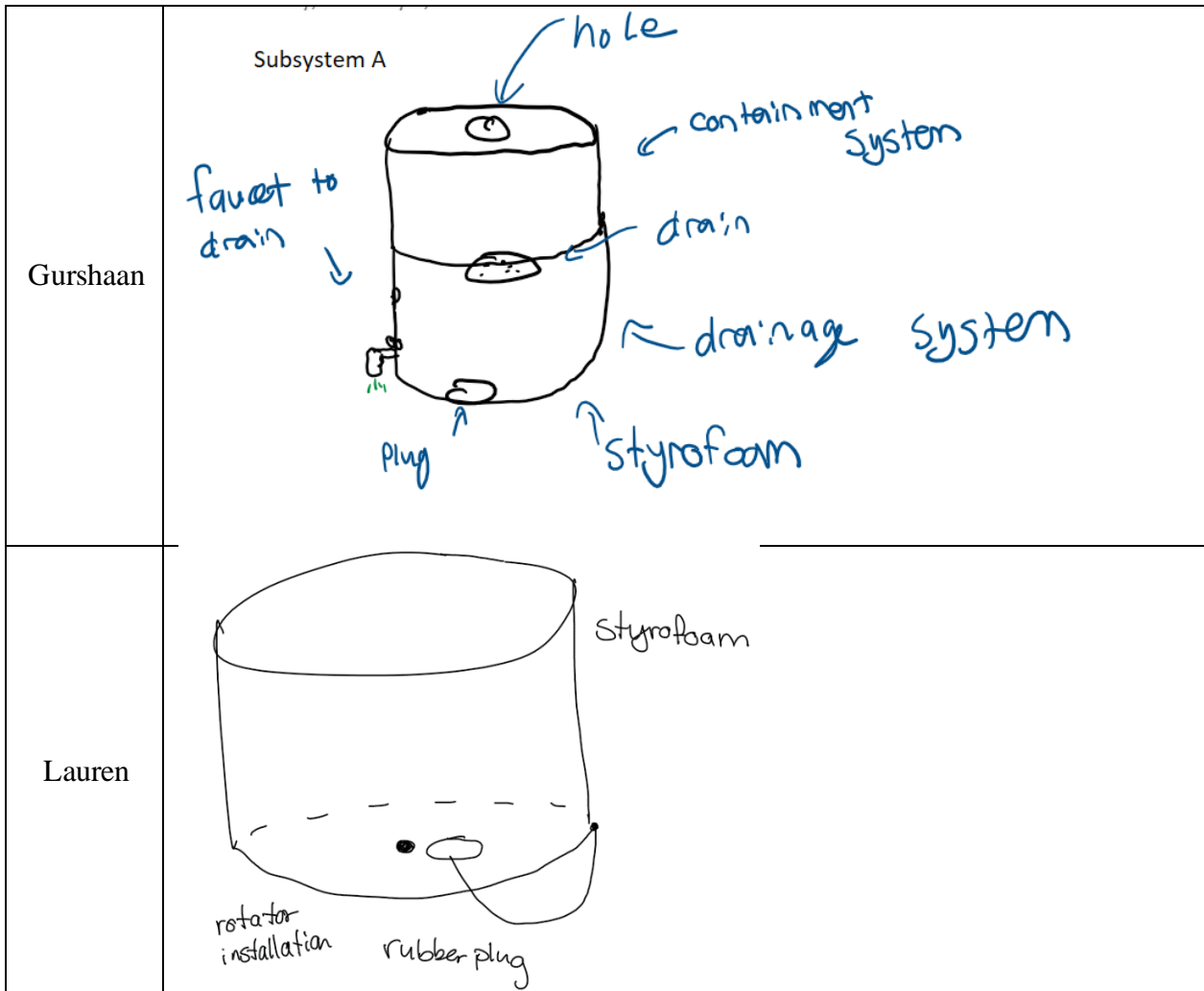
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1.0 List of Subsystems

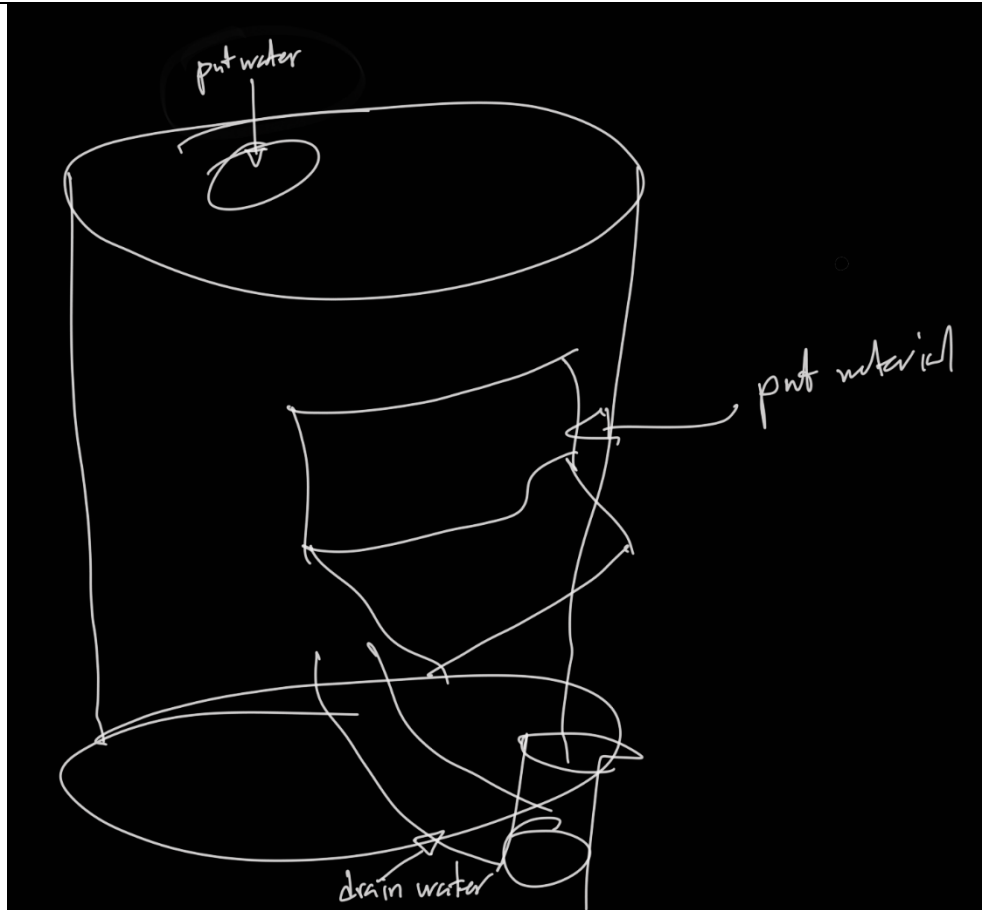
- A. Containment & drainage
- B. Debris analysis
- C. Physical components of rotator mechanism
- D. Rotator control
- E. Installation of sample
- F. Physical components of heating system
- G. Control of heating system

