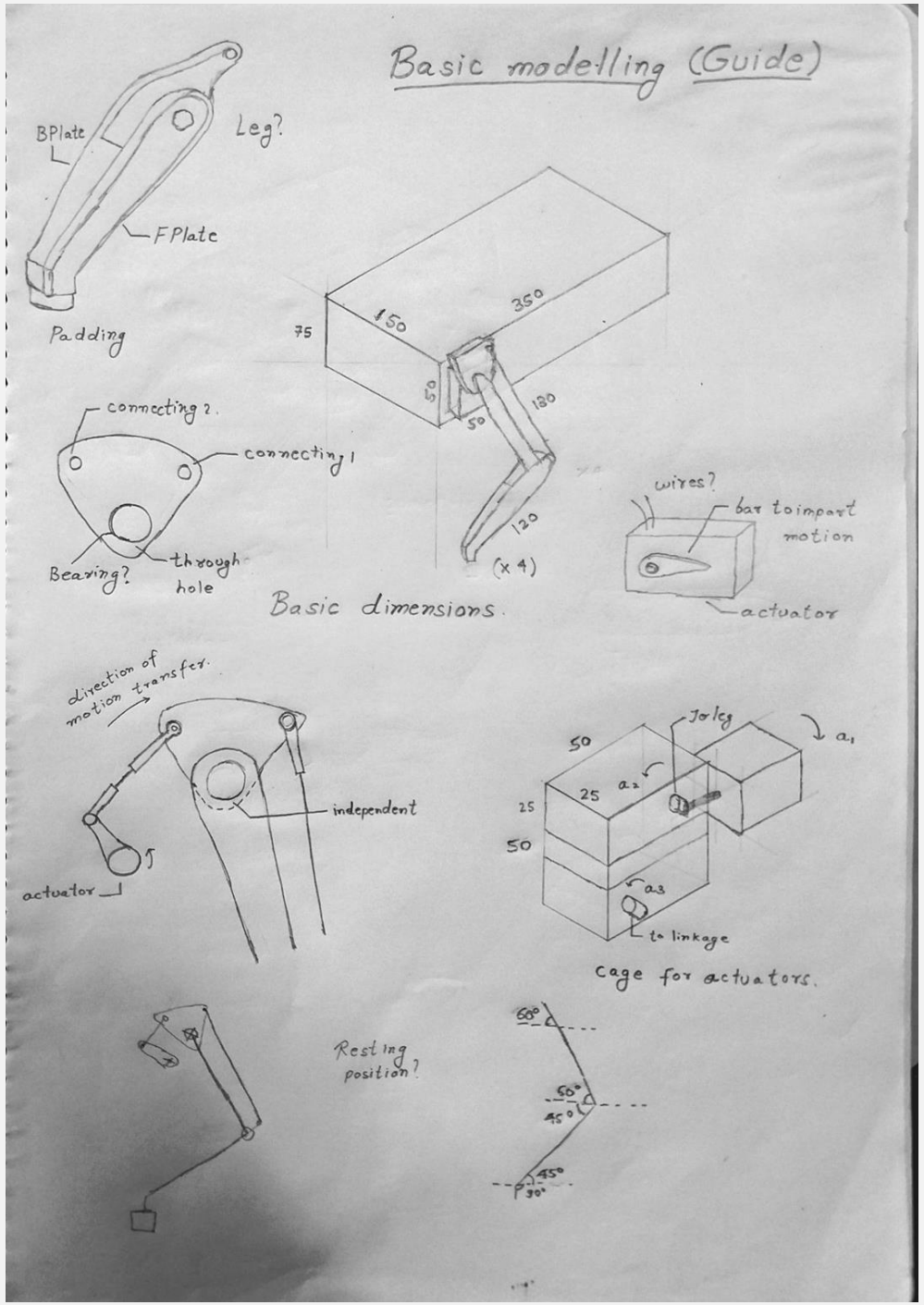
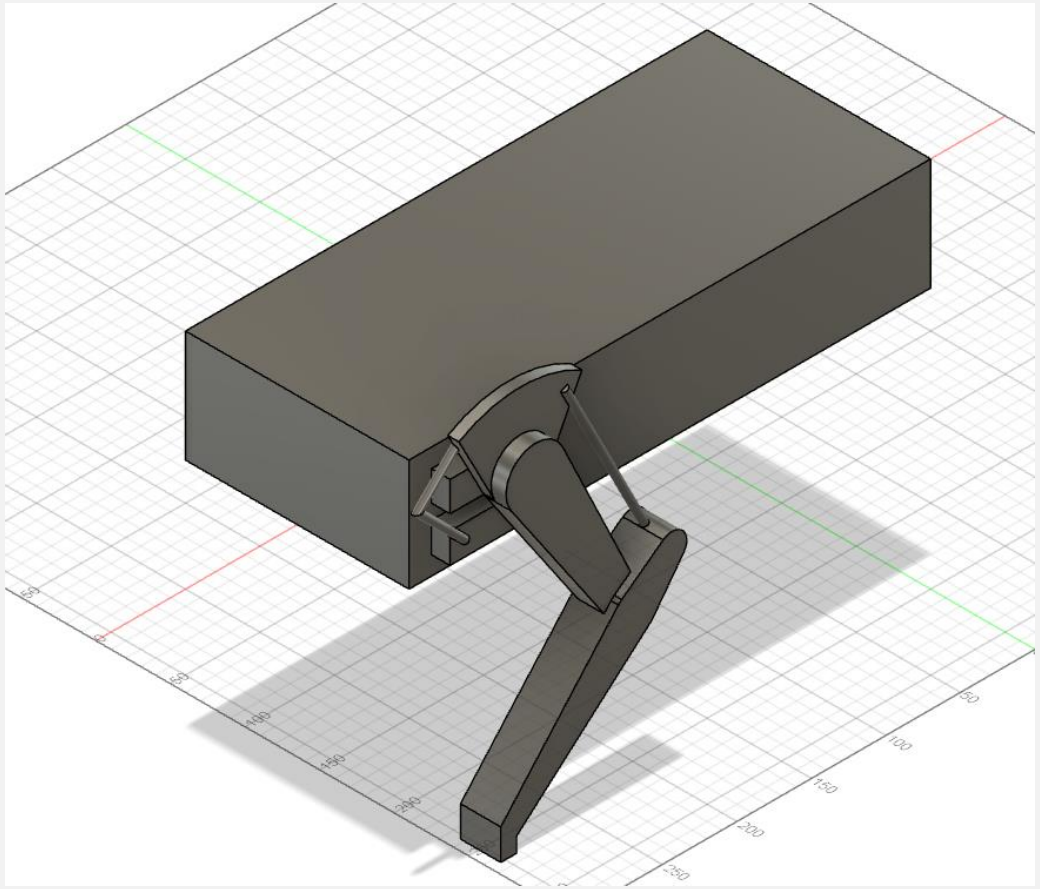
QUADRUPED PROJECT DISCUSSION

