



Latar belakang

Operasional gudang menghadapi masalah seperti kecelakaan kerja, human error, proses lambat, dan tata letak yang tidak efisien, dengan rata-rata hanya 68% kapasitas ruang yang dimanfaatkan. Solusi inovatif seperti teknologi robot sorting diperlukan untuk meningkatkan efisiensi, mempercepat proses, dan meningkatkan keselamatan kerja.

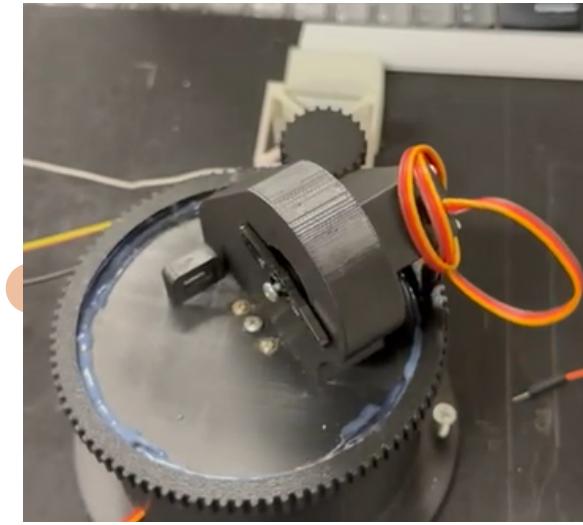
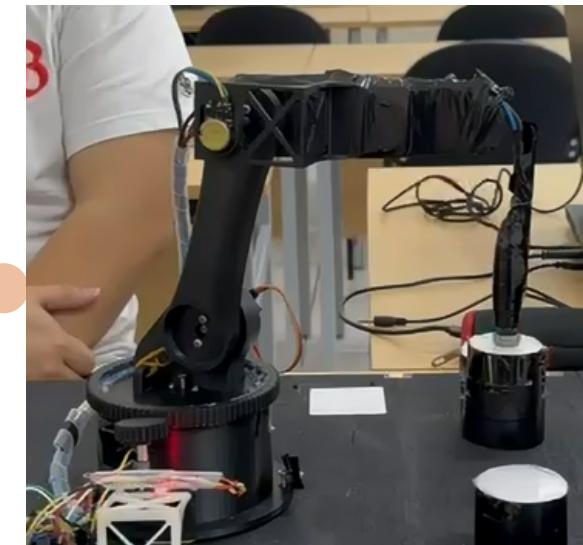
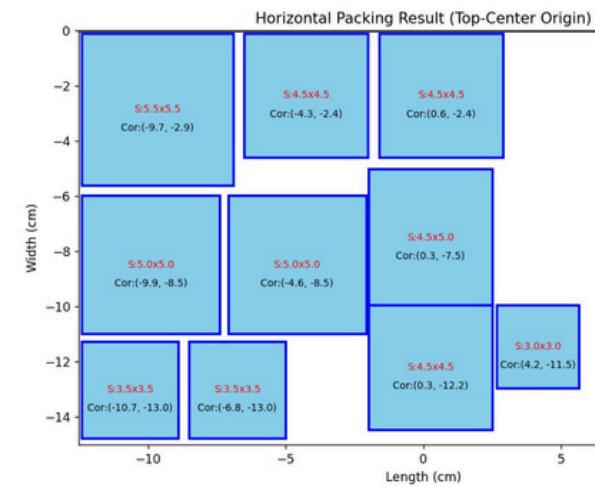
8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



