

A decorative graphic on the left side of the slide, consisting of a network of white lines and small circles on a dark blue background, resembling a circuit board or a stylized tree structure.

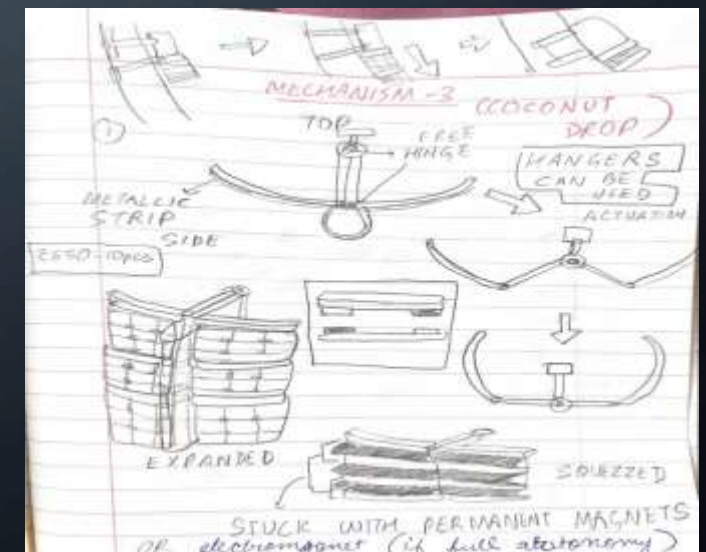
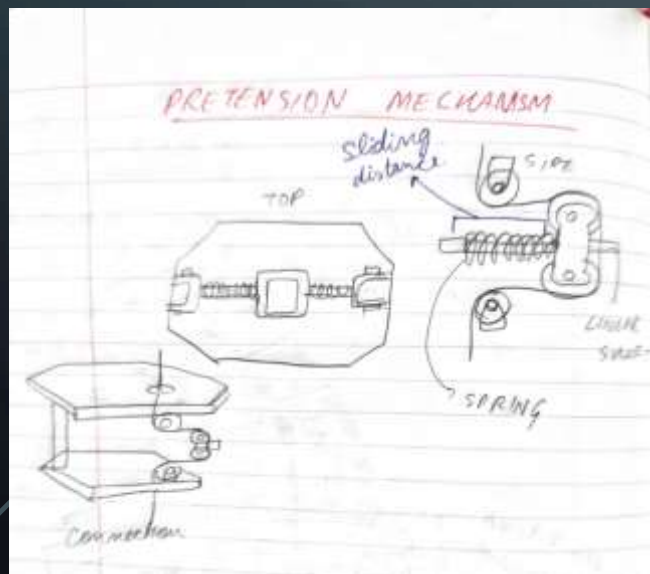
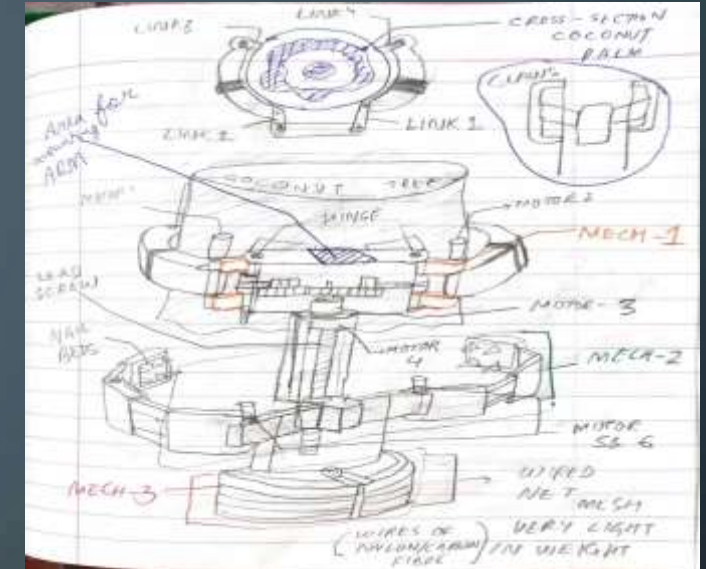
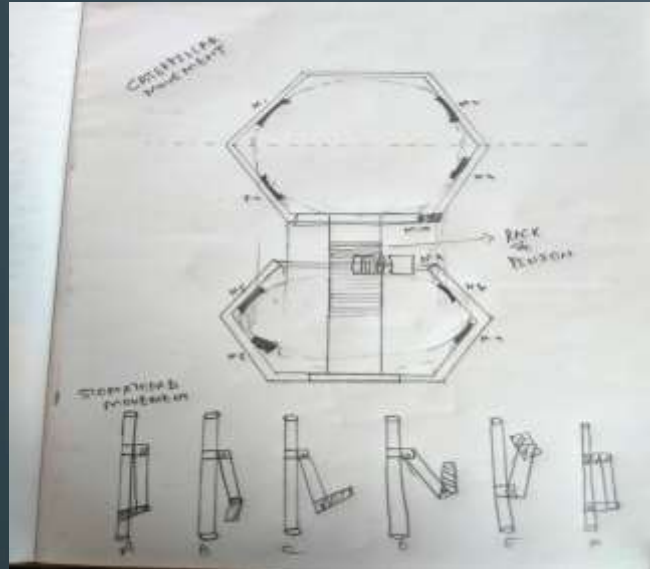
AUTOMATIC COCONUT HARVESTER