1.1 Subsystem A

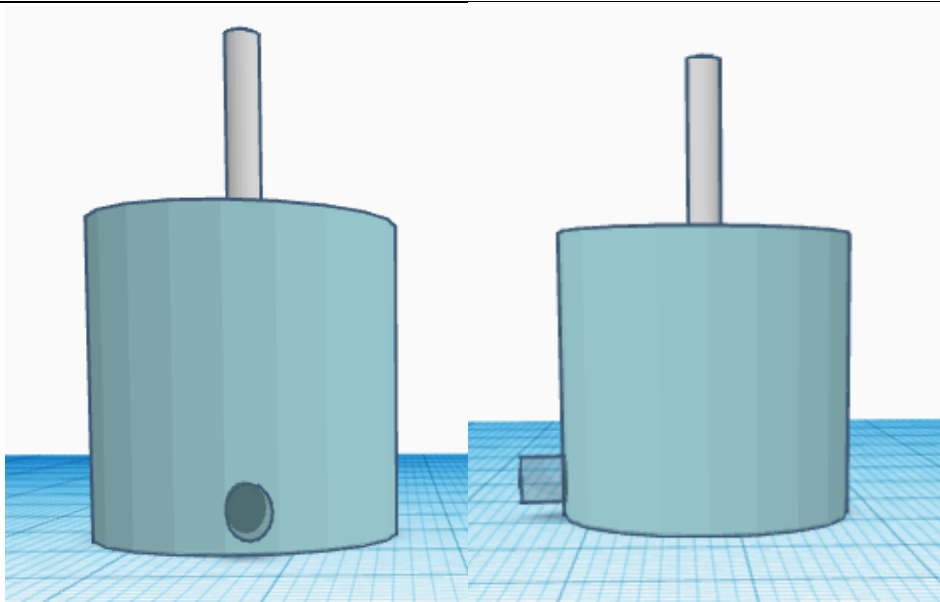
Name	Solution
Ahmad	 <p>The diagram shows a cylindrical container with a hole on top. A string is attached to a plug in the hole. The bottom of the container is retractable, allowing for the disposal of fluid. The container is filled with a liquid, and a small pink rectangular object is shown at the bottom.</p> <p>— String attached to Plug</p> <p>— Hole on top of container</p> <p>→ retractable bottom to dispose of fluid</p>



Sendwe

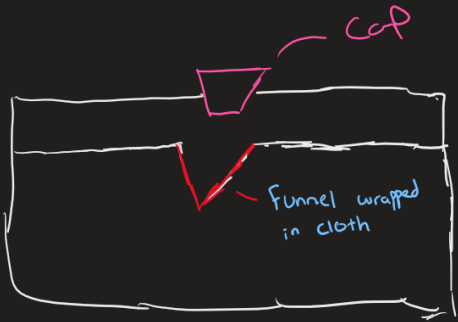
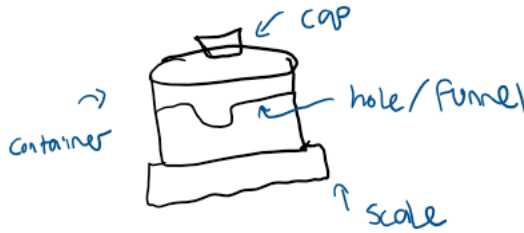
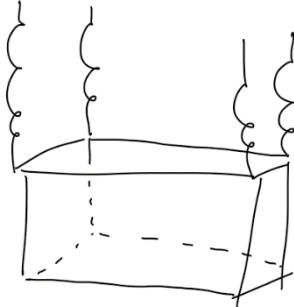


Yusra



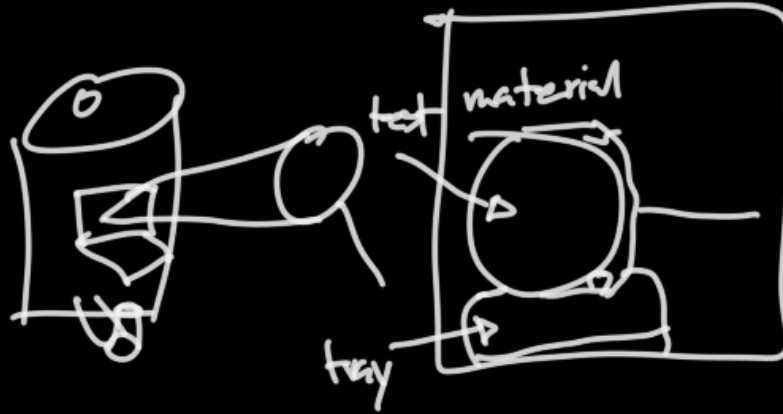
Just has a spout coming out of it. The cylinder is plastic, and it's see-through.

