Development of Cube Swarm for Search and Rescue Applications - Appendix C

Physical Weight Testing Calculations

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Physical Weight Testing Calculations

Andrew McCammon

March 2024

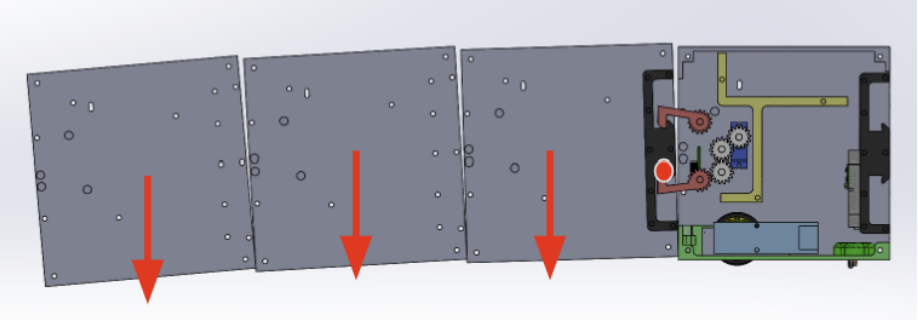

Figure 1: Cube Center of Mass Locations

Constants/Variables from Static Calculations

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Distances calculated from red dot on the gripper

COMdist1 = 0.06985 Meters = 2.75 Inches
COMdist2 = 0.224282 Meters = 8.83 Inches
COMdist3 = 0.378714 Meters = 14.91 Inches
WeightCOM = 8.33 Newtons = 850 Grams

New Constants

LAdist = 0.2286 Meters = 9 Inches

Calculating Torque on Gripper from Weight of Cubes

Torque from Three Cubes

Torque = WeightCOM*(COMdist1) + WeightCOM *(COMdist2) + WeightCOM*(COMdist3)

Torque = 5.6 Nm

Torque from Two Cubes

Torque = WeightCOM*(COMdist1) + WeightCOM *(COMdist2)

Torque = 2.45 Nm

Torque from One Cube

Torque = WeightCOM*(COMdist1) + WeightCOM *(COMdist2)

Torque = 0.58 Nm

Using Torque from Last Step to Calculate Necessary Weight for Lever Arm

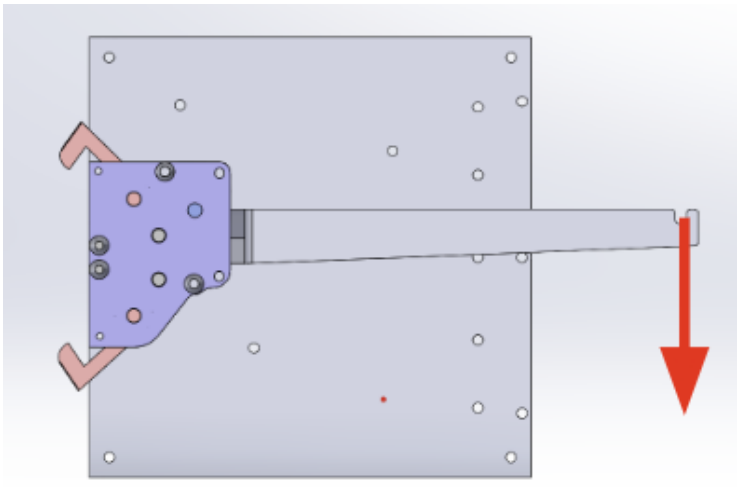

Figure 2: Lever Arm Weight Location

Equations

Torque = WeightLA*LAdist

WeightLA = Torque $\div LAdist$

WeightLA for three cubes

WeightLA = 24.49 N = 2.497 kg

WeightLA for two cubes

WeightLA = 10.72 N = 1.09 kg

WeightLA for one cube

WeightLA = 2.55 N = 0.26 kg