TEAM-3 RUDRA

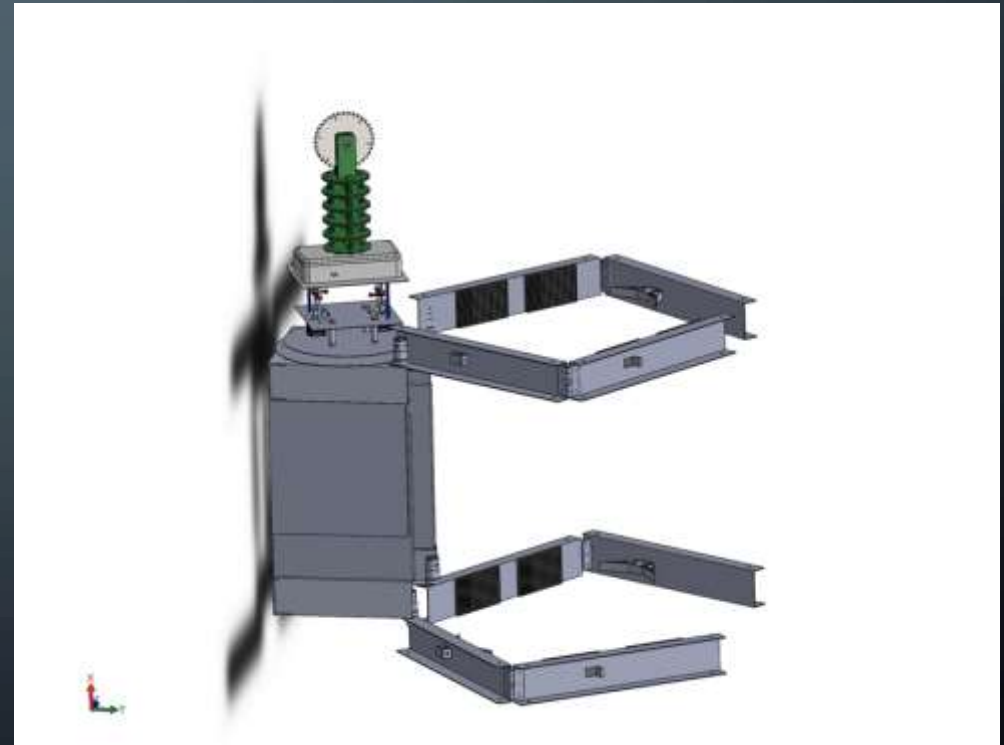
MECHANICAL

- Rough diagrams
- CAD Model
- Calculations
- Budget and weight
- Simulation

ROUGH DIAGRAMS



CAD MODEL



CALCULATIONS

Diagram 1: A schematic of a gripper mechanism. It shows a central motor shaft connected to two gripper arms. Forces F_m and F_g are indicated. A note says: "Symmetrically rotating for both sides".

Diagram 2: A force diagram showing the decomposition of forces F_{g1} and F_{g2} into components F_{g1x} , F_{g1y} , F_{g2x} , and F_{g2y} . The angle between the arms is θ_{12} .

Equations:

$$C_A = F_{g1x} \cdot \frac{l}{2} + F_{g1y} \cdot \sin \theta_{12} + F_{g2x} \cdot \frac{l}{2} + F_{g2y} \cdot \sin \theta_{12}$$

After designing C.A., we approximate some value as:

$$\theta_{12} \approx 90^\circ \quad \frac{l}{2} = \dots$$

Assumptions:

- Since there are 2 types of grippers, F_{grip} can be divided into 2 components.
- F_{g1} = force additionally provided by pin grippers
- F_{g2} = force additionally provided by friction pads
- l = length of each arm
- θ_{12} = angle between arms at hinge
- k = displacement between grippers and motor output shaft

Equations (continued):

$$Z_A = \frac{F_{g1} \cdot l}{2} + \frac{F_{g2} \cdot l}{2} + \frac{F_m \cdot l}{2} + \frac{F_{m2} \cdot l}{2}$$

$$Z_A = \left(\frac{F_{g1} + F_{g2} + F_m}{2} \right) \times l$$

from (1) substituting values

$$Z_A = \left(\frac{F_{g1} + F_{g2} + \frac{W}{2} - F_{grip}}{2} \right) \times l$$

ELECTRONICS DOMAIN SPECIFICATION

Now, substituting approximated values of variables

(1) W (weight of the system) = 35g

(2) F_{m2} = 14 (TPU dimensions and used polycarbonate)