1.2 Subsystem B

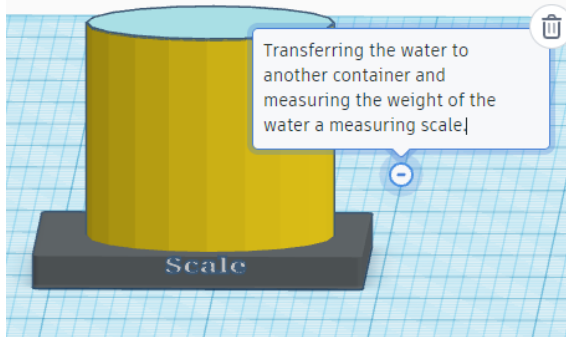
Name	Solution
A	 <p data-bbox="868 483 1331 609">Funnel is easily removed and semi-permeable</p>
G	
L	 <p data-bbox="673 1071 917 1144">springs to measure force (i.e. weight)</p> <p data-bbox="925 1291 1331 1333">or a cylinder with three springs</p>

B. Debris Analysis

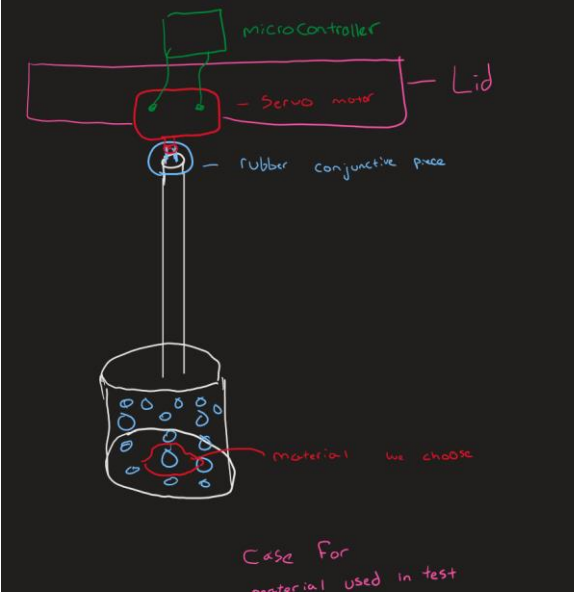
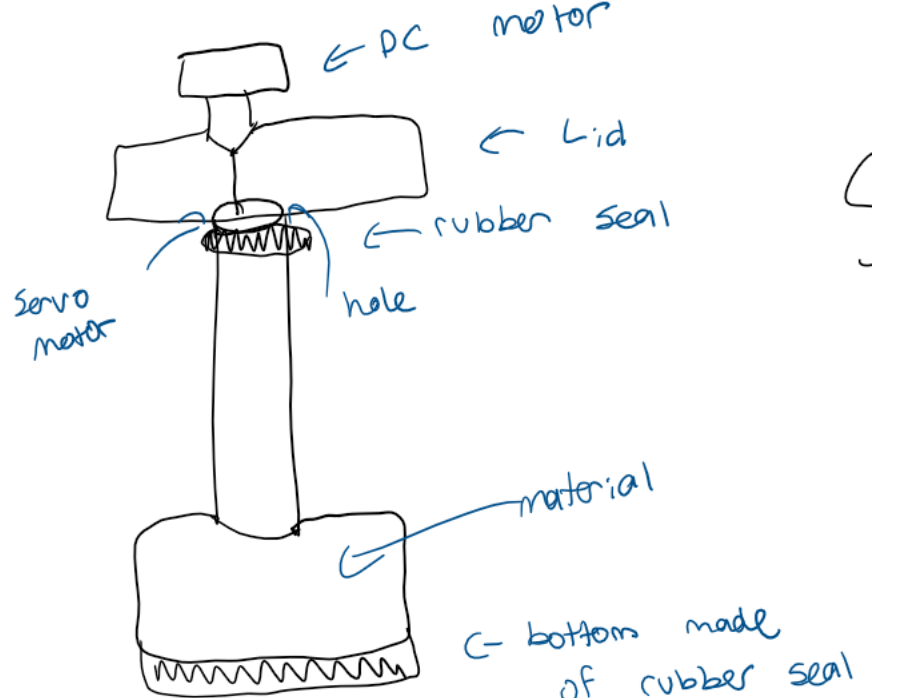
S

