roost

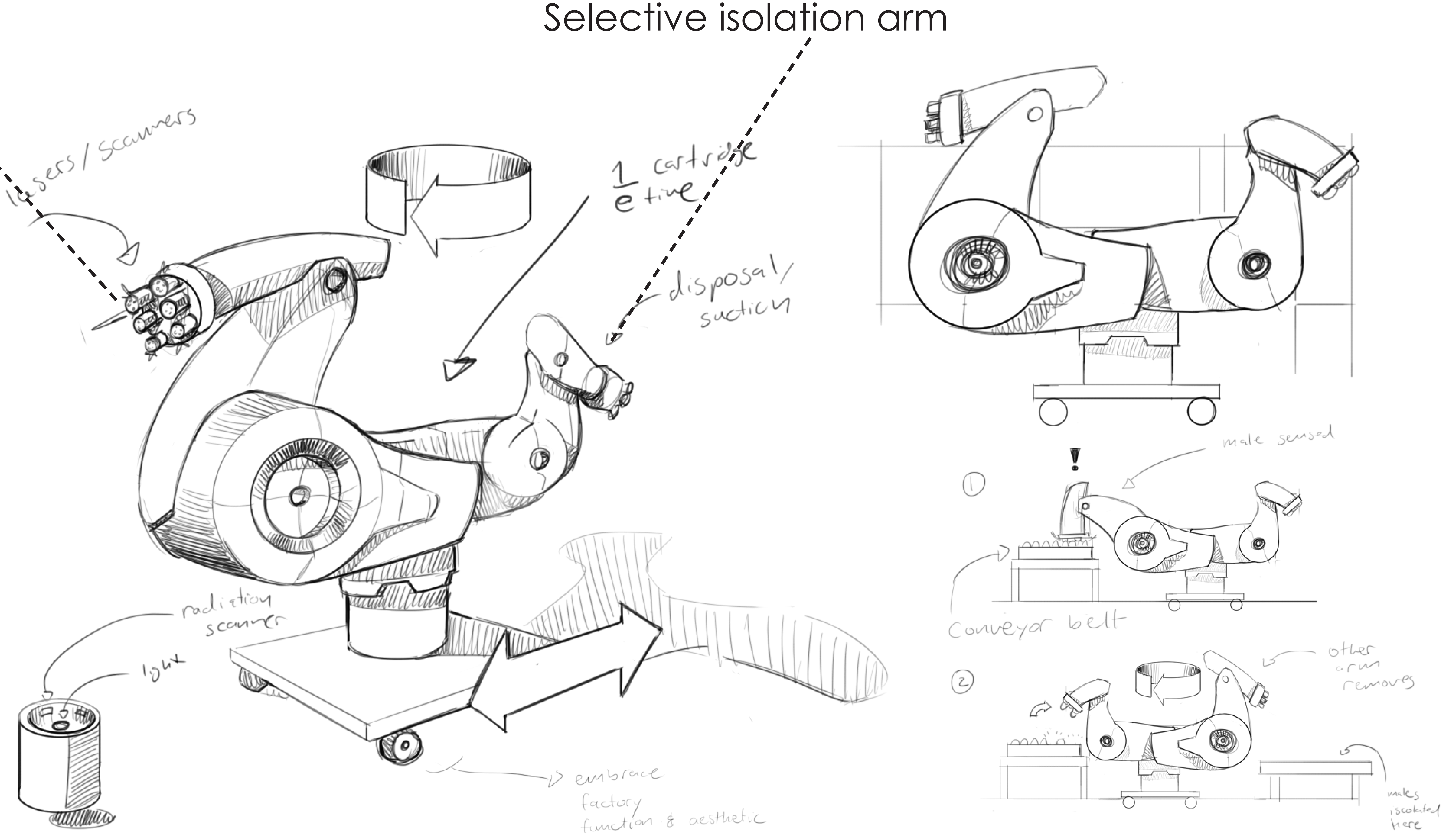
Process Book

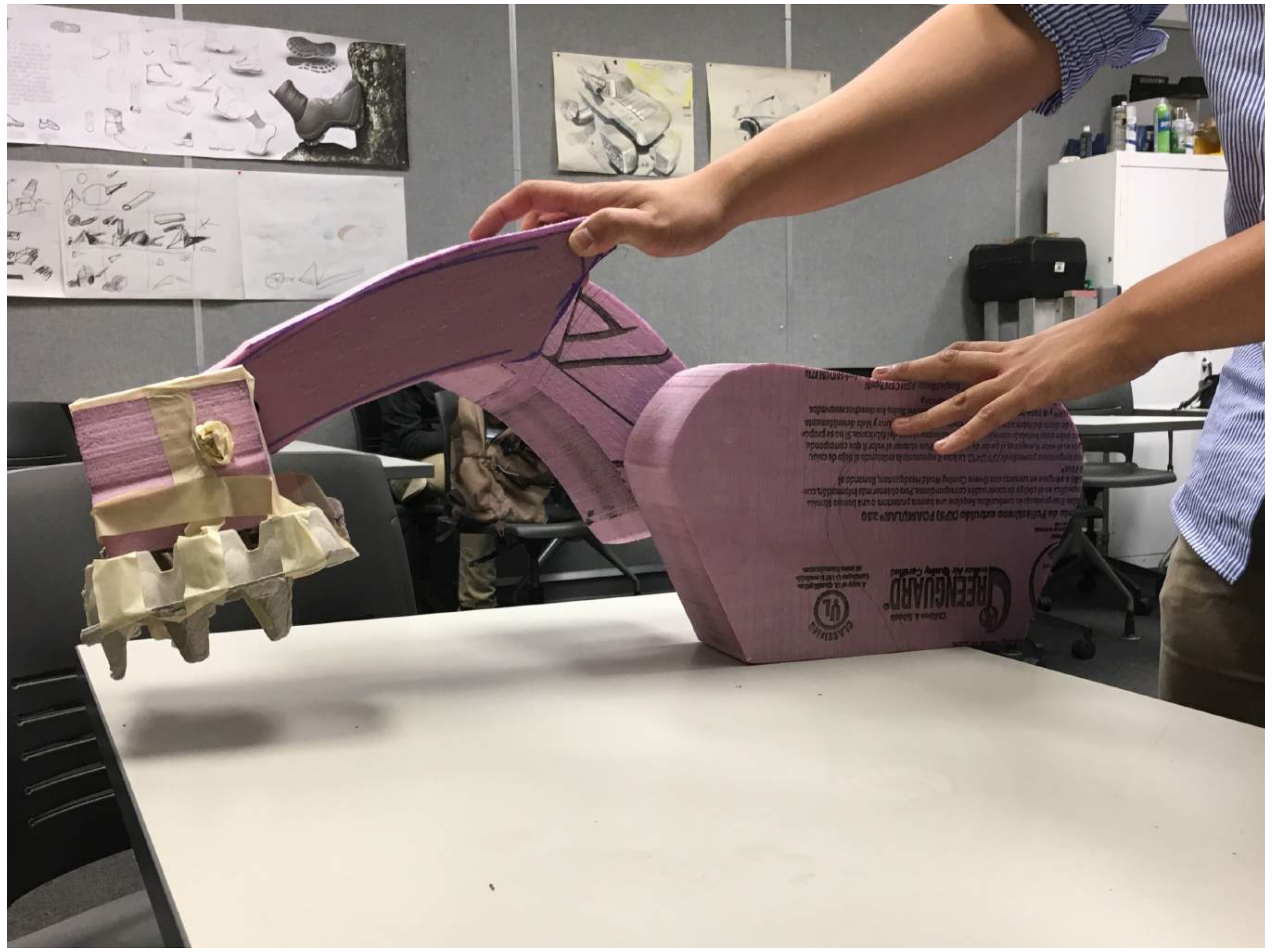
Chick culling is the process of killing newly hatched poultry for which the industry has no use. It occurs in all industrialized egg production whether free range, organic, or battery cage. Within the **chicken egg industry**, this practice specifically targets cockerels, i.e. **male chicks**, because they cannot lay eggs.

