

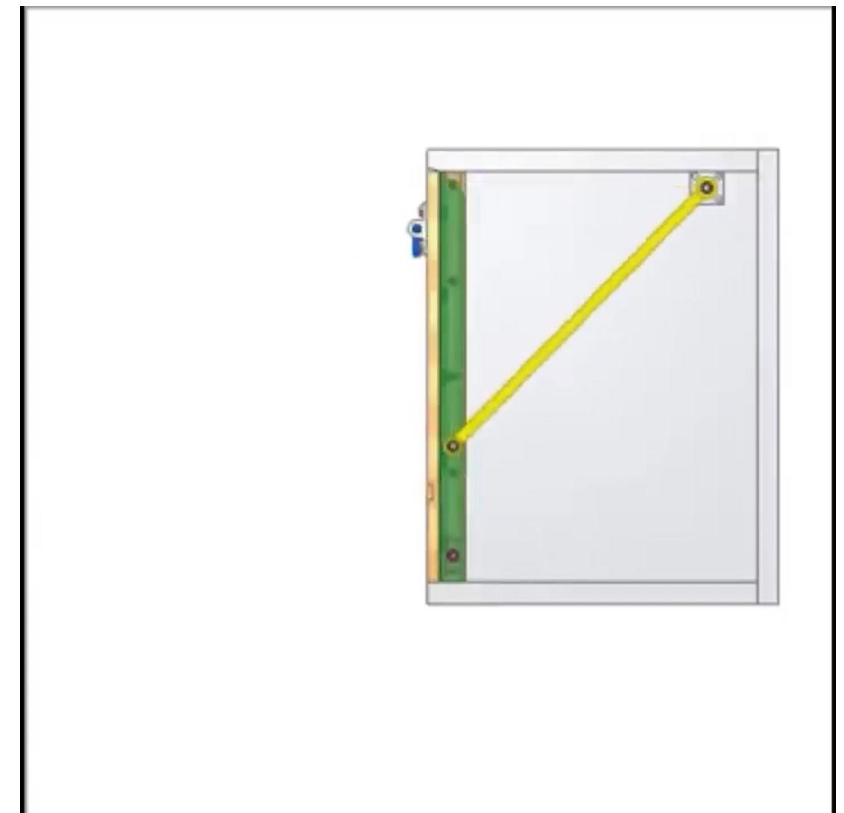
Choosing electric motors

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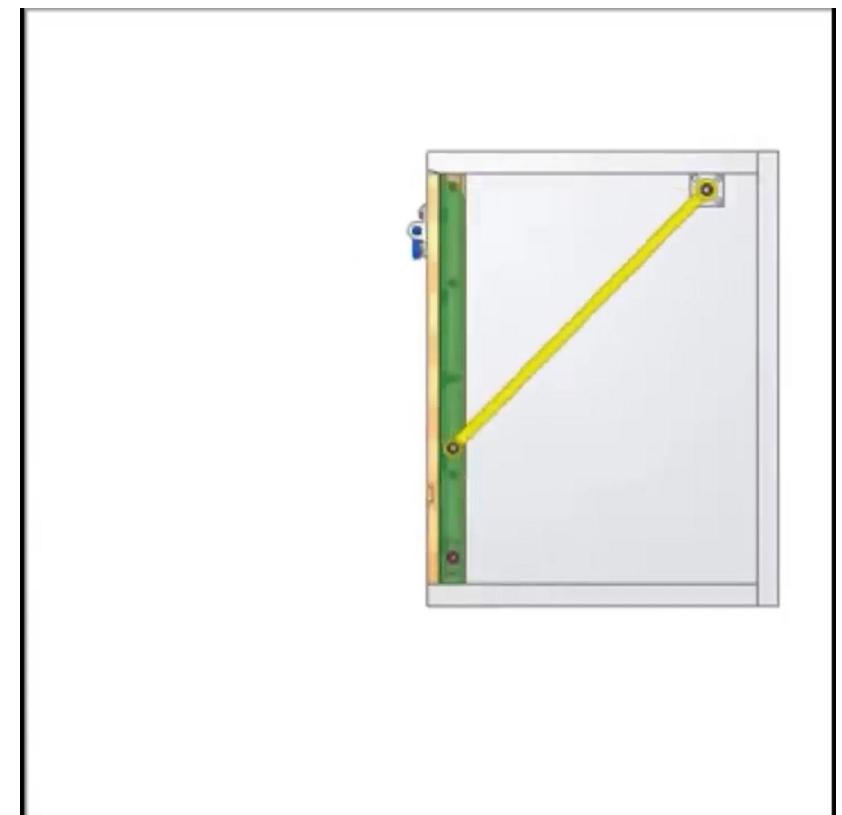
Scenario 1