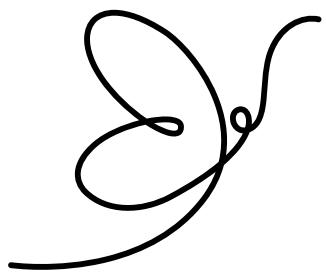
Topik yang Tercakup



**MACHINE
LEARNING**

**RKD
(ROBOTICS KINEMATICS DYNAMICS)**

**CONTROL
SYSTEM**



Material & tahapan project



3d printing filament



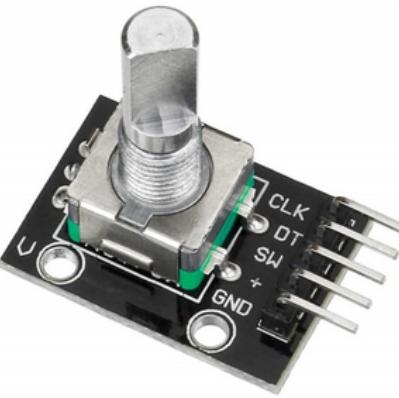
limit switch



positional servo 180 7kg



camera



rotary encoder



Continuous servo 360 20kg



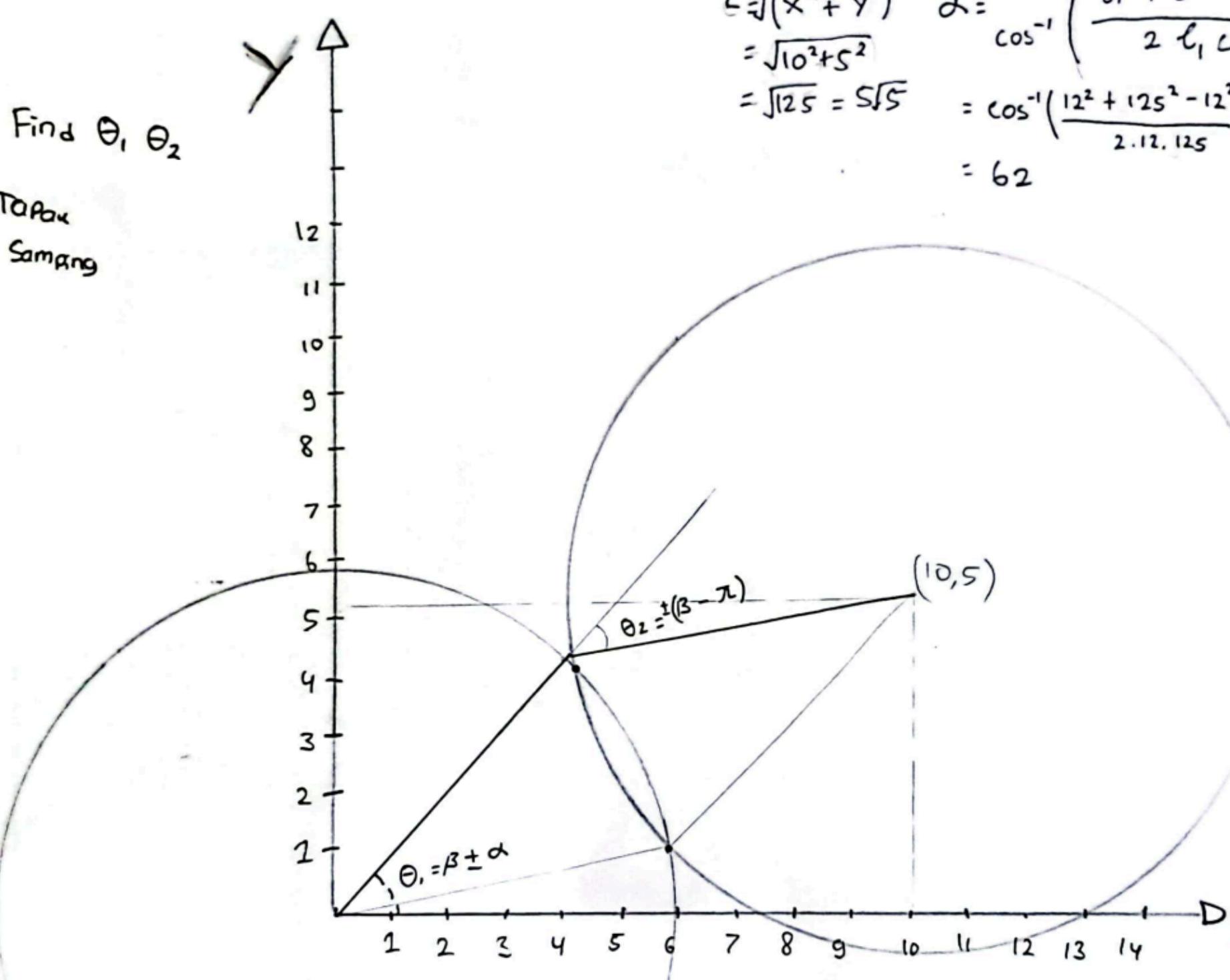