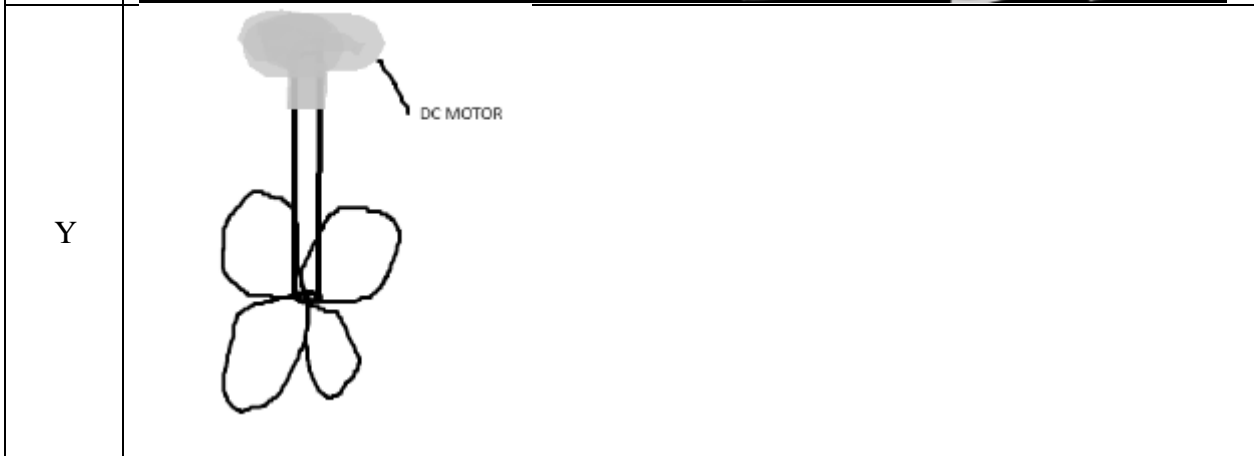
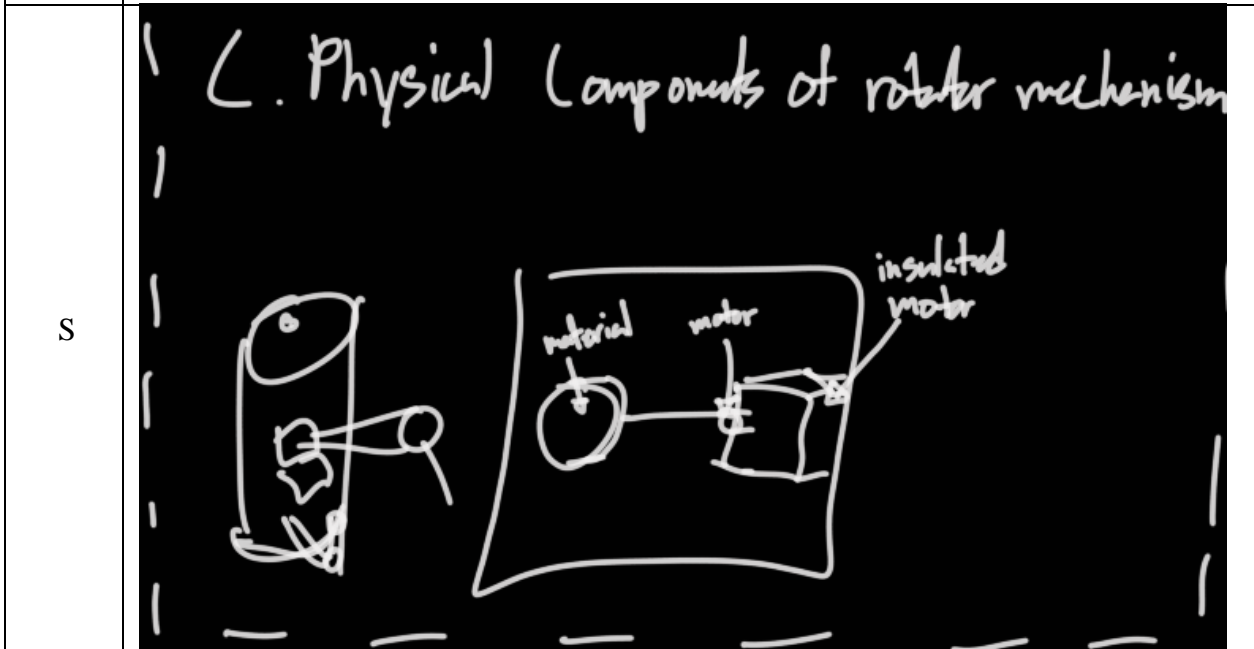
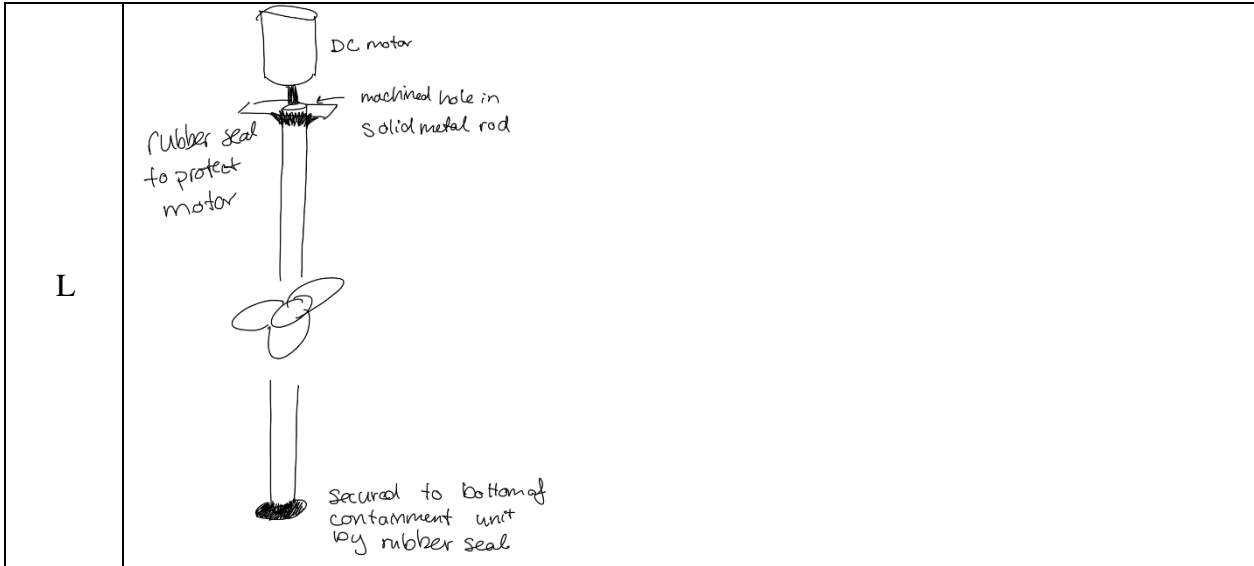