ME751-A

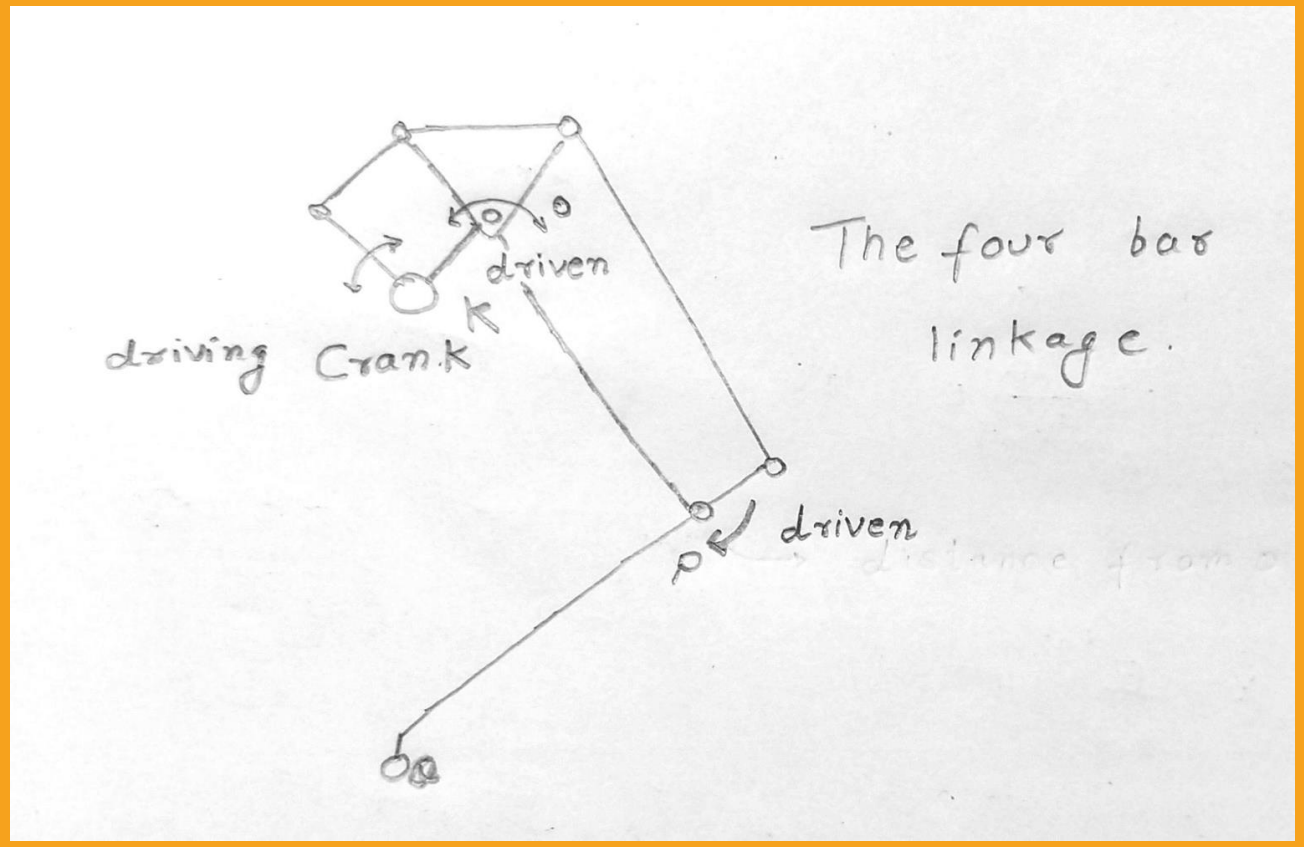
31 Aug 2023



Basic Scheme



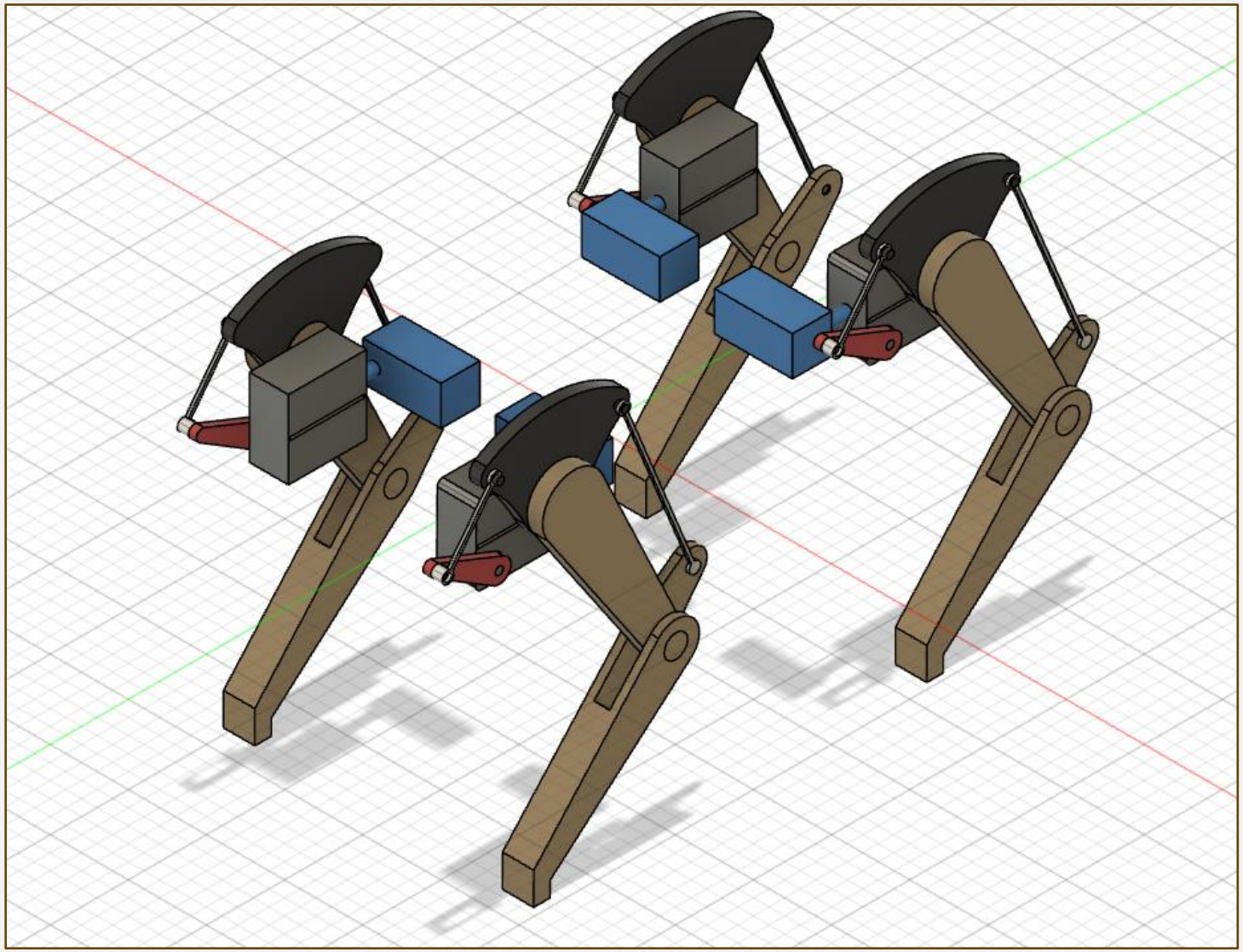
KNEE ACTUATION – 4 BAR LINKAGE



4 BAR LINKAGE MECHANISM

Two four bar linkages coupled by a hub. Driving crank imparts the motion which in turn is transferred to the ankle by a series of constrained links.