With the female to male ratio being approximately **50:50**, culling can become used to massive extents. An estimated **3.2 billion** male chicks are killed this way. India alone is estimated to slaughter 180 million chicks and shows a growing egg industry.

Laser scanning arm

Selective isolation arm





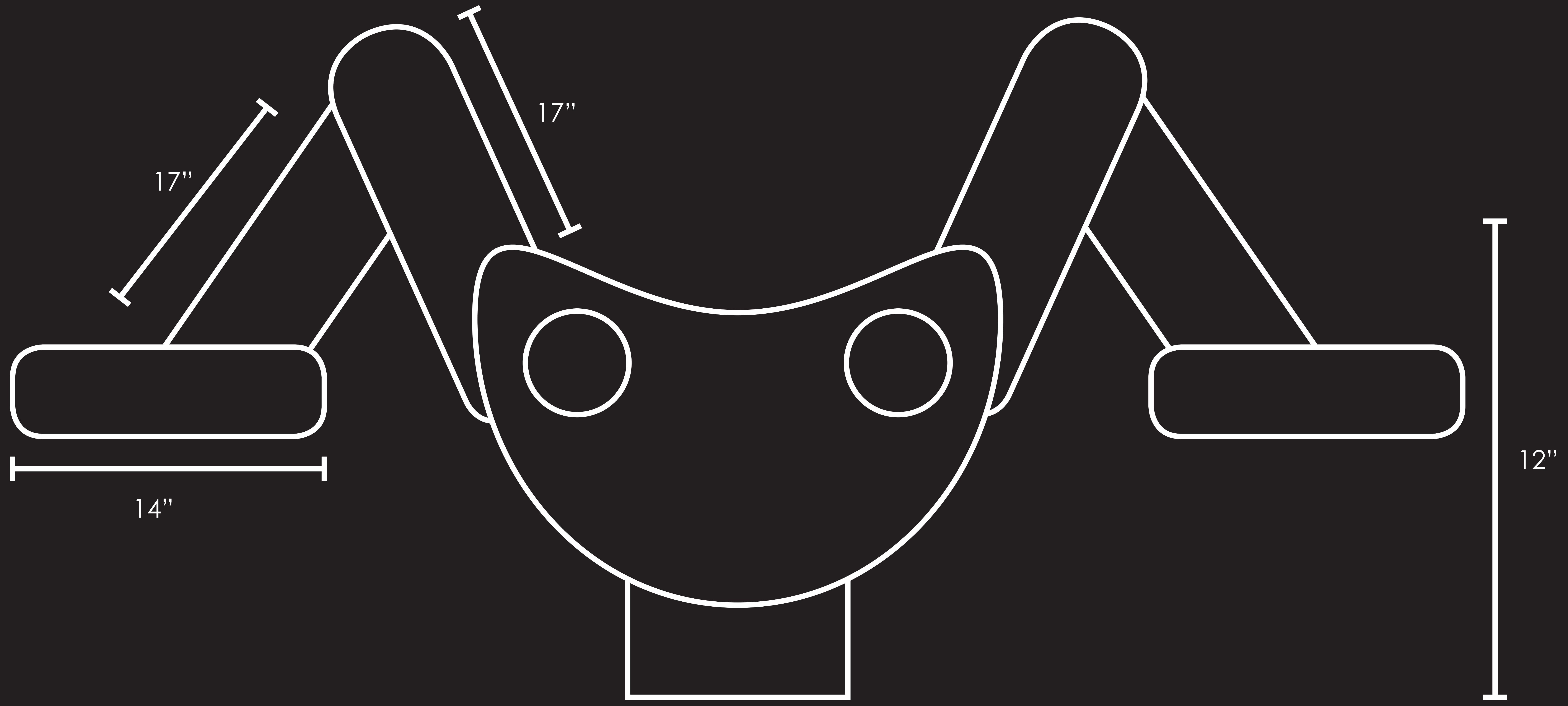
A primitive **sketch-model** was built to check the possible axis-rotations of the arm as well as determine the scale of the object. The early sketch of Option 2 have the arms designed at a large towering scale, which could create issues in placing the arms inside of a hatchery.

An egg container was torn apart to determine an accurate **scale** for the machine relative to the size of the eggs. Creating the model proved that the device could scan a reasonable amount of eggs while retaining a manageable scale. The model above is capable of scan-ning **9 eggs** at a time.

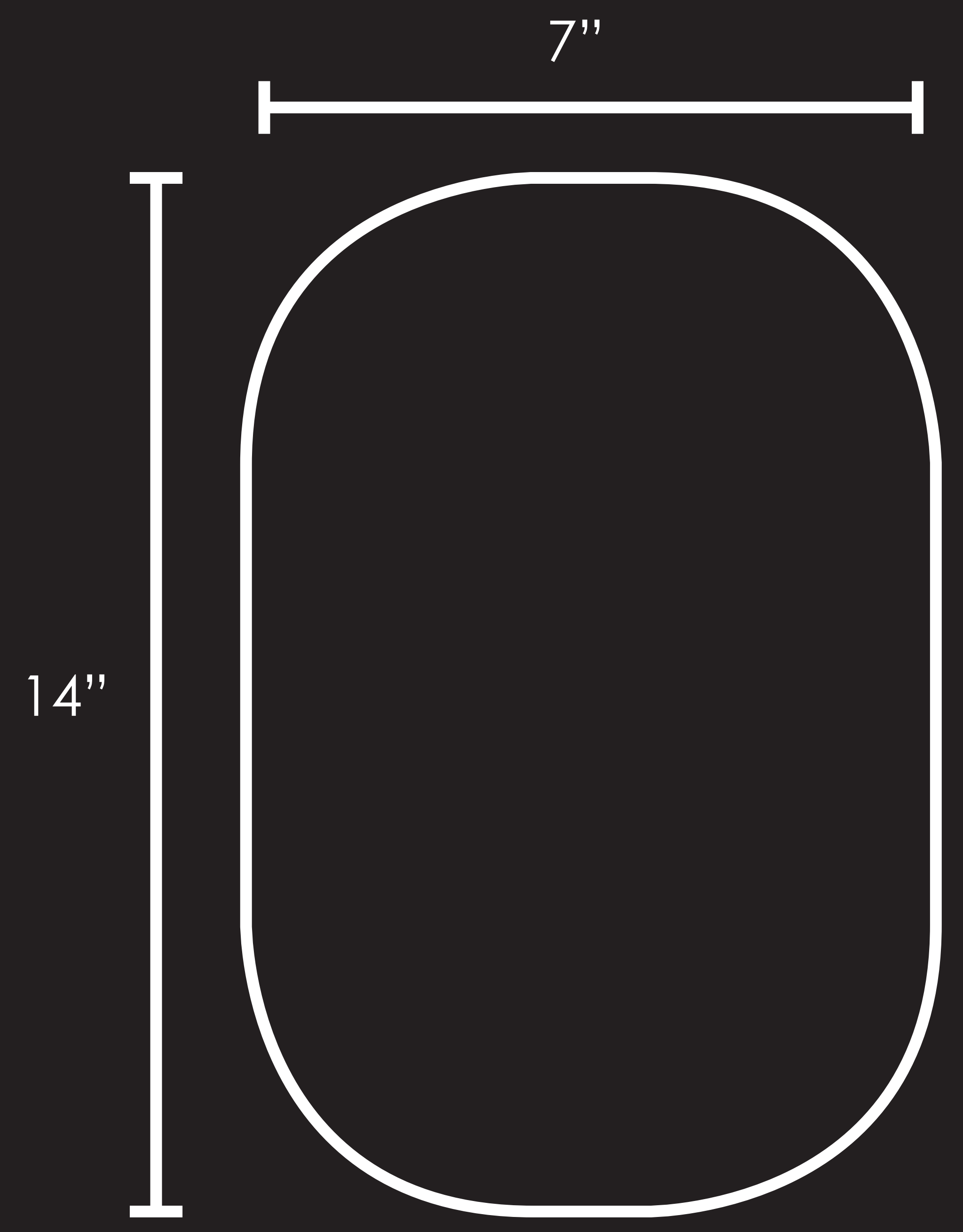
Early designs struggled with an egg scanning threshold because the design was originally going to scan around incubation trays. Research suggested that incubation trays vary by model and with spacing between the eggs, complicating the preferred amount of eggs the device should be able to scan.