(3) l = 845mm = 0.845m

(4) assuming $F_{g2} = F_{g1} = F_g$

from (1) $F_m = \frac{35 \times g}{2 \times 0.85} = F_{grip}$

$F_m = (35.8 - F_{grip}) \text{ N}$

from (3) [approximating]

$$Z_A = \left(\frac{F_{g1} + F_{g2} + F_m}{2} \right) \times l$$

$$= \left(\frac{F_g + 206 - F_{grip}}{2} \right) \times 0.845$$

$$= \left[\frac{206 - (F_{grip} - F_g)}{2} \right] \times 0.845$$

$$= \left[\frac{206 - 197.8}{2} \right] \times 0.845$$

$$= 6.929$$

Required torque vary from 4.7 Nm to 7 Nm or 47 Kg cm to 70 Kg cm

Equation (5):

$$Z_A \approx 7 \text{ Nm}$$

BASIC TORQUE VALUES

from the table of

MOTOR 1

for cutting

Torque doesn't matter for accordingly

→ should be 1000 rpm or greater

→ 12V DC motor

ACTUATORS / MOTORS #1

5 for microcontroller

for gripping

MOTOR FOR SPIKE

(lubrication can be used)

MOTOR FOR arms and leg × 2

$4.7 \text{ Nm to } 7 \text{ Nm}$

or

$47 \text{ Kg cm to } 70 \text{ Kg cm}$

whichever is possible choose that

Required torque

$4.38 \text{ Nm or } 43 \text{ Kg cm}$

NOTE:

keep rated torque > required torque

COST ANALYSIS OF FRAME

1) Aluminum U sections
3mm thickness 6061 alloy X 30
Refer: <https://www.flackmart.com/product/aluminum-u-sections-30x30x3mm/>
Estimated length used: 9.1m
Estimated weight: 18.3 kg
Total Cost approx: Rs.4135

2) Mild steel sheet metal 4mm for making forgings by performing forming operations. X 8
Refer: <https://www.flackmart.com/product/mild-steel-sheet-20x67x3mm-4mm/>
Weight: >0.28 kg
Cost est. ~Rs. 15

Torsion spring 2.5 mm diameter X4
Refer: <https://www.flackmart.com/product/torsion-spring-2-5mm-diameter-x4/>

Metal link chain for supports X4
Refer: <https://www.flackmart.com/product/metal-link-chain-for-supports-x4/>

In ray gripper 3D printed, TP6 or TP2 filament
Refer: <https://www.flackmart.com/product/in-ray-gripper-3d-printed-tp6-or-tp2-filament/>

GEAR BCK references
Shafts: <https://www.flackmart.com/product/gear-shafts-10mm-diameter-x30mm-length/>
Bearings: <https://www.flackmart.com/product/bearings-10mm-diameter-x30mm-length/>
Gears: <https://www.flackmart.com/product/gears-10mm-diameter-x30mm-length/>
Coupling Motor Gears: <https://www.flackmart.com/product/coupling-motor-gears-10mm-diameter-x30mm-length/>
Shaft Coupler Motor: <https://www.flackmart.com/product/shaft-coupler-motor-10mm-diameter-x30mm-length/>
Coupler motor: <https://www.flackmart.com/product/coupler-motor-10mm-diameter-x30mm-length/>