Y

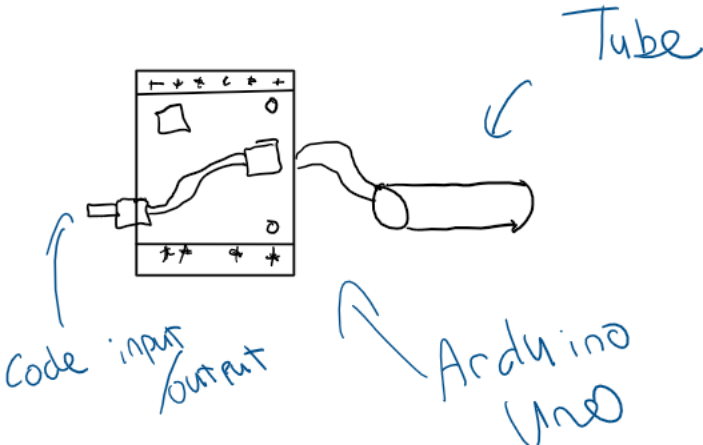
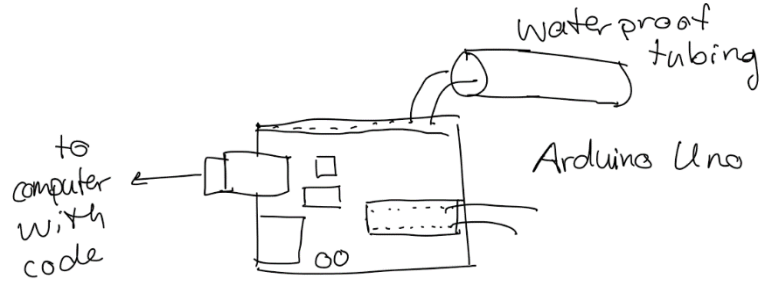


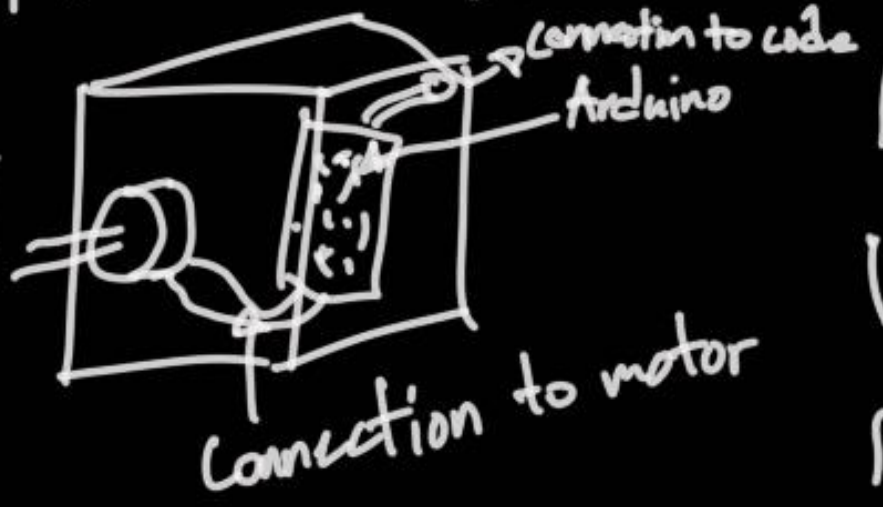
1.3 Subsystem C

Name	Solution
A	 <p>microController</p> <p>Servo motor</p> <p>Lid</p> <p>Rubber conjunctive piece</p> <p>material we choose</p> <p>Case For material used in test</p>
G	 <p>DC motor</p> <p>Servo motor</p> <p>Lid</p> <p>rubber seal</p> <p>hole</p> <p>material</p> <p>bottom made of rubber seal</p>

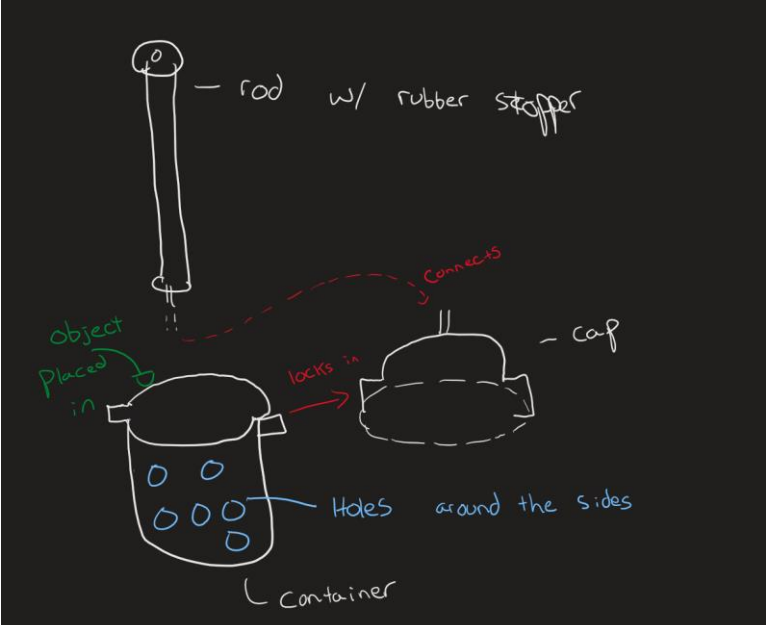
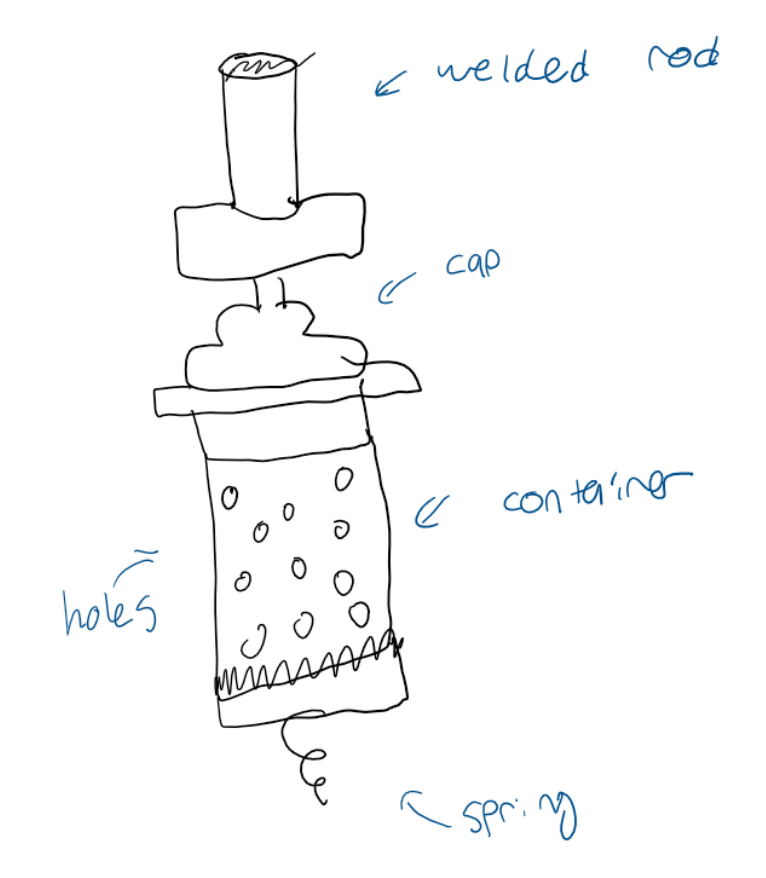


