Height → 0.65m
Width → 2m
} Solar Panel

Mechatronics Calculations

Tyre Diameter → 15cm ($r = 0.075$ m)
Circumference → $2\pi r$ = 0.47 m

Desired speed → 10cm/s or 0.1 m/s

$$RPM = \frac{0.5}{0.47} \times 60 = 63.6 \text{ RPM}$$

RPM ≈ 64 RPM or 13 RPM (Per motor)
$v = 0.5$ m/s

Power Required: RPM = 12.73 RPM ($v = 0.1$ m/s) ≈

Assuming Weight of Solar Panel = 10kg

M

(friction coefficient) = 0.3

mg ↓

Normal Force = $mxg = 10 \times 9.81 = 98.1$ N

Rolling Resistance Force (F_r) = $0.3 \times 98.1 = 29.43$ N

Torque Required = $\left(\frac{29.43}{4}\right) \times 0.075 = 0.5518$ Nm

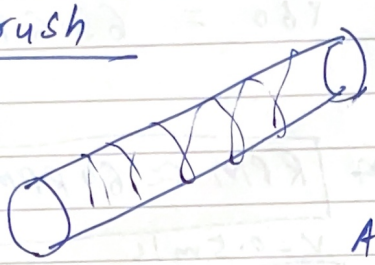
↑ Per motor

10cm/s desired speed

Angular velocity (ω) = $\frac{0.1}{0.075}$ = 1.33 rad/s

Power = 0.5518 Nm × 1.33 ≈ 0.736 W

Rolling Brush



Assuming radius = $\frac{15}{2}$ cm

Assuming mass = 4 kg

$I = \frac{1}{2} Mr^2 = \frac{1}{2} 4 (0.075)$ = 0.01125 kg m²

Moment of Inertia

Assuming Brush Rotates at 60 RPM

ω (Angular v) = $\frac{2\pi \times 60}{60}$ = 6.28 rad/s

Torque ($T = I \cdot \alpha$)

$\alpha = \frac{\omega}{t}$ Assuming it should reach 60 RPM in 5 seconds

= $\frac{6.28}{5}$ = 1.256 rad/s²

$T = 0.01125 \times 1.256 = 0.014142$ Nm

Power of Motors = T·W = 0.0887 W Per Motor