Further research as well as contacting a local hatchery found that standard egg shipping crates are universal and are what eggs are shipped to hatcheries in. This provided the needed scale and amount of eggs the design needed, as the final design scans half of the tray at a time.

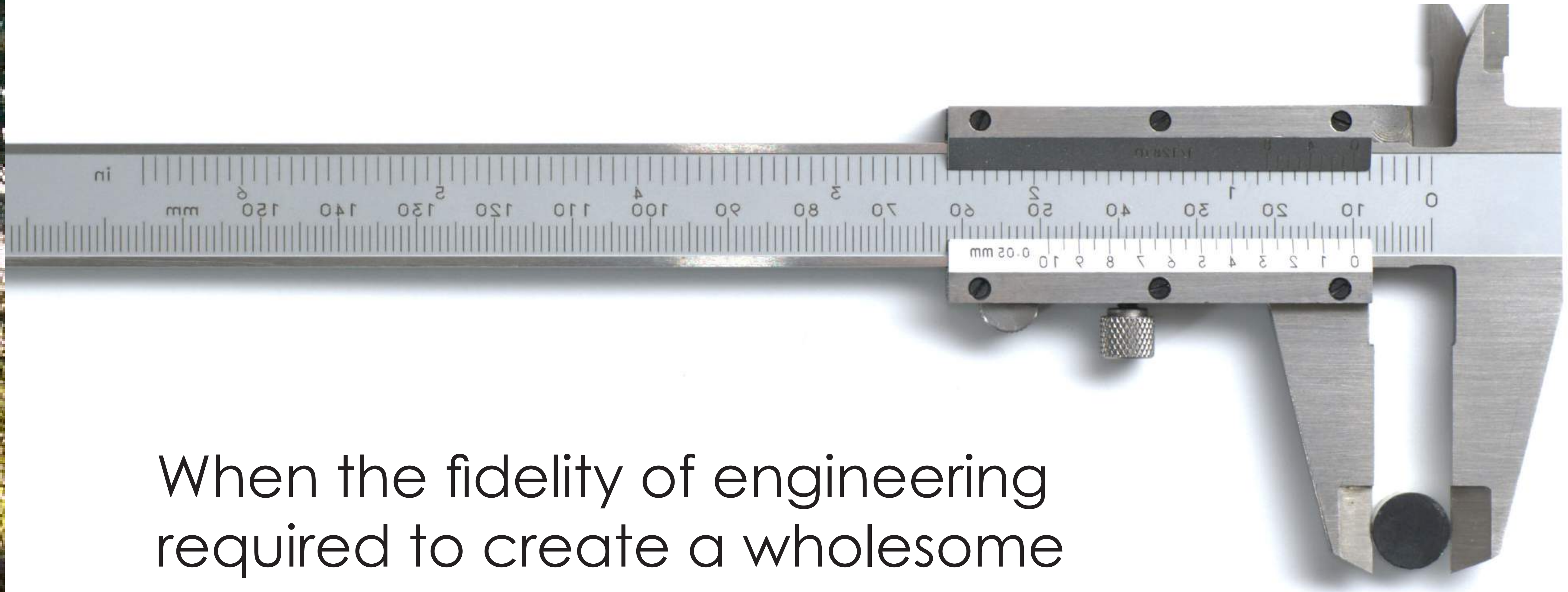
https://www.mcmurrayhatchery.com/index.html



Necessary robot scale



Egg tray scale



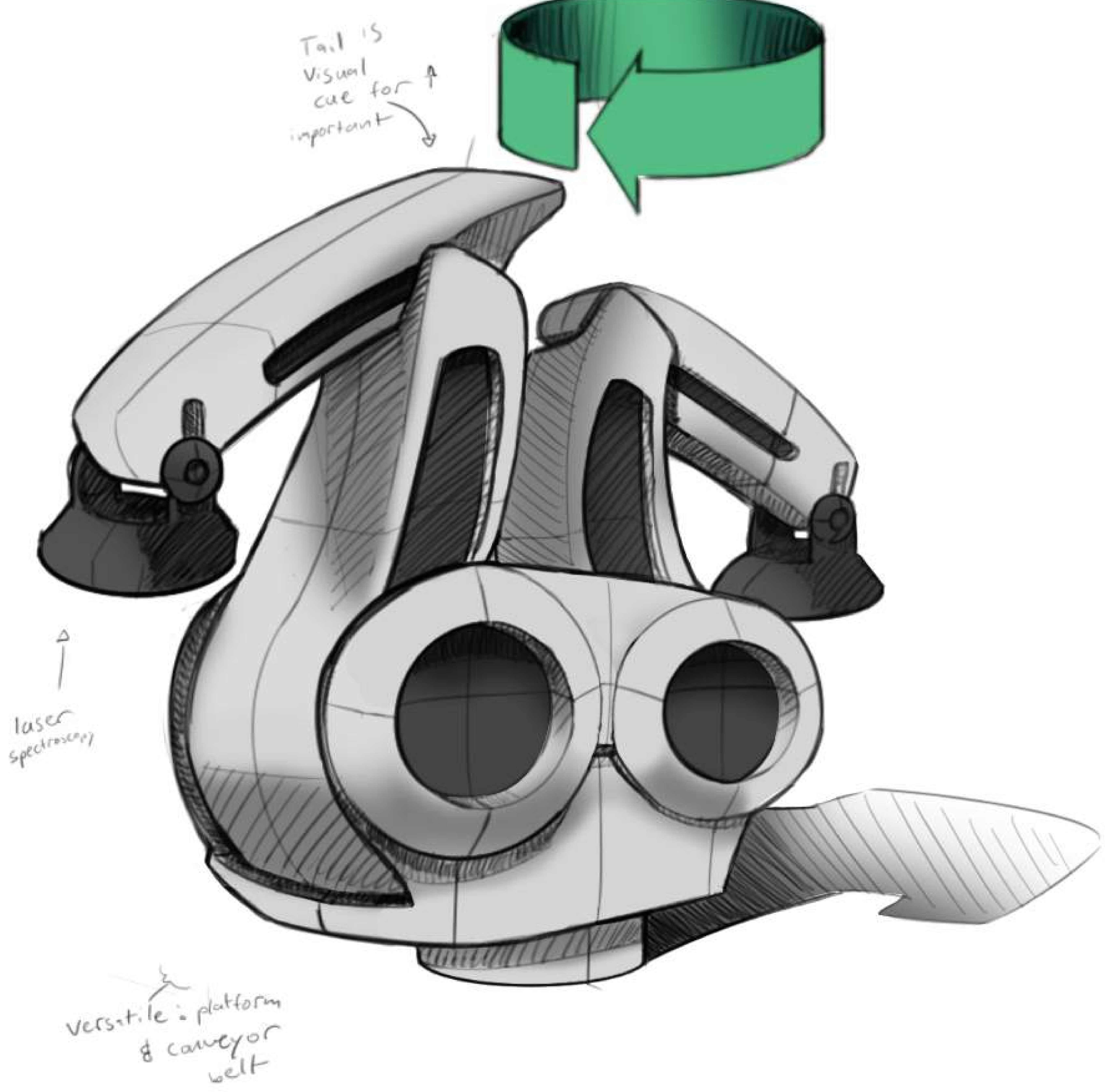
When the fidelity of engineering required to create a wholesome concept as well as a working prototype was realized, it became clear that the designer alone is not equipped to wire a machine and calculate torque.

Armstrong University was contacted, due to their proximity to SCAD as well as their prestigious engineering program. Their program has worked with companies like Gulfstream and NASA.

With automations having been checked, an early draft of the final aesthetic was created to fully package the laser spectroscopy and selective isolation arm. On the right is a straight forward design with simple injection-molded plastic pieces.

