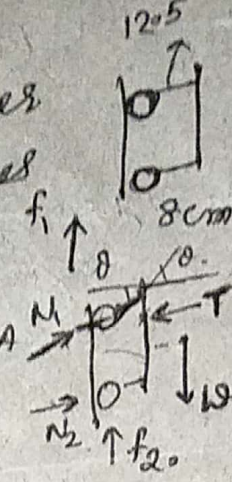
Range of μ values calculation:

Assuming the bot stays at homes we have to find the range of μ values for which it stays like that.



$$N_1\cos\theta + N_2 = T \quad \text{——— (1)}$$

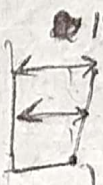
$$f_1 + f_2 + \mu N_1 \sin\theta = W \quad \text{——— (2)}$$

$$f_1 = \mu N_1 \cos\theta \quad \text{——— (3)}$$

$$f_2 = \mu N_2 \quad \text{——— (4)}$$

Net moment about A is zero. (12.5 ↑)

$$T(4.2) + W \times [10.25] - N_2(20 - 18\sin\theta) = 0 \quad \text{——— (5)}$$



$12.5 - 8 = 4.5 \times 10$

$\frac{4.5}{2} + 8$

$2.25 + 8$

$= 10.25$

$$N_2 = \frac{T(4.2) + W(10.25)}{(20 - 12.5\sin\theta)}$$

$$\boxed{N_1 = \frac{T}{\cos\theta} - \frac{T(4.2) + W(10.25)}{\cos\theta(20 - 12.5\sin\theta)}}$$

$f_1 + f_2 + N_1\sin\theta = W$.

$\boxed{N_1 \geq 0}$ for the bot to stay connected on the wall,

$$f_2 = \mu N_2$$

$$\mu \times N_1\cos\theta + \mu N_2 + N_1\sin\theta = W.$$

$$(\mu\cos\theta + \sin\theta) + \mu N_2 = W.$$

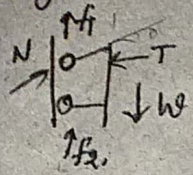
when

$12.5\sin\theta = 4.2$

$\sin\theta = \left[\frac{4.2}{12.5}\right]$

$\theta = 19.47°$

↗



$$T(4\cdot2) + W(10\cdot25) - N_2(20 - 18\sin\theta) = 0$$

$$N_2 = \frac{T(4\cdot2) + W(10\cdot25)}{(20 - 12\cdot5\sin\theta)}$$

$$N_1\cos\theta + N_2 = T$$

$$N_1 = \left[T - \frac{T(4\cdot2) + W(10\cdot25)}{(20 - 12\cdot5\sin\theta)}\right] \frac{1}{\cos\theta}$$

$$f_1 + f_2 + N_1\sin\theta - W = \left(\frac{W}{g}\right)a.$$

$$N_1 \geq 0 \qquad T - \frac{T(4\cdot2) + W(10\cdot25)}{(20 - 12\cdot5\sin\theta)} \geq 0.$$

$$T \geq \frac{T(4\cdot2) + W(10\cdot25)}{(20 - 12\cdot5\sin\theta)}.$$

(N)

$$\frac{W}{T} = \mu$$

$$20T - 12\cdot5\sin\theta\, T - T(4\cdot2) \geq W(10\cdot25)$$

$$(15\cdot8 - 12\cdot5\sin\theta)\, T \geq W(10\cdot25)$$

$$T \geq \frac{W(10\cdot25)}{(15\cdot8 - 12\cdot5\sin\theta)}.$$

Thrust minimum required for the bat to not to topple.

$\theta = 90°$

$$\left[T = \frac{W(10\cdot25)}{15\cdot28}\right].$$

$$T = 920 \times \left[\frac{10\cdot25}{15\cdot28}\right].$$

$\theta = 90°$

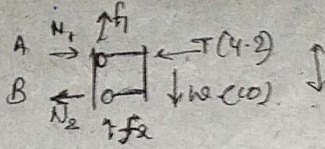
$$T = \frac{W(10\cdot25)}{(15\cdot8 - 12\cdot5)}$$

$$T = 920 \times 3\cdot1$$

$$= 2852 \text{ gm}$$

$T \approx 2900$ gm roughly.

