

Appendix

Modeling Equations for Finger Movement Using Joint Angle and Length Between Joint

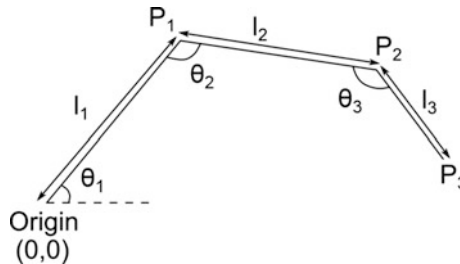


Fig. A.1 Demonstration of algorithm for human machine-interfacing or advanced input methods. Schematic of finger to calculate the coordinates of finger. Sensors are attached at Origin, P1 and P2 which can measure the angles. l_1 , l_2 and l_3 are known parameters

Co-ordinates of the points (Fig. A.1):

$$\begin{aligned}
 \mathbf{P1}: & \quad x = l_1 \cos(\theta_1), \quad y = l_1 \sin(\theta_1) \\
 \mathbf{P2}: & \quad x = l_1 \cos(\theta_1) - l_2 \cos(\theta_1 + \theta_2), \quad y = l_1 \sin(\theta_1) - l_2 \sin(\theta_1 + \theta_2) \\
 \mathbf{P3}: & \quad x = l_1 \cos(\theta_1) - l_2 \cos(\theta_1 + \theta_2) + l_3 \cos(\theta_1 + \theta_2 + \theta_3), \quad y = l_1 \sin(\theta_1) \\
 & \quad \quad \quad - l_2 \sin(\theta_1 + \theta_2) + l_3 \sin(\theta_1 + \theta_2 + \theta_3)
 \end{aligned}$$

Variation ranges:

$$\begin{aligned}
 \theta_1 & \in [90^\circ, 180^\circ] \\
 \theta_2 & \in [60^\circ, 180^\circ] \\
 \theta_3 & \in [90^\circ, 180^\circ]
 \end{aligned}$$

In the equations points P1, P2 are the points at joints and point P3 is the finger tip. It is assumed the length between the finger joints l_1 , l_2 and l_3 are constant. The movement of the finger has been simulated in **Video 1** for finger movement using above equations and the data acquired from sensor for finger joint.