- Arm with position control to open and close a box
- Specifications:
 - Weight of the door: 500g
 - Weight of arm and cables: 100g
 - Length of arm: 50cm
 - Continuous motion over 45° in 2s
 - 9V power supply
 - Max. motor diameter: irrelevant
 - Weight: irrelevant



Scenario 1

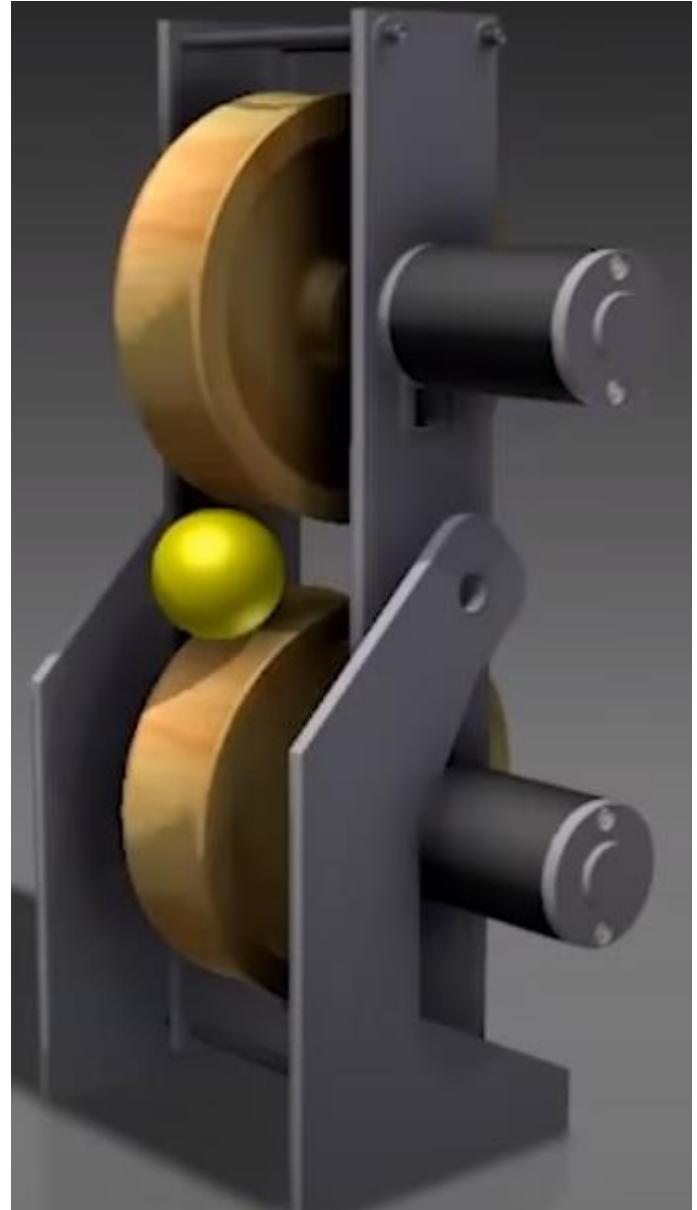
- Design implications:
 - Continuous motion: DC motor, not stepper
 - Low speed application: high gear reduction
- Motor Parameters:
 - $(0.5 \text{ m} * 0.5 \text{ kg} + 0.25 \text{ m} * 0.1 \text{ kg})$
 $* 9.81 \text{ m/s}^2 = 2.7 \text{ Nm} (\sim 27.5 \text{ kg-cm})$
 - Min. speed: $0.125 \text{ rev} / 0.033 \text{ min} = 3.8 \text{ rpm}$



