① **Python & kinematika Cerah.**

Servo 1 & 2

40° & 30°

$\theta_1 = 40°$ $\theta_2 = 30°$ $L_f = 56$ $L_2 = 65$

Ditanya = koordinat akhir

$$H_1^0 \begin{bmatrix} \cos(\theta_1 + \theta_2) & -\sin(\theta_1 + \theta_2) & l_1 \cos\theta_1 + l_2 \cos(\theta_1 + \theta_2) \\ \sin(\theta_1 + \theta_2) & \cos(\theta_1 + \theta_2) & l_1 \sin\theta_1 + l_2 \sin(\theta_1 + \theta_2) \\ 0 & 0 & 1 \end{bmatrix}$$

$$l_1 \cos\theta + l_2 \cos(\theta_1 + \theta_2) = 56 . \cos 40° + 65 . \cos(40° + 30°)$$

$$= 56 . 0,7660 + 65 . \cos(70°)$$

$$= 42,8985 + 65 . 0,3420.$$

$$= 42,8985 + 22,2313$$

$$= \boxed{65,1298}$$

$l_1 \sin\theta_1 + l_2 \sin(\theta_1 + \theta_2)$

$= 56 \sin 40° + 65 \sin(40° + 30°)$

$= 35,9961 + 61,08$

$= \boxed{97,0761 .}$

← dikali dari belakang

$$H_4^0 = H_1^0 \, H_2^1 \, H_3^2 \, H_4^3$$

$$H_1^0 \begin{bmatrix} \cos\theta_1 & -\sin\theta_1 & 0 \\ \sin\theta_1 & \cos\theta_1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$H_4^3 \times H_3^2$

$$\begin{bmatrix} 1 & 0 & L_2 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} \cos\theta_2 & -\sin\theta_2 & 0 \\ \sin\theta_2 & \cos\theta_2 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} \cos\theta_2 + 0 + 0 & -\sin\theta_2 + 0 + 0 & L_2 \\ 0 + \sin\theta_2 + 0 & \cos\theta_2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

kali H_2^1

$$\begin{bmatrix} 1 & 0 & L_1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos\theta_2 & -\sin\theta_2 & L_2 \\ \sin\theta_2 & \cos\theta_2 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} \cos\theta_2 & -\sin\theta_2 & L_2 + L_1 \\ \sin\theta_2 & \cos\theta_2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\text{hasil } H_q^0 = \begin{bmatrix} \cos(\theta_1 + \theta_2) & -\sin(\theta_1 + \theta_2) & \boxed{l_1\cos\theta_1 + l_2\cos(\theta_1 + \theta_2)} \\ \sin(\theta_1 + \theta_2) & \cos(\theta_1 + \theta_2) & \boxed{l_1\sin\theta_1 + l_2\sin(\theta_1 + \theta_2)} \\ 0 & 0 & 1 \end{bmatrix}$$

$$\theta_1 = 90° \qquad \theta_2 = 30° \quad l_1 = 56 \qquad l_2 = 65$$

~~cos~~

$$\cos 90° \approx 0,766044 \qquad \sin 90° \approx 0,642788,$$

hasil perhitungan sebelumnya

$$\begin{aligned} x &= l_1 \cos\theta_1 + l_2 \cos(\theta_1 + \theta_2) \\ &= 56 \cos 90° + 65 \cos(90° + 30°) \\ &= 65,1298 \approx 65,13 \end{aligned}$$

$$\begin{aligned} y &= l_1 \sin\theta_1 + l_2 \; \sin(\theta_1 + \theta_2) \\ &= 56 \sin 90° + 65 \sin(90° + 30°) \\ &= 97,0761 \approx \cancel{97,0761} \; 97,08 \end{aligned}$$

$$\text{Jadi } E(x, y) = (65,13 \; , \; 97,08) \;//$$

$$H_1^0 \times H_3 = \begin{bmatrix} \cos\theta_1 & -\sin\theta_1 & 0 \\ \sin\theta_1 & \cos\theta_1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} \cos\theta_2 & -\sin\theta_2 & L_2 + C_1 \\ \sin\theta_2 & \cos\theta_2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} \cos\theta_1 \times \cos\theta_2 + (-\sin\theta_1 + \sin\theta_2) & \cos\theta_1 + \sin\theta_2 + -\sin\theta_2 \\ & -\sin\theta_2 \end{bmatrix}$$

$$\begin{bmatrix} \cos\theta_1 \times \cos\theta_2 + (-\sin\theta_1 \times \sin\theta_2) & \cos\theta_1 \cdot -\sin\theta_2 + -\sin\theta_1 \cdot \sin\theta_2 & L_2 + C_1 \cdot \cos\theta_1 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\boxed{\sin\theta_1 \cdot (L_1 + L_2)}$$

$$\boxed{L_1 \sin\theta_1 + L_2 \sin(\theta_1 + \theta_2)}$$

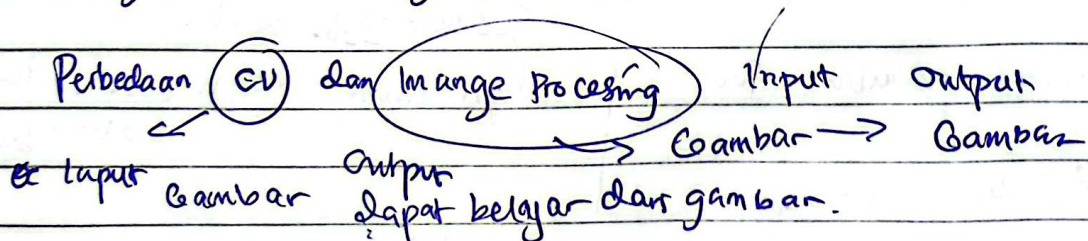$$\boxed{(L_2 + L_1)\cos\theta} = \boxed{L_1 \cos\theta_1 + L_2 \cos(\theta_1 + \theta_2)}$$

Inverse kinematik.

↳ menghitung jumlah rotasi (butuh berapa rotasi agar sampai akhir),

Computer Vision
↳ kemampuan komputer melihat & menafsirkan dunia
↳ agar robot bisa gerak sendiri

Perbedaan (CV) dan (Image Procesing)   Input   Output
                                        Coambar → Gambar
et laput   Output
     Gambar   dapat belajar dari gambar.

→ ditangkap kamera go pro   gambar → ke bmer
→ dgn AI atau open cv, deep learning

Dipindai dengan CamScanner