The attempt here was to create a minimal design that would be cheaper to produce.

Unfortunately, this idea ran into issues when it did not suggest the ability to rapidly scan eggs. This idea was also scrapped out of concerns that it looked too toy-like.



Mood Board

Confident

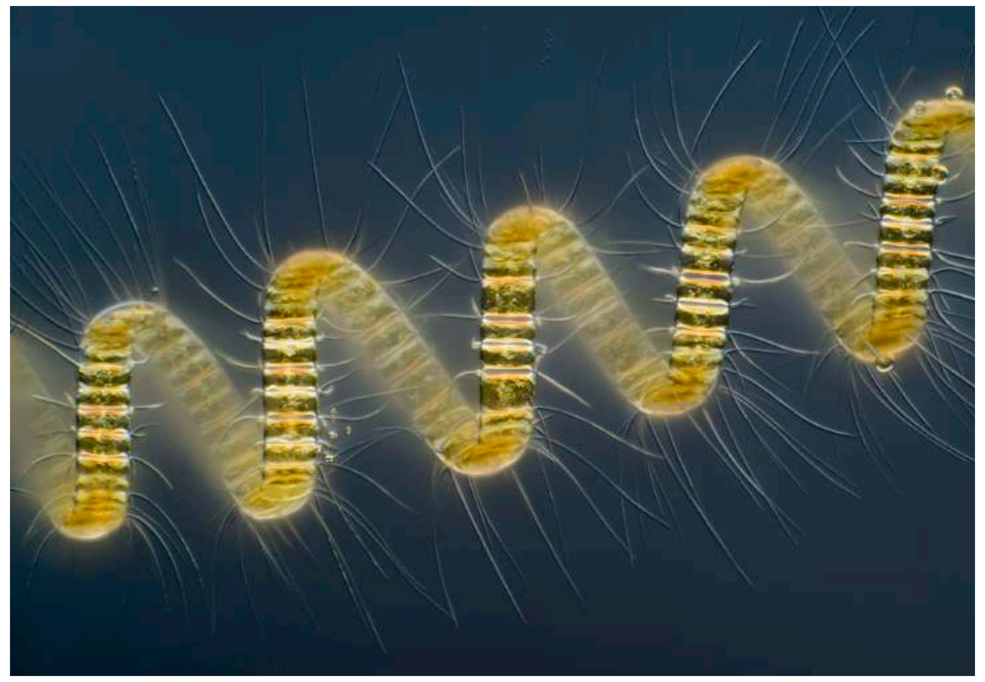
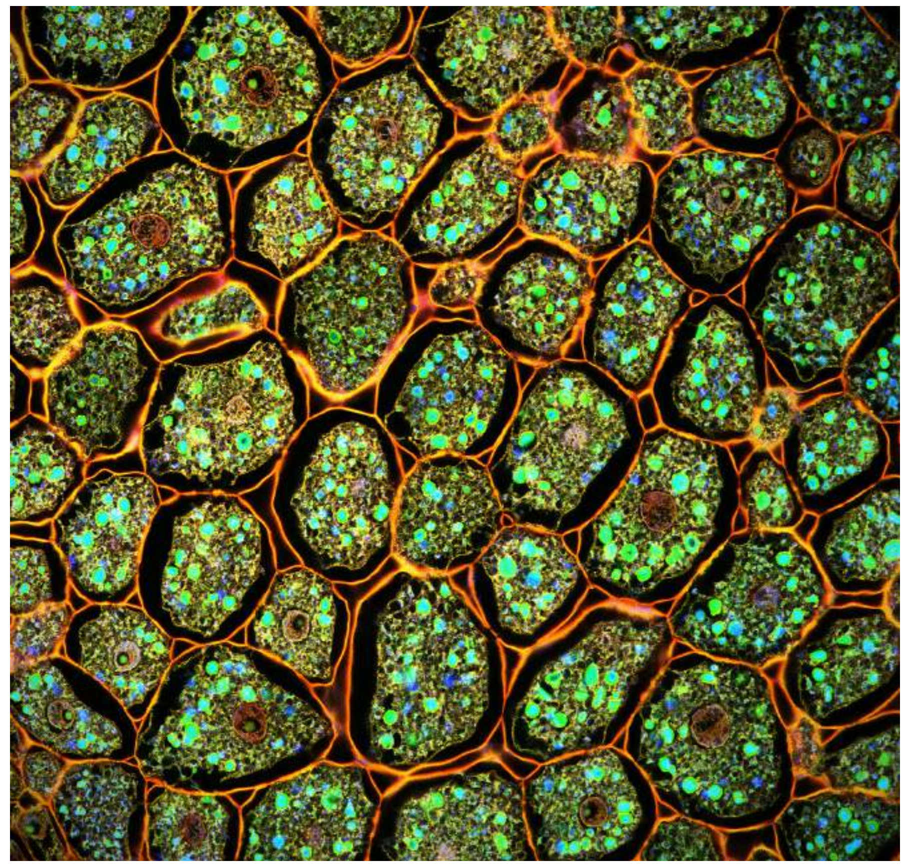
Focused