1.4 Subsystem D

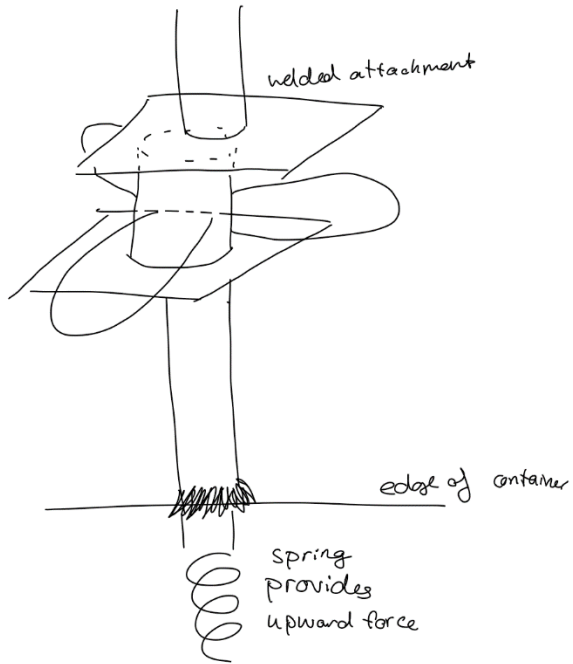
Name	Solution
A	Same as Lauren's design
G	 <p>A hand-drawn diagram showing a rectangular box representing a subsystem. On the left side of the box, there are two ports labeled "Code input" and "Code output" with arrows pointing into and out of the box. On the right side, a cylindrical "Tube" is connected to the box. Below the box, the text "Arduino Uno" is written with an arrow pointing to the box.</p>
L	 <p>A hand-drawn diagram showing a rectangular box representing a subsystem. On the left side, there is a port labeled "to computer with code" with an arrow pointing away from the box. On the top right side, a cylindrical "Waterproof tubing" is connected to the box. Below the box, the text "Arduino Uno" is written.</p>

S	<h1>D. Rotator Control</h1>  <p>Connection to code</p> <p>Arduino</p> <p>Connection to motor</p>
Y	Same as Lauren and Gurshaaan's design

1.5 Subsystem E

Name	Solution
A	 <p>A hand-drawn diagram on a black background. At the top, a vertical rod with a small circle at the top is labeled "rod w/ rubber stopper". Below it, a dashed red arrow labeled "Connects" points to a cap. To the left, a container with several small circles inside is labeled "Container". A green arrow labeled "object placed in" points into the container. A red arrow labeled "locks in" points from the container to the cap. The cap is labeled "cap" and has a dashed line around its base. The container has several small circles inside, labeled "Holes around the sides".</p>
G	 <p>A hand-drawn diagram on a white background. At the top, a vertical rod is labeled "welded rod". Below it is a cap labeled "cap". Below the cap is a container labeled "container" with several small circles inside, labeled "holes". At the bottom of the container, there is a spring labeled "spring".</p>

L



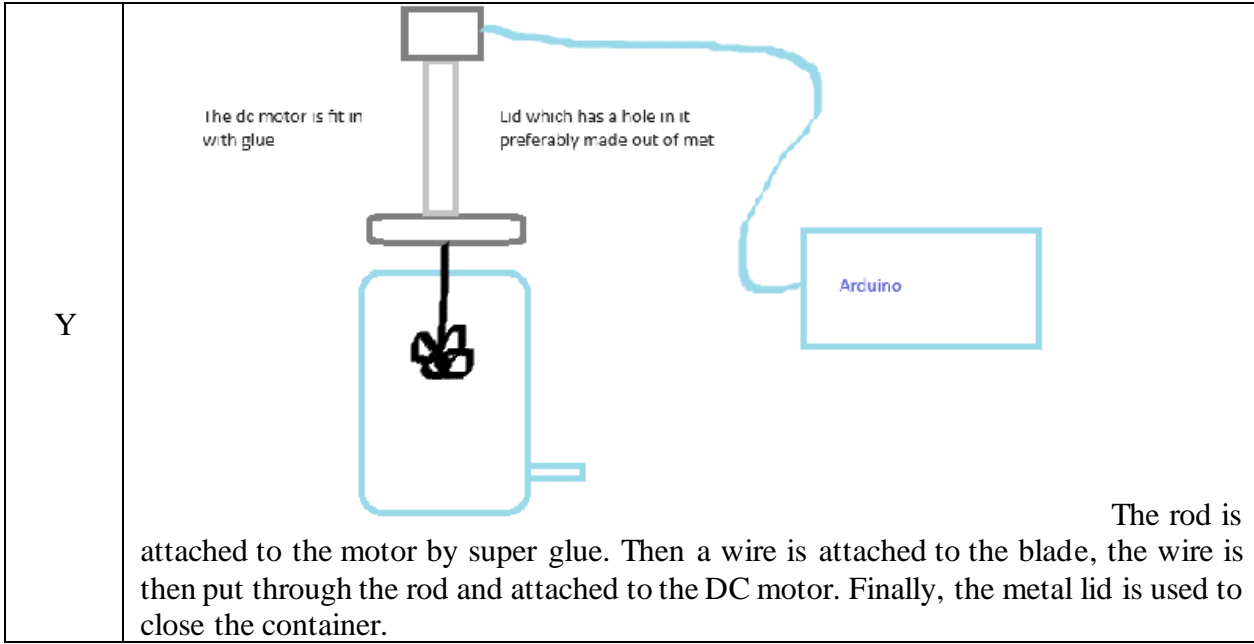
S

(E. Instillation Sample)