Gross ESTIMATED COST:
Rs. 7000-8000 for both frames

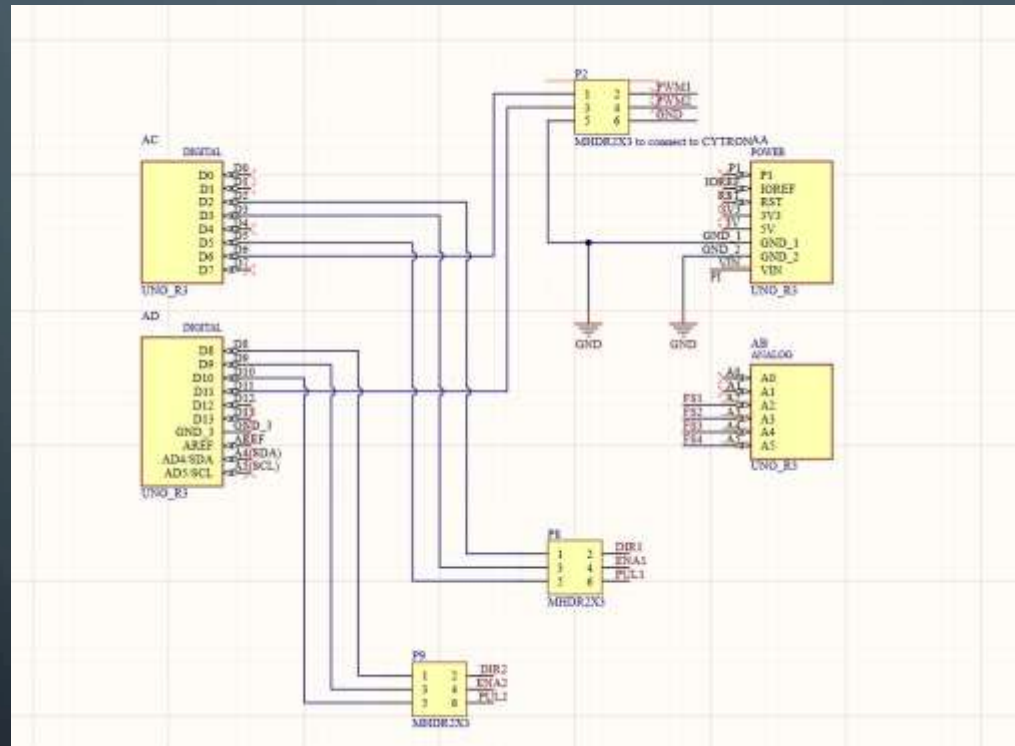
Cost: Rs. 1500

Cost: Rs. 500

ELECTRONICS

- Schematic for ARM
- Calculations
- Budget
- PCB Design

SCHEMATIC FOR ARM



BATTERY CAPACITY CALCULATION

formula: (current x time)

Current Requirement of different components (for body):

1. NEMA 34(45 kg-cm) stepper motor: 5A/phase x 4 = 20A
2. Linear Actuator: 2Amps max Total current = 20+2=22 Amps.

If the current drawn is x amps, the time is T hours then the capacity C in amhours is

$$C = xT$$

Capacity calculation: 22 x 1 Ah = 22Ah (we multiplied with 1 coz we need the system to work for one hour)

Cycle life considerations

It isn't good to run a battery all the way down to zero during each charge cycle. For example, if you want to use a lead acid battery for many cycles you shouldn't run it past 80% of its charge, leaving 20% left in the battery. This not only extends the number of cycles you get, but lets the battery degrade by 20% before you start getting less run time than the design calls for

$$C' = C/0.8$$

Final capacity requirement for body = 22/0.8 = 27.5Ah

CURRENT REQUIREMENT OF DIFFERENT COMPONENTS (FOR ARM):

1. NEMA 23(18.5 kg-cm) stepper motor: $2.8\text{A/phase} \times 2 = 5.6\text{A} \sim 6\text{A}$
2. Johnson dc motor: $5\text{A (max)} \times 2 = 10\text{A}$ Total current = 16 Amps.

If the current drawn is x amps, the time is T hours then the capacity C in amphotours is

$$C = xT$$

Capacity calculation: $16 \times (20/60) \text{ Ah} = 5.33\text{Ah}$ (we multiplied with $20/60$ coz we need the system to work for 20 min)

Cycle life considerations

$$C' = C/0.8$$

Final capacity requirement for arm = $5.33/0.8 = 6.66\text{Ah}$ NEMA 23(18.5 kg-cm) stepper motor: $2.8\text{A/phase} \times 2 = 5.6\text{A} \sim 6\text{A}$

1. Johnson dc motor: $5\text{A (max)} \times 2 = 10\text{A}$ Total current = 16 Amps.

If the current drawn is x amps, the time is T hours then the capacity C in amphotours is

$$C = xT$$

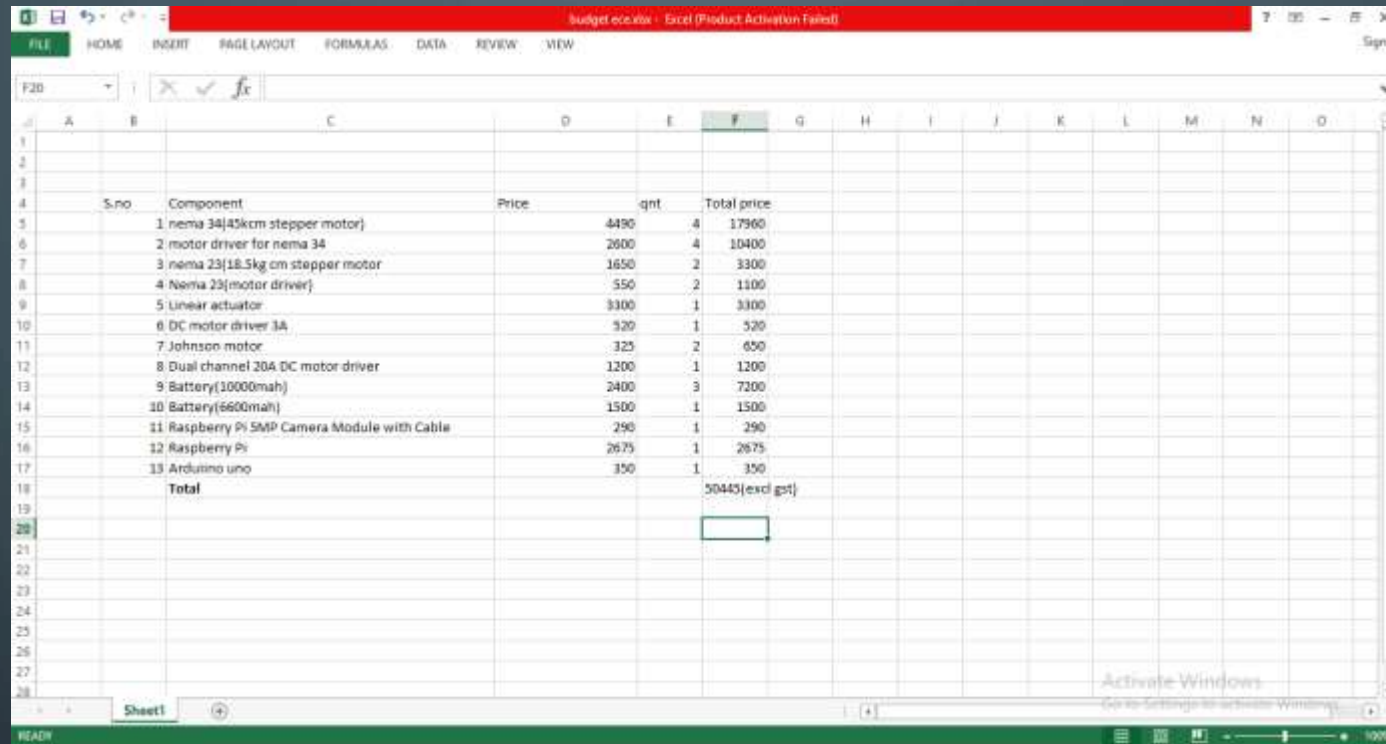
Capacity calculation: $16 \times (20/60) \text{ Ah} = 5.33\text{Ah}$ (we multiplied with $20/60$ coz we need the system to work for 20 min)