Functional

Futuristic

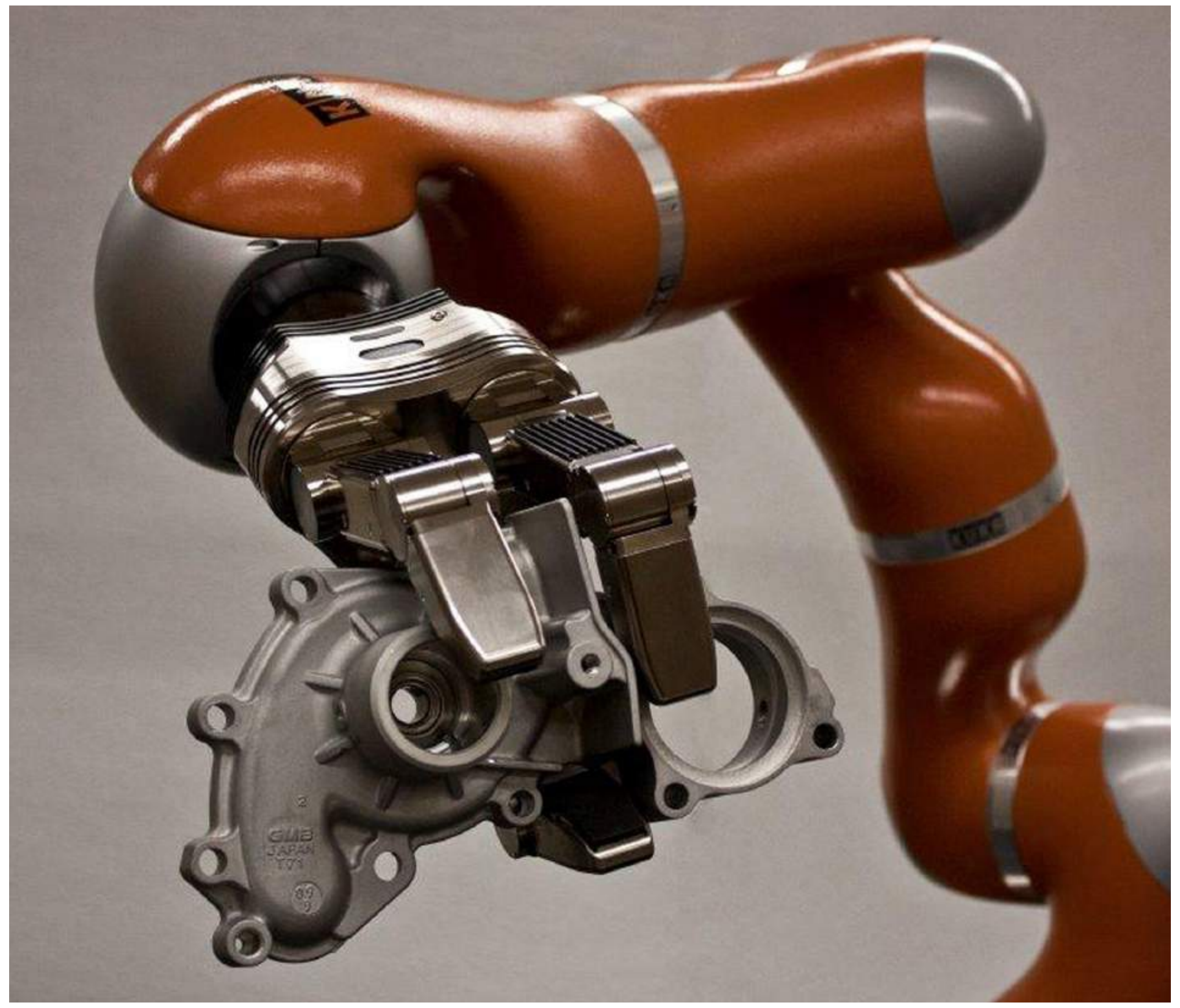
Professional

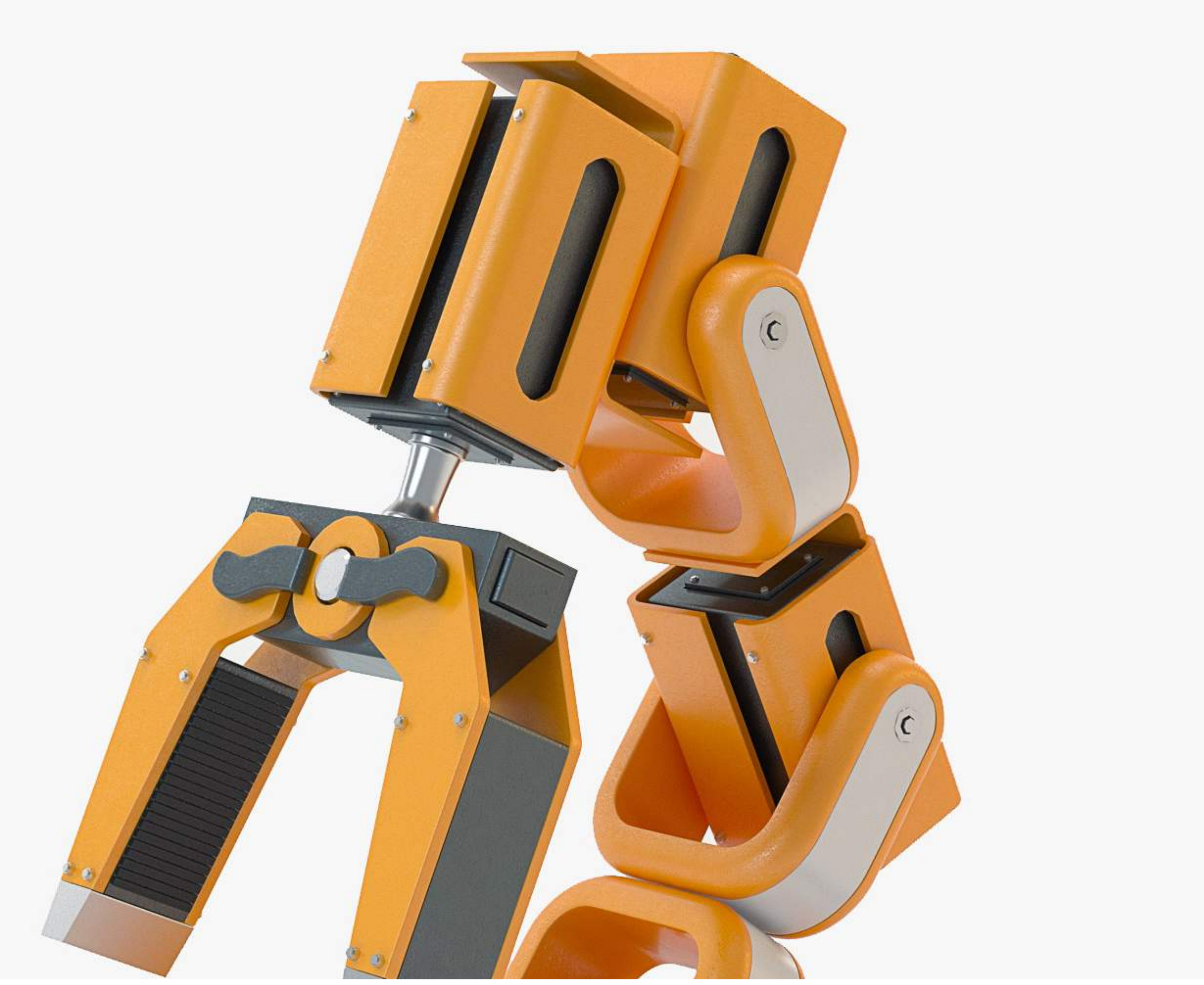
Smart




To attach a more fitting form to the final product, a mood board was created taking inspiration from **contemporary** design and fields of **science/engineering.**



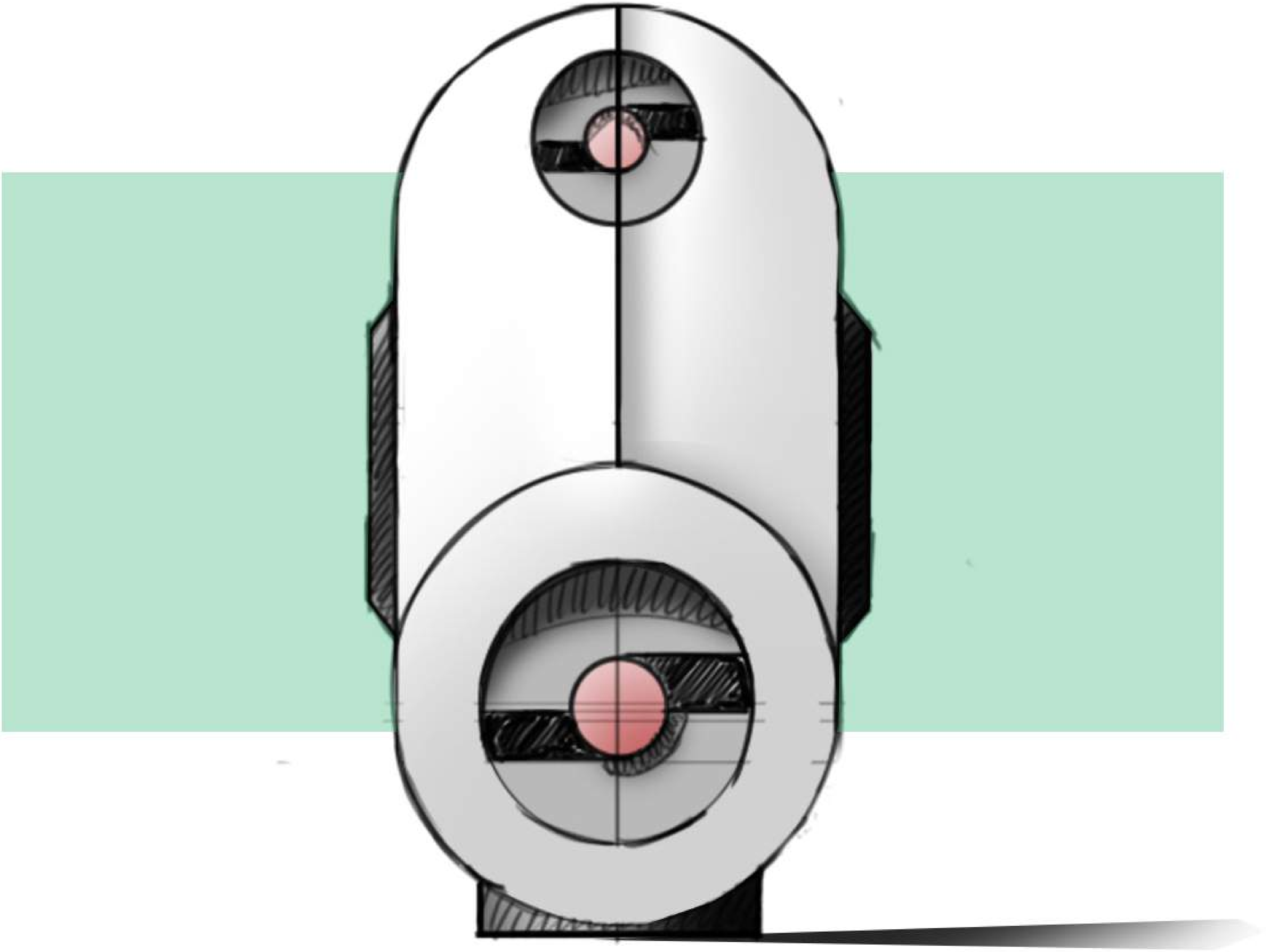


It was also important to examine the motor capabilities of the average pair of robotic arms. The robots above have drastically **different functions** that affect the look of their respective arms.