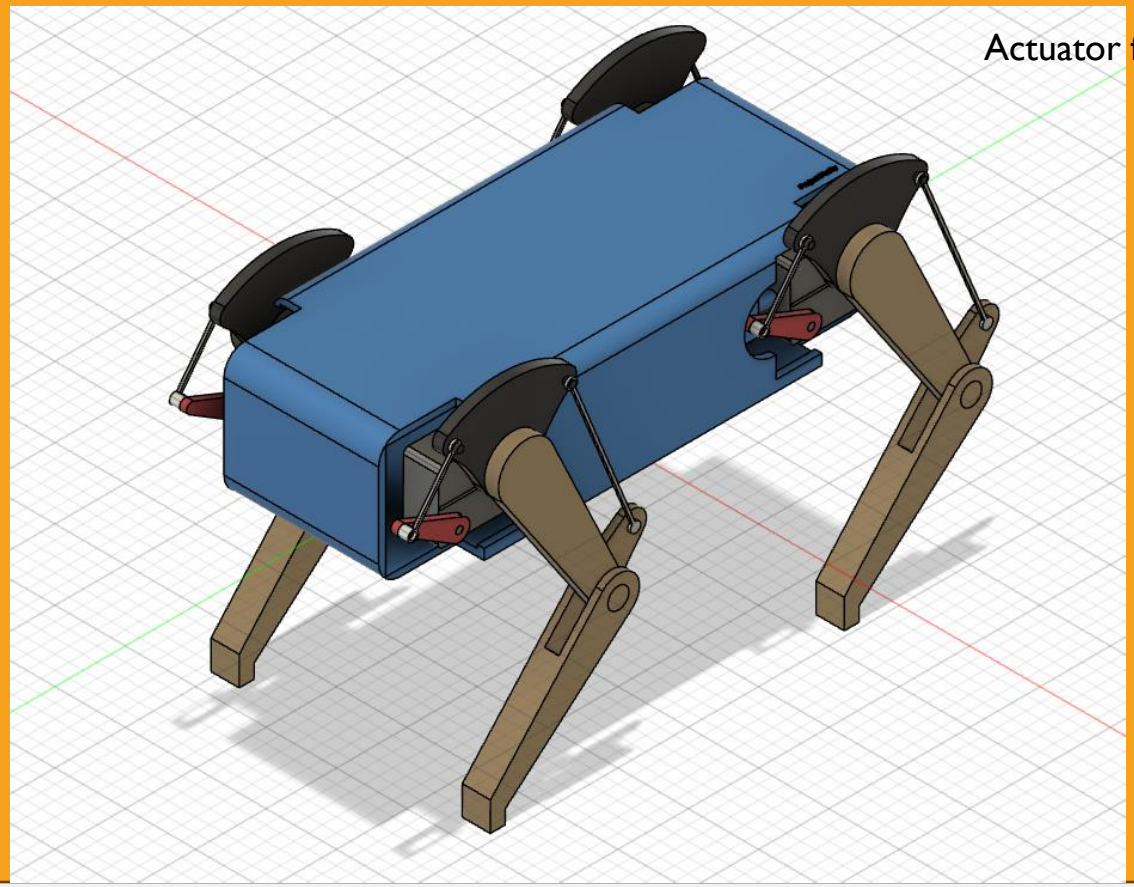
ACTUATORS

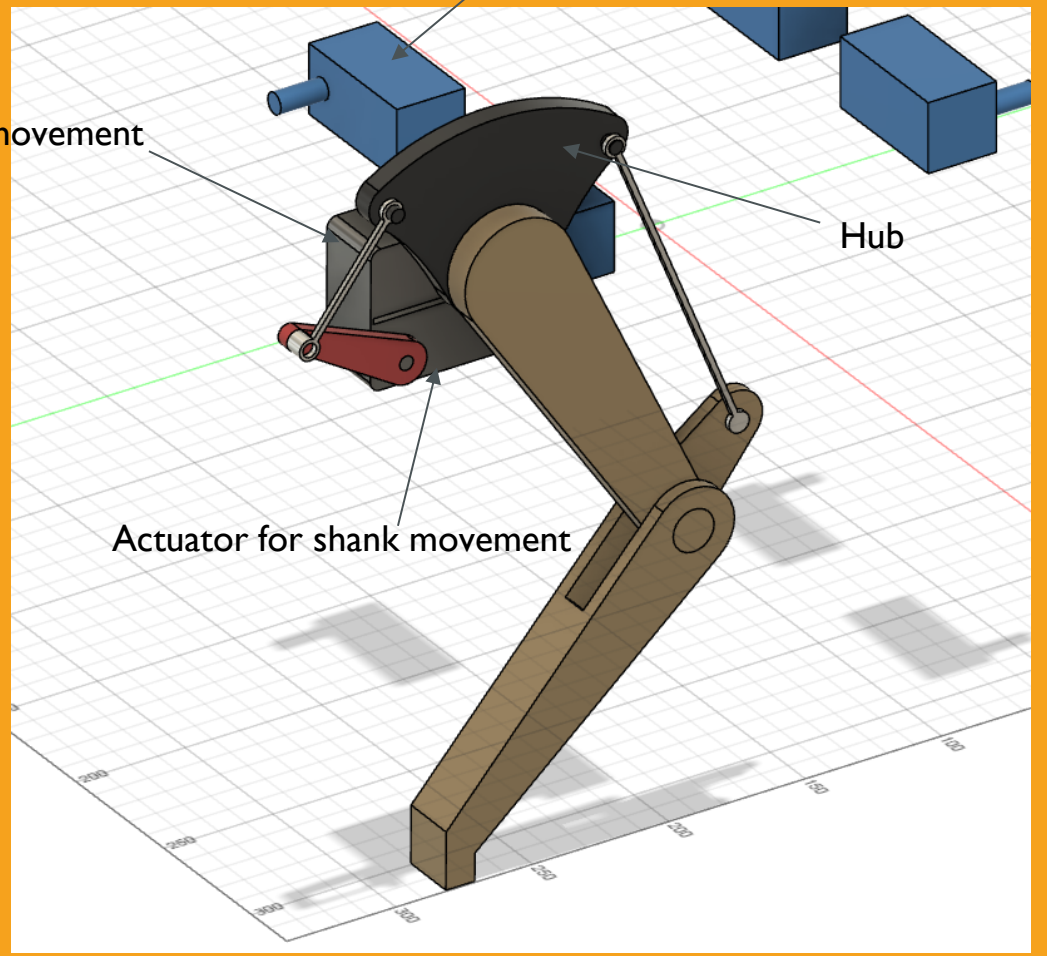


ISOMETRIC VIEW OF JOINTS OF TORSO AND LEG. ACTUATOR ASSEMBLY ALONG WITH LINKS

QUADRUPED ROBOT DESIGN

ISOMETRIC VIEW OF WHOLE ROBOT. POINTING OUT THE TORSO, LEGS





MATERIAL ANALYSIS

Sr.No.	Material	Density (kg/m^3)	Price/kg (INR)	Advantages	Disadvantages
1	Aluminium	2,710	Rs. 206.85	- Good Strength-to-Weight Ratio	- Moderate Weight (Heavier than Some Lightweight Materials) - Limited Strength Compared to High-Strength Materials
2	Steel	7,930	Rs. 40-250	- High Strength and Load-Bearing Capacity	- Heavier Weight Compared to Lightweight Materials - Limited Design Flexibility due to Weight
3	Acrylic	1170	Rs. 210-300	- Transparency and aesthetics - Ease of Machining and Fabrication	- Limited Load-Bearing Capacity - Brittleness and Susceptibility to Cracking
4	Wood	200	Rs. 250-500	-Weight Reduction, -Cost-Effectiveness	- Limited Strength, -Durability Issues