Cycle life considerations

$$C' = C/0.8$$

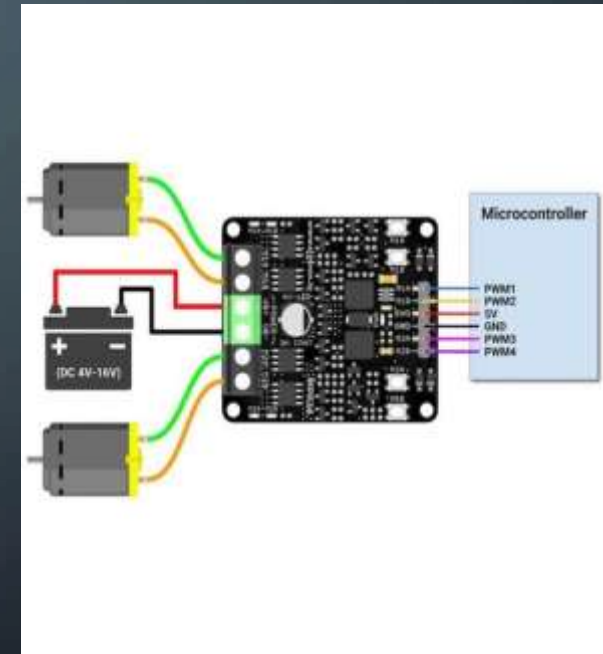
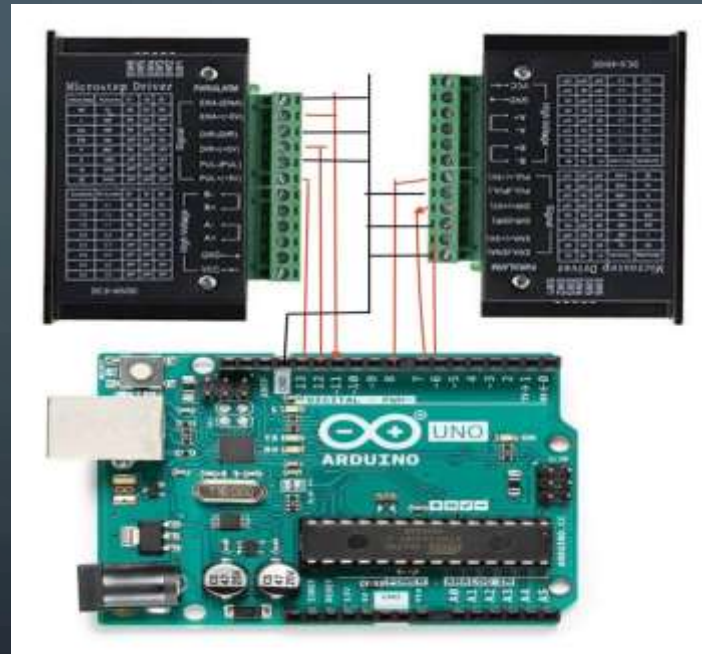
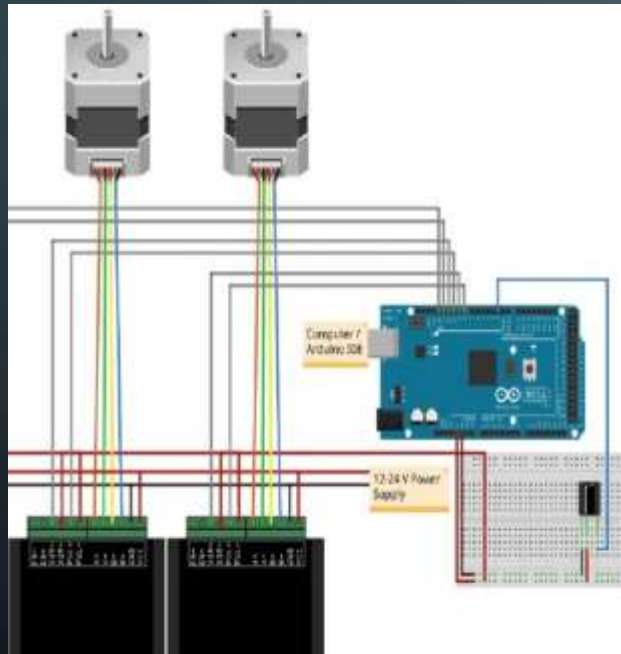
Final capacity requirement for arm = $5.33/0.8 = 6.66\text{Ah}$