Final **Branding**

An idea that was strongly considered was one where the arms and egg scanning bits compressed into a smaller model. The arms and end bits would fold out when it was activated, and there would be a visible state change.

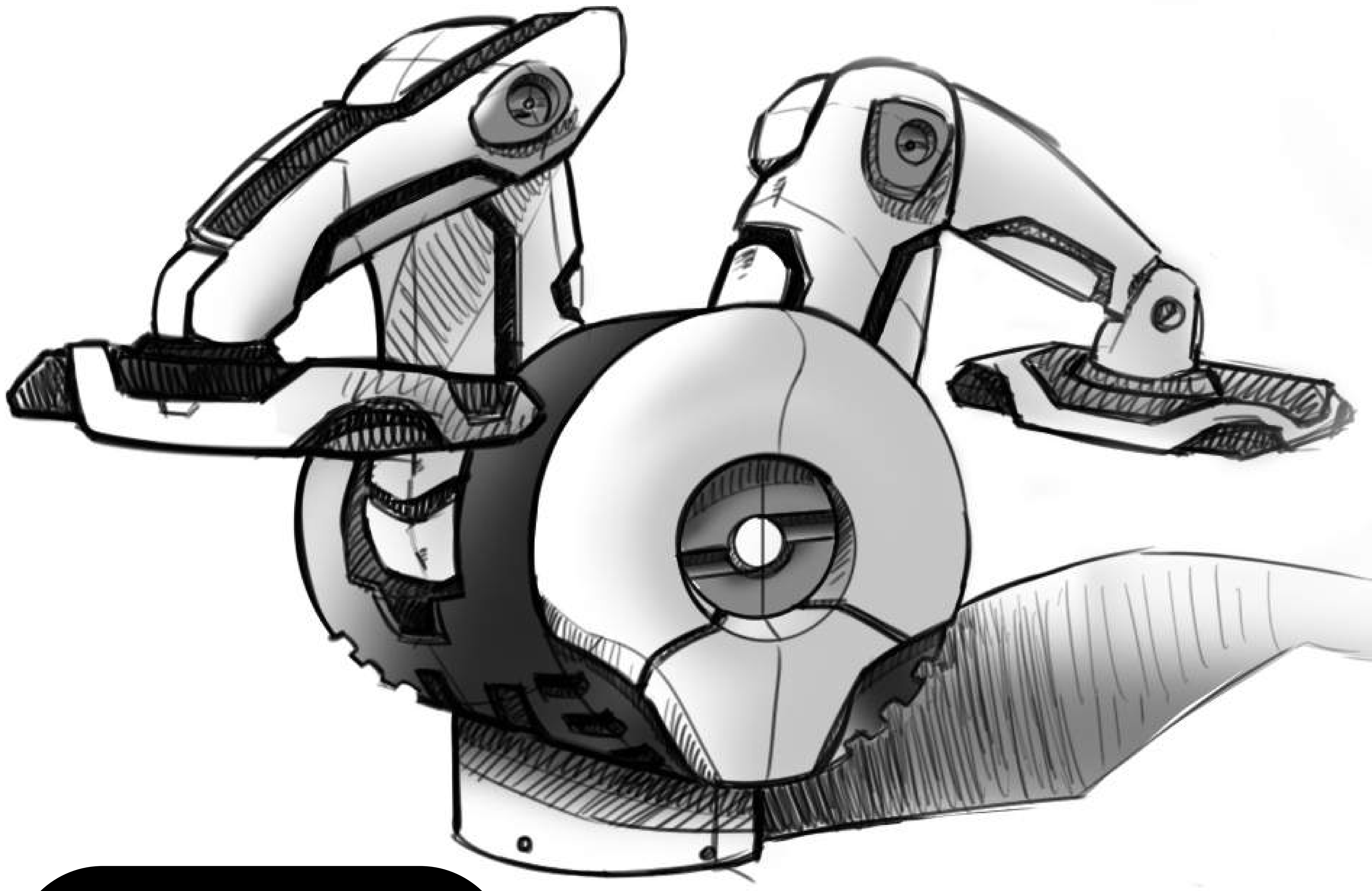
A long conversation was had with this idea and it was ultimately tweaked to not collapse. Discussion with other designers suggested that a collapsing set of manufacturing arms did not seem necessary and almost exclusively added more calculation and random functions. Elements of this design, particularly the circular base, were still kept for the final design.



Final Design

The selected design embraced a more utilitarian aesthetic as well as the idea that this is solely an efficient piece of equipment design.

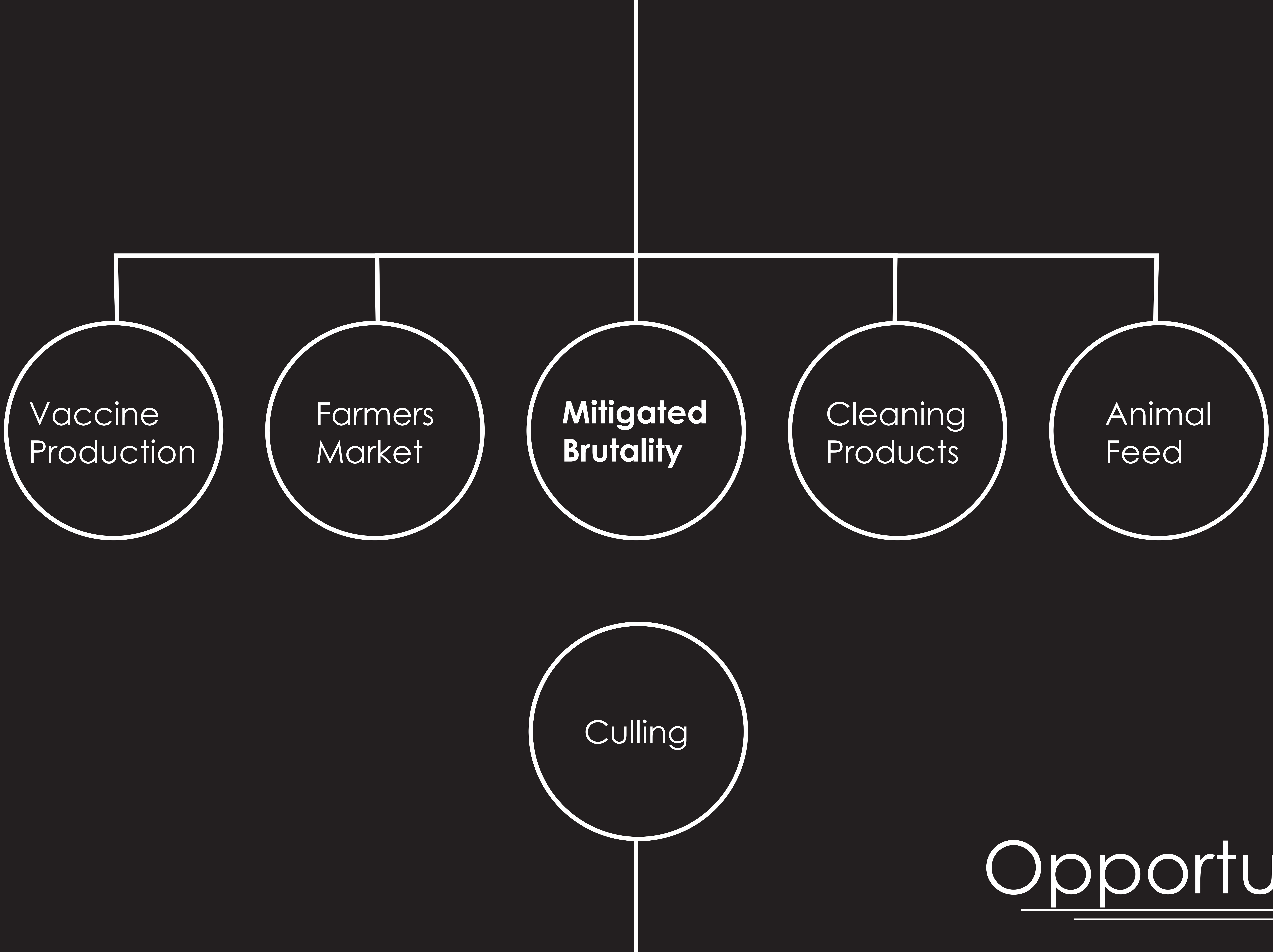
Because of the lack of human interaction as well as it being a product of high level science, it seemed unnecessary to force ornamental elements of “beauty” into the design. The design sought function, robustness, and reliability.