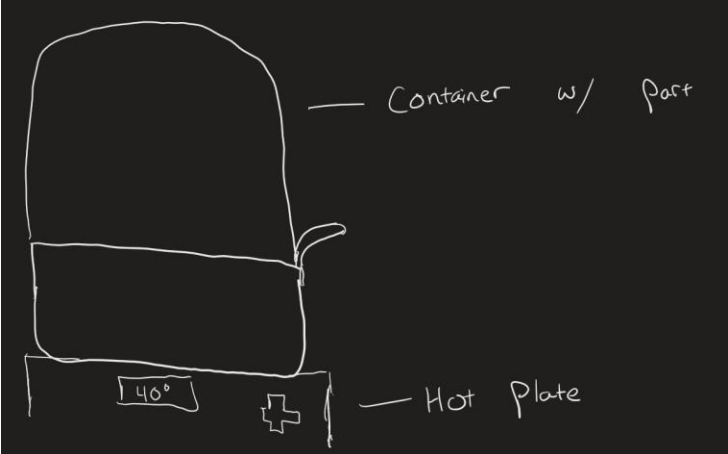
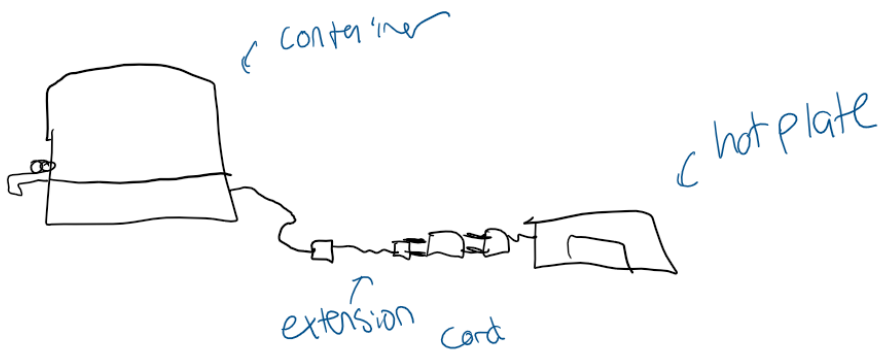
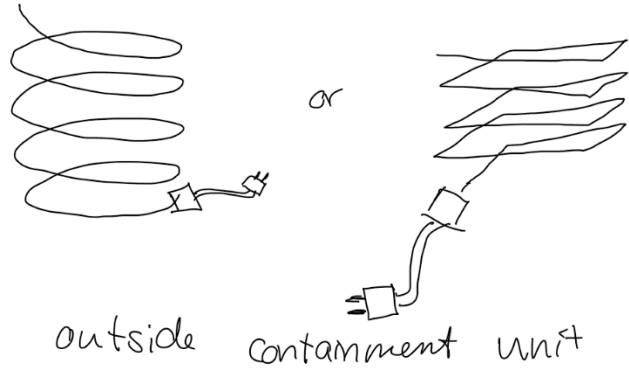


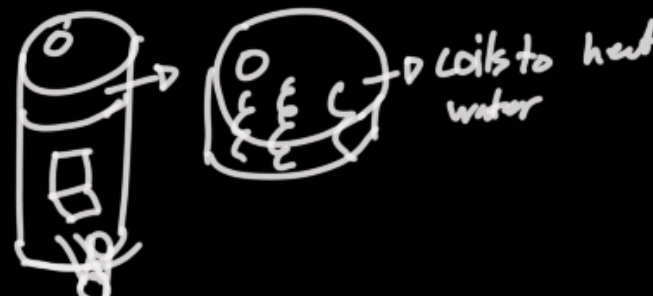
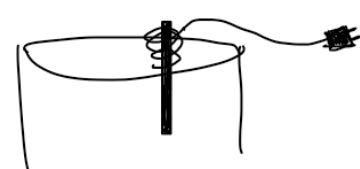
material