BUDGET

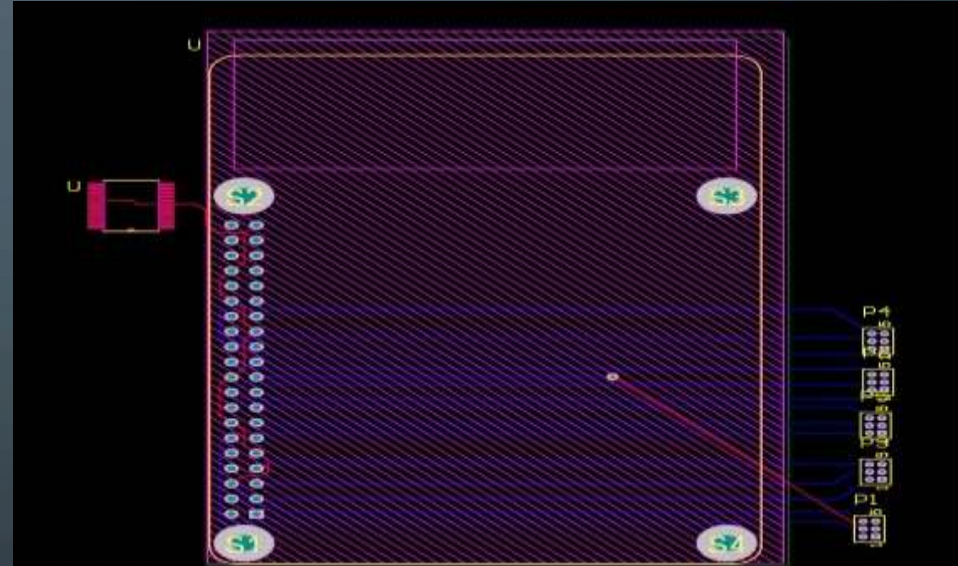
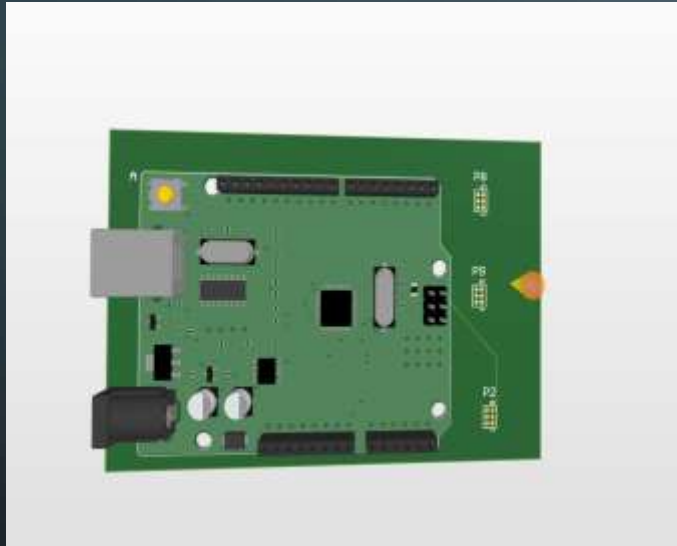


S.no	Component	Price	qnt	Total price
1	nema 34(45cm stepper motor)	4490	4	17960
2	motor driver for nema 34	2600	4	10400
3	nema 23(18.5kg cm stepper motor	1650	2	3300
4	Nema 23(motor driver)	550	2	1100
5	Linear actuator	3300	1	3300
6	DC motor driver 3A	520	1	520
7	Johnson motor	325	2	650
8	Dual channel 20A DC motor driver	1200	1	1200
9	Battery(10000mah)	2400	3	7200
10	Battery(6600mah)	1500	1	1500
11	Raspberry Pi 5MP Camera Module with Cable	290	1	290
12	Raspberry Pi	2675	1	2675
13	Arduino uno	350	1	350
	Total			50445(excl gst)