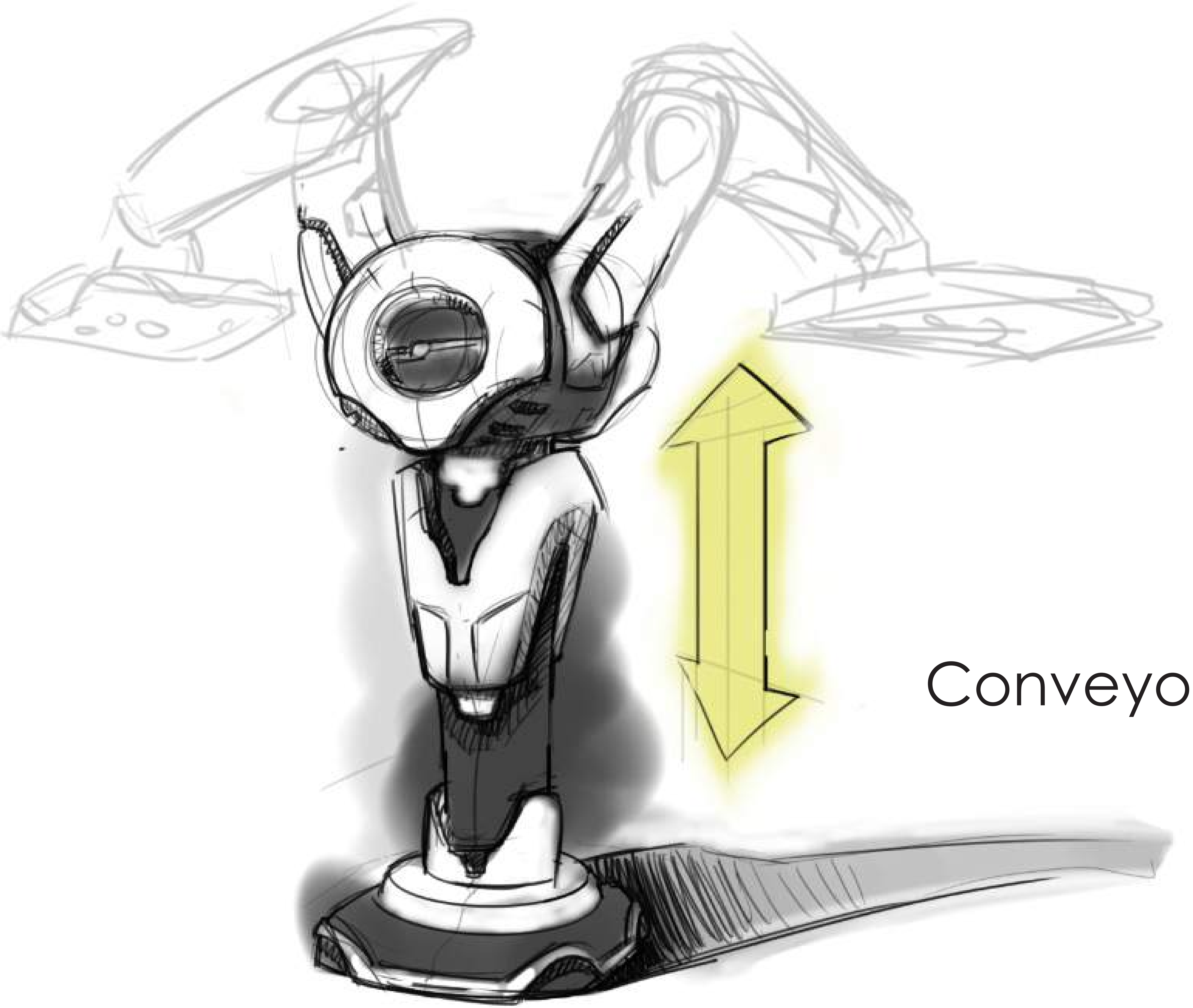
roost


SOLIDWORKS
Assem1.SLDASM *
Search SOLIDWORKS Help
Edit Component
Insert Components
Mate
Component Preview Window
Linear Component Pattern
Smart Fasteners
Move Component
Show Hidden Components
Assembly Features
Reference Geometry
New Motion Study
Bill of Materials
Exploded View
Explode Line Sketch
Instant3D
Update Speedpak
Take Snapshot
Assembly
Layout
Sketch
Evaluate
Render Tools
SOLIDWORKS Add-Ins
Simulation
SOLIDWORKS MBD
Assem1 (Default<Display State-1>)
History
Sensors
Annotations
Front Plane
Top Plane
Right Plane
Origin
(f) ken_thesis_subbase_edit<1> (Default
(-) ken_thesis_left_main_arm<1> (Defau
(-) ken_thesis_left_main_arm<2> (Defau
(-) ken_thesis_connectingarm<1>->? (D
(-) ken_thesis_connectingarm<2>->? (D
(-) ken_thesis_laserarm<1>->? (Default<
(-) ken_thesis_endbits<1>->? (Default<
(-) ken_thesis_endbits<2>->? (Default<
Mates
PLANE1
(-) Sketch1
(-) Sketch2
Split2 of ken_thesis_left_main
Model
3D Views
Motion Study
SOLIDWORKS Education Edition - Instructional Use Only
Search Windows
7:45 PM
4/27/2017