Scenario 1

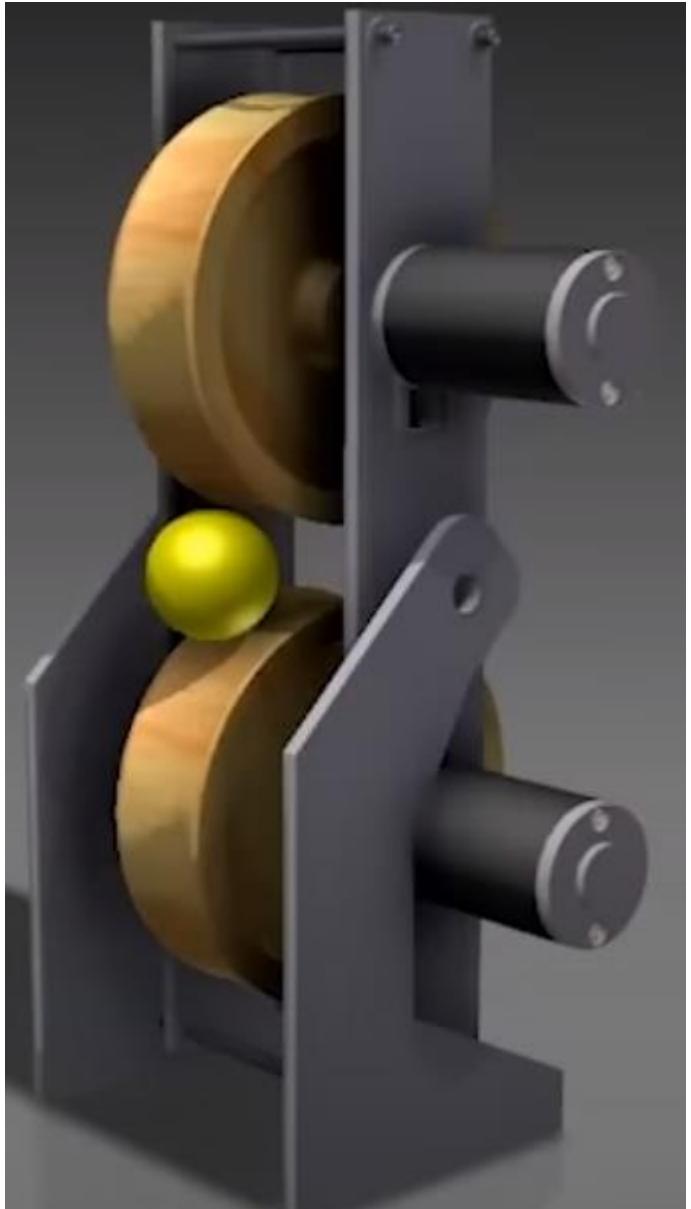
Scenario 2

- Tennis ball thrower
- Specifications:
 - Disk dia.: 20cm
 - Min. ball speed: 50km/h
 - 12V power supply
 - Req. force applied on the ball: 1.5N
 - Continuous motion
 - Motor diameter: irrelevant
 - Weight: irrelevant



Scenario 2

- Design implications:
 - Continuous motion
 - High speed, low torque
- Speed
 - $\frac{\frac{50}{3.6}}{0.1} = 139 \frac{rad}{s}$, $\frac{278}{2*\pi} * 60 = 1326 \text{ rpm}$
- Torque:
 - $\frac{1.5}{2} * 0.2 = 0.15 \text{ Nm} (\sim 1.5 \text{ kgcm})$



Scenario 2