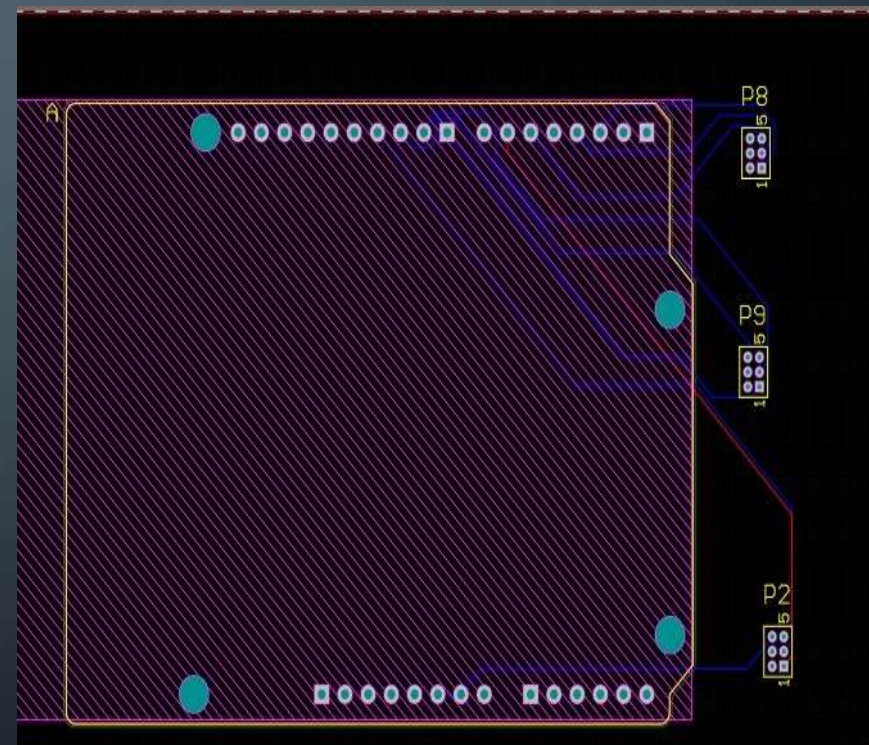
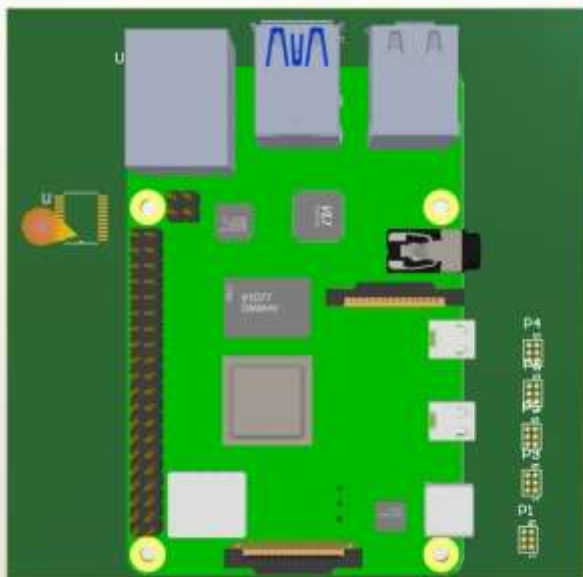
PICTORIAL REPRESENTATION