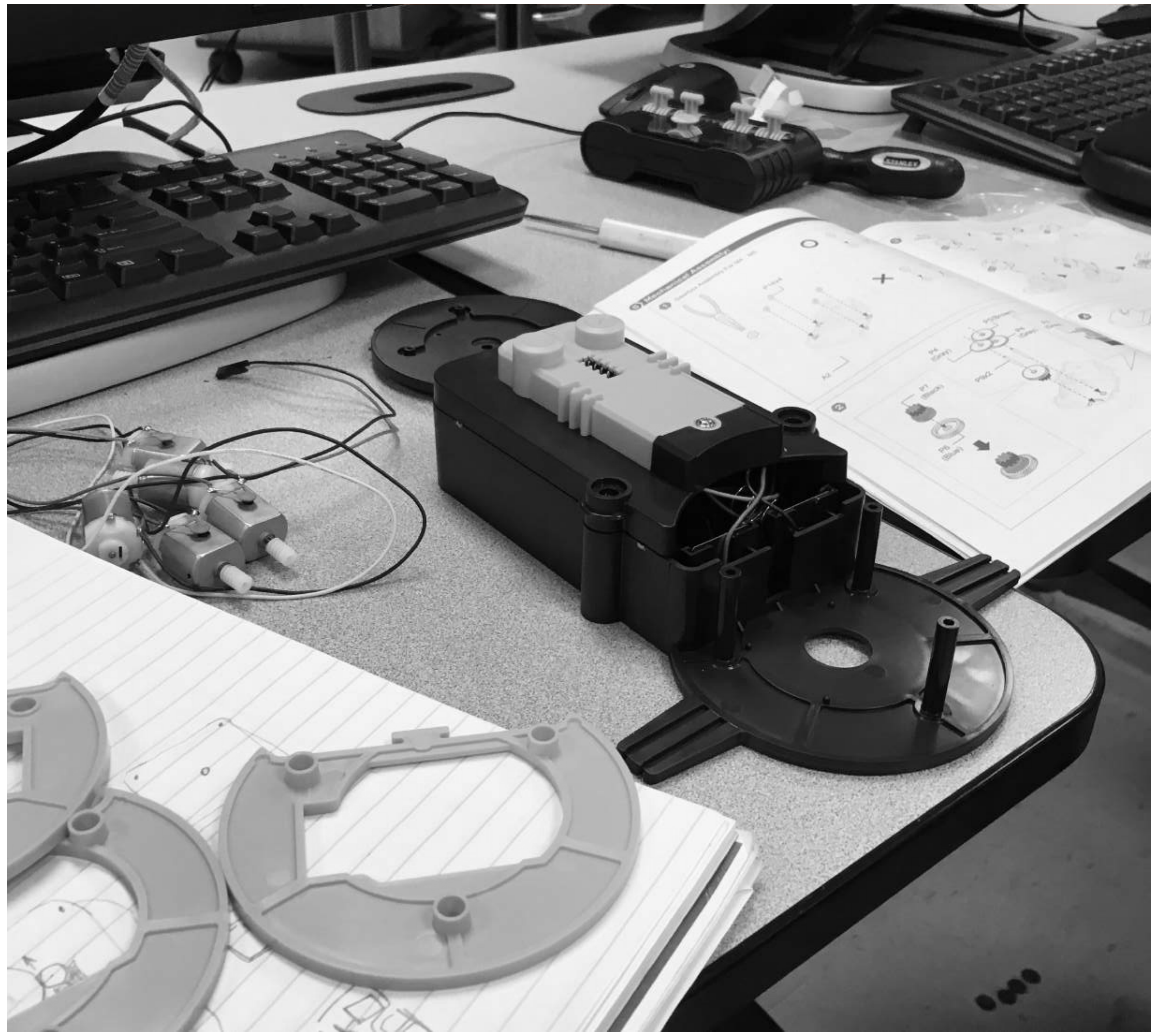
Roost the Egg Scanner



Opportunity



Conveyor belt stand



Each design made modifications to its final aesthetic after talking with the engineer. The selected design was proofread for its desired movements and functions. The engineer also proofread that desired arm-joint mechanism, where the design asked for an asymmetrical arm joining. As it turns out, this simplified the housing of a motor and was seen as the most practical connection method.

Despite limitations in resources, it was important to create a proof of concept. A 70% scale model was prepared along with the CAD file to provide a demonstration of the motion capabilities.


DREMEL
4000


Needs to show


Final Prototype

Code

```
//***************************************************************************************
// Roost Project
//***************************************************************************************
// Program demonstrates the movement of each joint.
//***************************************************************************************
// Dylan Russell
// Original 05/18/2017
// Modified
// Created for Ken Macalino
// Copyright (c) 2017 for Dylan Russell, all rights reserved.
//***************************************************************************************



int shoulderMotorEnablePin = 2;
int shoulderMotorPin1 = 3;
int shoulderMotorPin2 = 4;
int baseMotorEnablePin = 14;
int baseMotorPin1 = 15;
int baseMotorPin2 = 16;
int elbowMotorEnablePin = 8;
int elbowMotorPin1 = 9;
int elbowMotorPin2 = 10;
int wristMotorEnablePin = 5;
int wristMotorPin1 = 6;
int wristMotorPin2 = 7;
int handMotorEnablePin = 11;
int handMotorPin1 = 17;
int handMotorPin2 = 18;
int switchState = 12;

void setup() {
  // set the motor pins as outputs:
  // set all chips to enabled state
  pinMode(baseMotorPin1, OUTPUT);
  pinMode(baseMotorPin2, OUTPUT);
  pinMode(baseMotorEnablePin, OUTPUT);
```

```
  digitalWrite(baseMotorEnablePin, HIGH);
  pinMode(shoulderMotorPin1, OUTPUT);
  pinMode(shoulderMotorPin2, OUTPUT);
  pinMode(shoulderMotorEnablePin, OUTPUT);
  digitalWrite(shoulderMotorEnablePin, HIGH);
  pinMode(elbowMotorPin1, OUTPUT);
  pinMode(elbowMotorPin2, OUTPUT);
  pinMode(elbowMotorEnablePin, OUTPUT);
  digitalWrite(elbowMotorEnablePin, HIGH);
  pinMode(wristMotorPin1, OUTPUT);
  pinMode(wristMotorPin2, OUTPUT);
  pinMode(wristMotorEnablePin, OUTPUT);
  digitalWrite(wristMotorEnablePin, HIGH);
  pinMode(switchState,INPUT);

}

void loop() {
   // if (switchState == HIGH){
    // SET either one to HIGH to turn the motor on.
    for(int i = 0; i <= 1; i++){
      delay(5000);
    digitalWrite(baseMotorPin1, HIGH);
    digitalWrite(baseMotorPin2, LOW);
    delay(3850);
    digitalWrite(baseMotorPin1, LOW);
    digitalWrite(baseMotorPin2, LOW);
    delay(1000);
    digitalWrite(baseMotorPin1, LOW); // Return home
    digitalWrite(baseMotorPin2, HIGH);
    delay(3850);
    digitalWrite(shoulderMotorPin1, HIGH);// Shoulder drop
    digitalWrite(shoulderMotorPin2, LOW);
    digitalWrite(baseMotorPin1, LOW);
    digitalWrite(baseMotorPin2, LOW);
    delay(1000);
```

```
    delay(1000);
    digitalWrite(baseMotorPin1, LOW); // Return home
    digitalWrite(baseMotorPin2, HIGH);
    delay(3850);
    digitalWrite(shoulderMotorPin1, HIGH);// Shoulder drop
    digitalWrite(shoulderMotorPin2, LOW);
    digitalWrite(baseMotorPin1, LOW);
    digitalWrite(baseMotorPin2, LOW);
    delay(1000);
    digitalWrite(shoulderMotorPin1, LOW);
    digitalWrite(shoulderMotorPin2, LOW);
    digitalWrite(baseMotorPin1, LOW);
    digitalWrite(baseMotorPin2, LOW);
    delay(1000);
    digitalWrite(wristMotorPin1, HIGH);//Wrist out
    digitalWrite(wristMotorPin2, LOW);
    delay(1000);
    digitalWrite(wristMotorPin1, LOW);
    digitalWrite(wristMotorPin2, LOW);
    delay(1000);
    digitalWrite(wristMotorPin1, LOW);//Wrist home
    digitalWrite(wristMotorPin2, HIGH);
    delay(1000);
    digitalWrite(baseMotorPin1, LOW);// end of Program
    digitalWrite(baseMotorPin2, LOW);
    digitalWrite(shoulderMotorPin1, LOW);
    digitalWrite(shoulderMotorPin2, LOW);
    digitalWrite(wristMotorPin1, LOW);
    digitalWrite(wristMotorPin2, LOW);

    delay(1000000000);
    }
}
```

The Program Drafter Dylan Russell wrote a code for the estimated movements for Roost, including the arm and egg scanning component swivels as well as the 180 degree turning of the main base.

Project Future

Roost has the potential to expand into a large scale project that receives both an R&D team as well as government funding. A limited time frame caps the exploration the designer and engineer can provide, but the main goal with this project was to create a feasible device that could exist in large numbers in hatcheries.

The working prototype was built on a limited budget for its automations, proving that the automations are feasible. The laser spectroscopy end bits would be the most expensive component, but the device can ultimately be seen as an investment that saves money over time.

Thank You