Overview: Link

Section	Material	Purpose and Use	Advantages	Considerations
Frame Structure	Steel	Main structural frame for stability and durability	High strength, load-bearing capacity	Weight, potential electromagnetic interference (EMI)
Legs and Joints	Steel	Leg components and joints for mechanical strength	Effective movement and navigation	Weight, complexity in machining
Motor Mounts	Steel	Securely attach motors for alignment and stability	Precise motor alignment	Weight, potential EMI
Load-Bearing Parts	Steel	Connectors, links for robust load-bearing capabilities	Handle high mechanical stresses	Weight, potential EMI
Chassis Components	Aluminum	Mounting plates for electronics with lightweight	Lightweight, corrosion resistance	Structural strength for heavy components
Non-Critical Structural Parts	Aluminum	Non-load-bearing structural parts for weight reduction	Improved maneuverability	Aesthetic considerations
Aesthetic Covers	Wood	Aesthetic covers for a natural and warm design	Unique visual appeal	Limited structural strength
Transparent Panels	Acrylic	Transparent panels for visibility of internal components	Enhanced visibility, visual appeal	Limited load-bearing capacity
Decoration	Acrylic	Decorative elements for aesthetic	Visual appeal	Not suitable for load-bearing parts

MOTOR TORQUE REQUIREMENTS

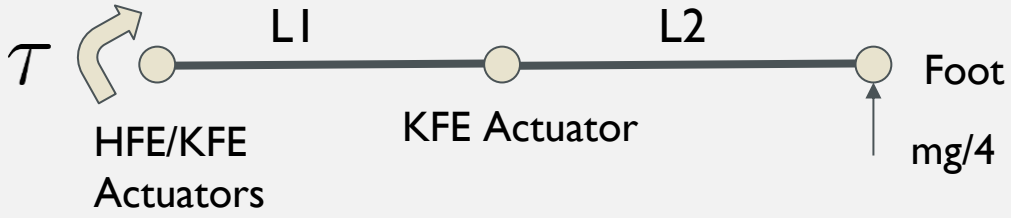
MINIMUM CONTACT FORCE FOR HOLDING BODY PER LEG: mg/4

MAXIMUM EXTENSION (ACCOUNTING FOR WORST CASE SCENARIO)

MAX TORQUE REQUIRED - 1.911 Nm (19.5 Kg-cm)

NO GEARBOX NECESSARY

COMPLETE EXTENSION



$$\tau = \eta_D mg/4(L2)$$

$$\tau = 1.911Nm$$

L1 = 0.12 m
L2 = 0.13 m
m = 2.5 kg

$\eta_D = 1.5$

Dynamic coefficient

COST ESTIMATES

ITEM	LINK	REMARKS	QTY	PRICE PER ITEM	TOTAL PRICE
Servo Motors	Link	180 degrees, 3.43 Nm	12	1799.00	₹21,588.00
Raspberry Pi 4 Model B	Link	8GB Ram	1	7269.00	₹7,269.00
LiPo Battery	Link	4000mAh Battery	1	2299.00	₹2,299.00
IMU	Link	Integrated Measuring Unit	1	115.00	₹115.00
Servo Driver PCA9685	Link	To control servo motors, via I2C interface	1	349.00	₹349.00
Arduino Nano	Link	For IMU, Battery sensing, any other sensor	1	294.00	₹294.00
32GB MicroSD card	Link	Rasp Pi memory	1	359.00	₹359.00
GPIO Cable	Link	To connect Rasp Pi to components	1	449.00	₹449.00
Power Management Board	Link	To distribute power	2	294.00	₹588.00
Miscellaneous Electronics					₹1,000.00
Nuts, Bolts etc					₹500.00
Material Cost					₹1,200.00
				Total Cost	₹36,010.00