mate for material

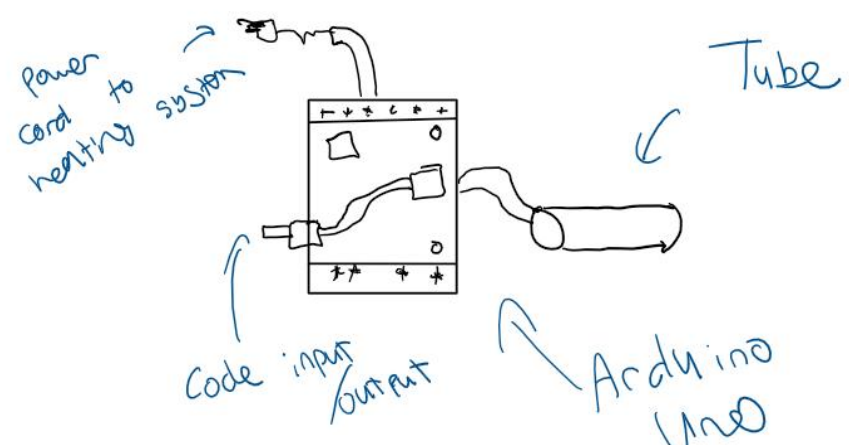
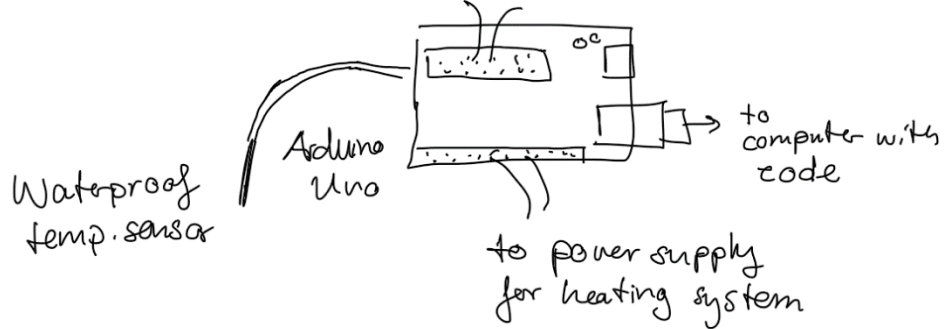


1.6 Subsystem F

Name	Solution
A	 <p>A hand-drawn diagram on a black background. On the left is a rounded rectangular container with a small handle on its right side. Below the container is a rectangular hot plate. The hot plate has a small box labeled "40°" and a plus sign (+) on its surface. A horizontal line points from the text "Container w/ Part" to the container. Another horizontal line points from the text "Hot Plate" to the hot plate.</p>
G	 <p>A hand-drawn diagram showing a container on the left connected to a hot plate on the right by an extension cord. The container is a rounded rectangle with a handle. The hot plate is a simple rectangle. The extension cord is a wavy line with connectors at both ends. Blue handwritten labels with arrows point to each component: "Container" points to the container, "hot plate" points to the hot plate, and "extension cord" points to the wavy line.</p>
L	 <p>A hand-drawn diagram showing two alternative designs for an "outside containment unit". The word "or" is written between the two designs. The first design on the left is a coiled spring-like structure with a connector at the bottom. The second design on the right is a stack of four horizontal rectangular plates with a connector at the bottom. Below the designs is the text "outside containment unit".</p>

S	<p>F. Physical components of heating system</p> 
Y	

1.7 Subsystem G

Name	Solution
A	Hot plate can have a pre-determined max.
G	 <p>Power cord to heating system</p> <p>Tube</p> <p>Code input/output</p> <p>Arduino Uno</p>
L	 <p>Waterproof temp. sensor</p> <p>Arduino Uno</p> <p>to power supply for heating system</p> <p>to computer with code</p> <p>Sensor is placed near the material.</p>

G. Control of heating System

connected to
arduino w/ set



times for
heating

S

Y

Device can be controlled by hand so no need for Arduino

2.0 Selection of Best Solution

Using a selection matrix, the subsystem will be evaluated based on whether it meets the design criteria (green), partially meets the design criteria (yellow), or does not meet the design criteria (red).

2.1 Combination I

- A. A sloped bottom and faucet to drain water, made from plastic on the inside and Styrofoam on the outside as insulation.
- B. Draining the water through a filter and out of the container, then weighing the wet filter with debris.
- C. DC motor with two (plastic) rods.
- D. Arduino Uno with waterproof tubing.
- E. Small plastic container with holes, which has a cap to enclose the sample within.
- F. Metal rod semi-immersed in water with heating coil around the upper section.
- G. Arduino measures & controls power supply to heating system.

Criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Subsystem														
A	Green	Green	Green	Yellow	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
B	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
C	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
D	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Green	Green	Green	Green
E	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Green
F	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
G	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green

2.2 Combination II

- A. Two-container system with a faucet to drain the water and a plug as a backup drainage mechanism.
- B. Draining the water through a filter and out of the container, then manually removing and weighing the wet filter with debris.
- C. DC motor with two metal rods.
- D. Arduino Uno with waterproof tubing.
- E. Small plastic container with holes, which has a cap to enclose the sample within.
- F. Three heating coils immersed in the water.
- G. Arduino measures & controls power supply to heating system.

Criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Subsystem														
A	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Green	Green	Green	Green	Green
B	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
C	Green	Green	Yellow	Green	Green	Green	Green	Green	Yellow	Yellow	Green	Green	Green	Green
D	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
E	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Green
F	Green	Green	Green	Green	Yellow	Green	Green	Yellow	Yellow	Yellow	Green	Green	Green	Green
G	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green

2.3 Combination III

- A. A sloped bottom and faucet to drain water, made from plastic on the inside and Styrofoam on the outside as insulation.
- B. Draining the water through a filter and out of the container, then manually removing and weighing the wet filter with debris.
- C. DC motor with one plastic rod.
- D. Arduino Uno with waterproof tubing.
- E. Small plastic container with holes, which has a cap to enclose the sample within.
- F. Coils embedded in the cover of the container, which heat the water's surface.
- G. Thermometer and human turns on and off the power supply.

Criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Subsystem														
A	Green	Green	Green	Yellow	Green	Yellow	Green	Green	Green	Green	Green	Green	Green	Green
B	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
C	Green	Green	Green	Green	Yellow	Green	Green	Green	Yellow	Green	Green	Green	Green	Green
D	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Green	Green	Green	Green
E	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Green
F	Green	Green	Green	Green	Yellow	Green	Green	Green	Green	Yellow	Green	Green	Green	Green
G	Green	Green	Green	Green	Red	Green	Green	Green	Green	Green	Green	Green	Green	Green

2.4 Best Solution

Combination I would provide the best solution, since it has the most green sections on the selection matrix, meaning that it meets the greatest number of the design criteria. Combination II meets fewer of the criteria than Combination I. Combination III had one subsystem that was missing a critical element of being able to run for 2 weeks \pm 3 hours, and so would not be suitable.