PCB DESIGN/SCHEMATIC



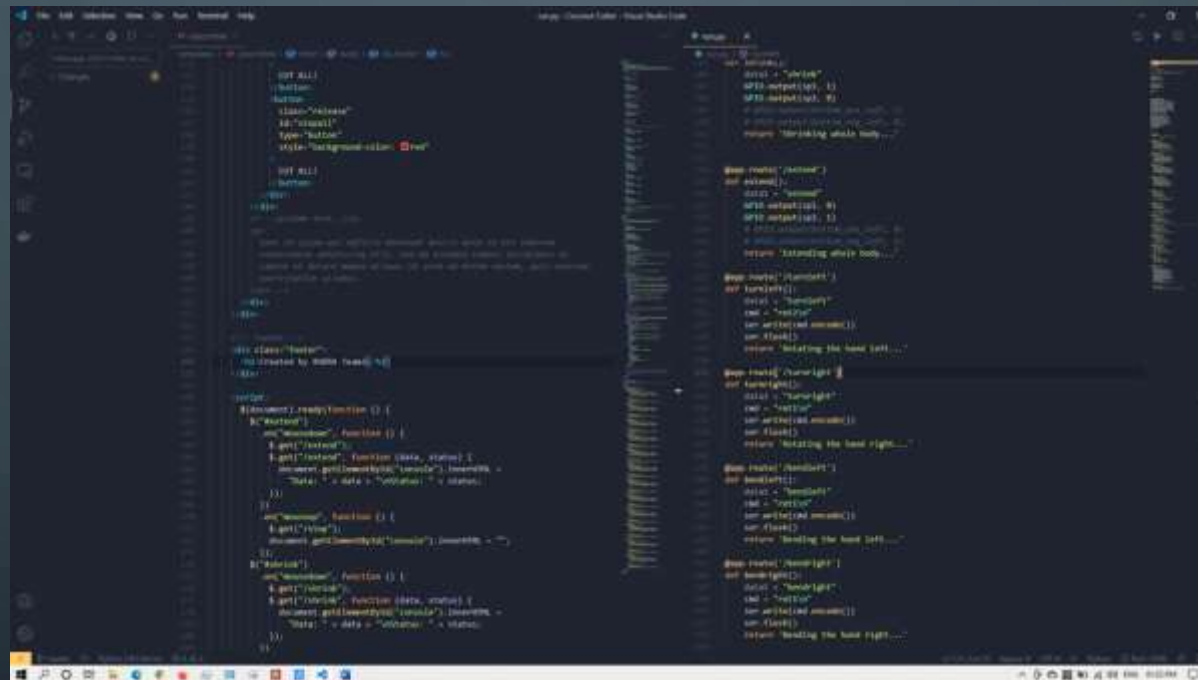
BODY DESIGN



CODING

- CODE
- INTERFACE
- PACKAGES USED

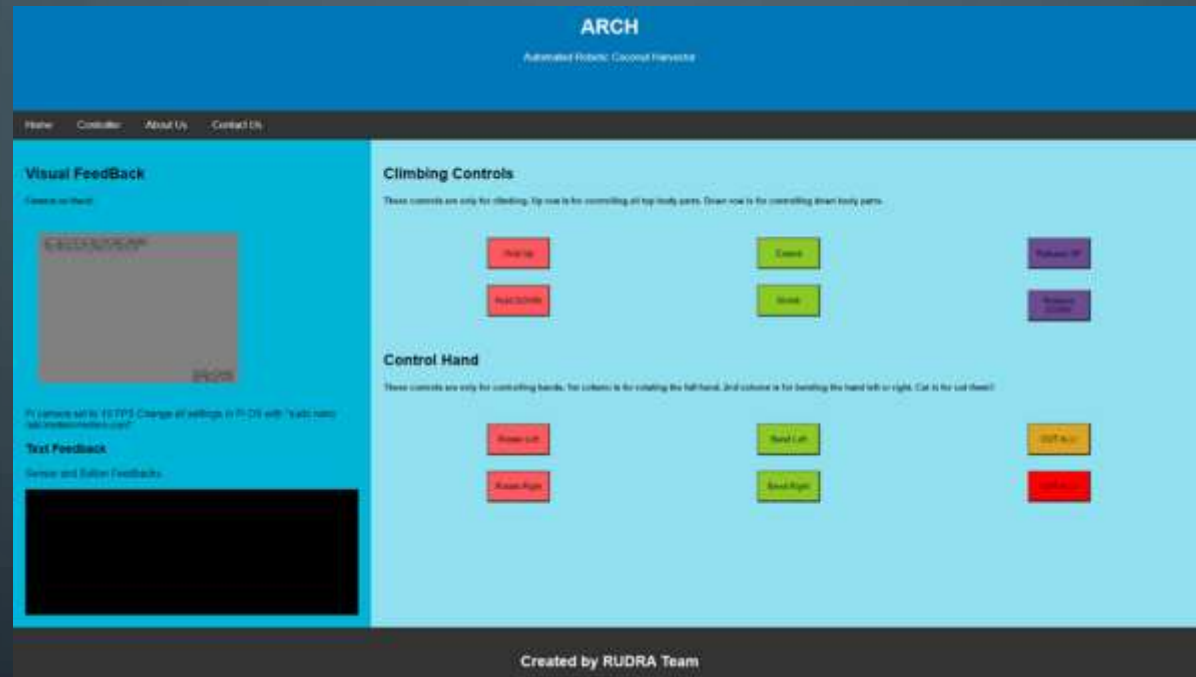
CODE



The screenshot displays a code editor with three panels. The left panel shows HTML code for a button element with attributes like class, id, type, and style. The middle panel shows CSS code for a class named 'button', including a ready function that updates the button's text and status. The right panel shows JavaScript code for a 'button' object, defining methods like 'click', 'mouseover', and 'mouseout' to handle user interactions and update the button's state.

```
HTML:  
<button  
  class="button"  
  id="button"  
  type="button"  
  style="background-color: #f0f0f0;"  
>  
</button>  
  
CSS:  
.button {  
  width: 100px;  
  height: 30px;  
  border: 1px solid #ccc;  
  text-align: center;  
  line-height: 30px;  
  cursor: pointer;  
}  
  
JavaScript:  
(function ($) {  
  $.fn.button = function (options) {  
    return this.each(function () {  
      var $this = $(this);  
      $this.addClass('button');  
      $this.click(function () {  
        $this.toggleClass('active');  
      });  
    });  
  };  
})(jQuery);  
  
$(document).ready(function () {  
  $('#button').button();  
});
```

INTERFACE



PACKAGES USED

- 1) Flask
- 2) GPIO
- 3) Serial
- 4) JQuery

BUSINESS PLAN

India is one amongst the highest producer and also consumer of coconut in the world market and yet this comes with a bit of risk and to counter that our product the Automatic Coconut Harvester will play a key role

- Our Idea is to make coconut harvesting much more fun and easy by providing farmers the access to our product through a scheme.
- Scheme- Under our scheme farmers can rent our machine to harvest coconuts in a safe and better way