$T_{max} = 2852$ gm



$N_1 = T + N_2$ ——— ①.

$f_1 + f_2 = W$ ——— ②.

$\mu N_1 + \mu N_2 = W$ ——— ③.

$\mu \Sigma$

$N_2 = N_1 - T = \frac{15.8(T) - 8W}{20} + T \geq 0.$

$N_1 + N_2 = T.$ $\quad 15.8(T) - 8W \geq 20T.$

$35.8T.$

$20T - 15.8T + 8W \geq 0.$

Take moments about B to be zero.

$N_2(20) + W(8)$

about B to be zero,

$N_1(20) + W(8) - T(4.2 + \ldots$

$\Rightarrow$

$N_1 = \left[\frac{T(15.8) - 8W}{20}\right]$

$\frac{T(15.8) - 8W}{20}.$

N_1

N_1

μ values

$\mu N_1 \cos\theta + \mu N_2 + N_1 \sin\theta = W.$

$N_1[\mu\cos\theta + \sin\theta] + \mu N_2 = W.$

$\mu \times \left[\frac{T \times 4.2 + 10.25W}{20 - 12.5\sin\theta}\right] + \left[\qquad\right] = W.$

$\mu N_1 \cos\theta + \mu N_2 + N_1 \sin\theta = W.$

$N_1[\mu\cos\theta + \sin\theta] = W - \mu N_2.$

$N_1 \geq 0.$

$W - \mu N_2 \geq 0.$

$W \geq \mu N_2.$

$\mu \geq \left[\frac{W}{N_2}\right].$

$\mu \geq \frac{W \times (20 - 12.5\sin\theta)}{T(4.2) + W(10.25)}.$

$\mu \geq \frac{W \times (20 - 12.5\sin\theta)}{T(4.2) + W(10.25)}$

$\mu \geq 0.2$

$0.2 \geq \frac{W(20 - 12.5\sin\theta)}{T(4.2) + W(10.25)}$

$T(4.2) \times 0.2 + W(10.25 \times 0.2) \geq W(20 - 12.5\sin\theta)$

$\therefore T = \frac{W(20 - 12.5\sin\theta - 10.25 \times 0.2)}{4.2 \times 0.2}$

$T = \frac{W[20 - 12.5\sin\theta - 10.25\mu]}{4.2 \times \mu}$

$\because 3W$

$[20 - 12.5\sin\theta - 10.25\mu] = 4.2\mu$

$\mu = 0.2$

$20 - 12.5\sin\theta - 10.25\mu = 4.2\mu \times k$ → (T/W) ratio.

$20 - 12.5\sin\theta - 2.5 = 4.2 \times \frac{2}{10} \times 3$

$12.5\sin\theta = 20 - 2.5 - 4.\frac{2 \times 2 \times 3}{10}$

$12.5\sin\theta = 10.86$

$\sin\theta = \frac{10.86}{12.5}$

θ should not ~~exceed~~ be $60°$.

0.4

$20 - 12.5\sin\theta = 10.25\mu + 4.2\mu k$. let $k = 3$

$[20 - 12.5\sin\theta] = 10.25\mu + 12.6\mu]$

$= 22.85\mu$.

$\left[\frac{20 - 12.5\sin\theta}{22.85}\right] = \mu$.

$\mu_{min} = 0.32$

θ calculations:

$20 - 12.5 \sin\theta - 10.25\mu = 4.2\mu k$.

$= 12.6\mu$.

$\left[\frac{20 - 22.85\mu}{12.5}\right] = \sin\theta$.

$0.82 \leftarrow \mu$ $\quad$ 0.67

$60°$ $\quad$ normal.

$\mu(T) = W$

$\mu = \left[\frac{W}{T}\right]$.

$\mu = \frac{W}{T}$ $\quad$ if $[\mu = 0.2]$, then $T = \frac{W}{\mu} = \left[\frac{920}{0.2}\right]$.

$= \frac{920 \times 10}{2} = 920 \times 5$

$= 4500$

$T = \frac{W}{\mu}$

$T =$

$3 \times 0.2 = 600$ gm.

↓ weight for a μ value of 0.2 //

$T = 3$ kgf.