power supply



items

Concept used on project

RKD



$$\phi = \tan^{-1} \left(\frac{a}{b} \right)$$

$$= \tan^{-1} \left(\frac{y - l_3 \sin \theta}{x - l_3 \cos \theta} \right)$$

$$\alpha = \cos^{-1} \left(\frac{l_1^2 + c^2 - l_2^2}{2l_1c} \right)$$

$$\beta = \cos^{-1} \left(\frac{l_1^2 + l_2^2 - c^2}{2l_1l_2} \right)$$

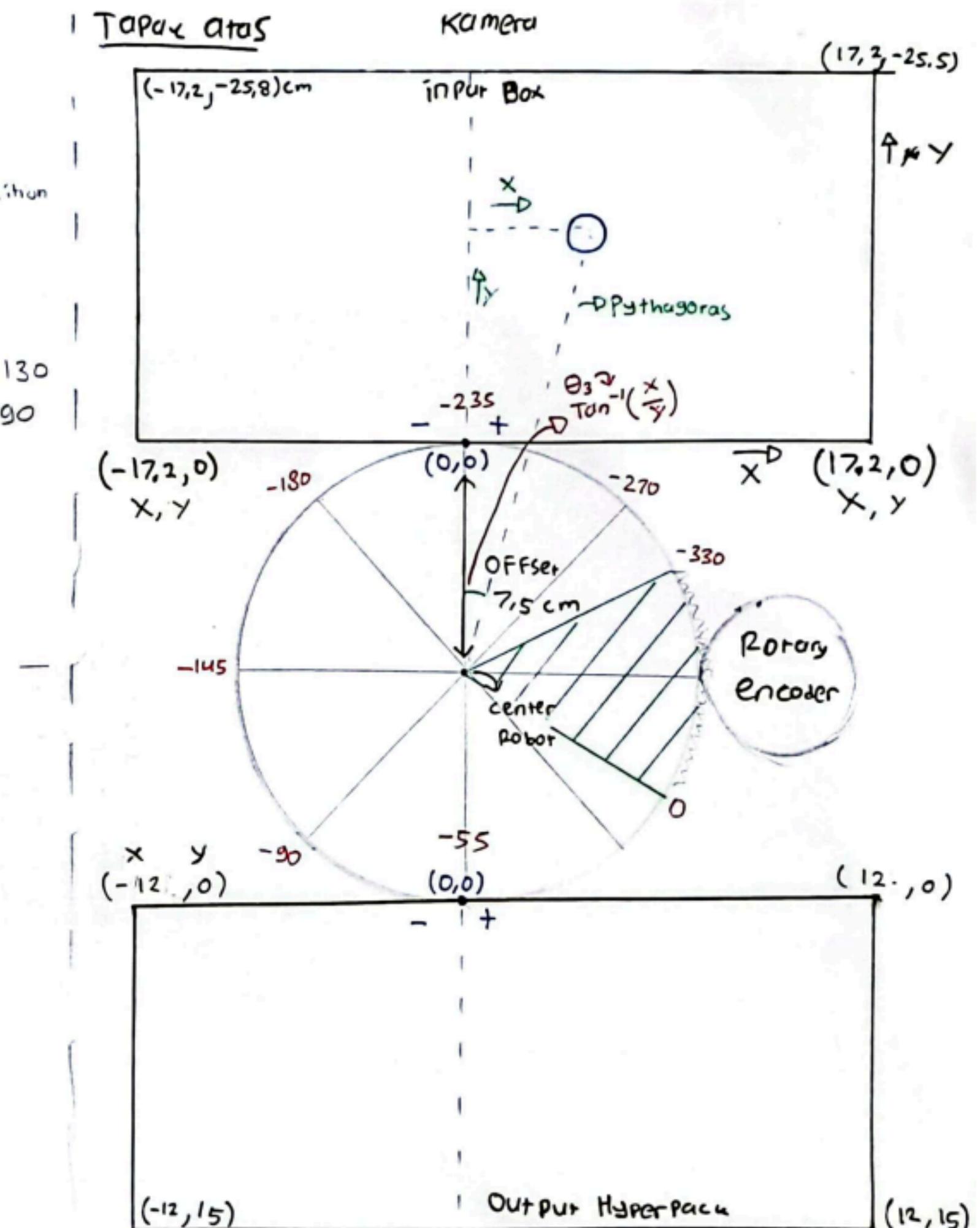
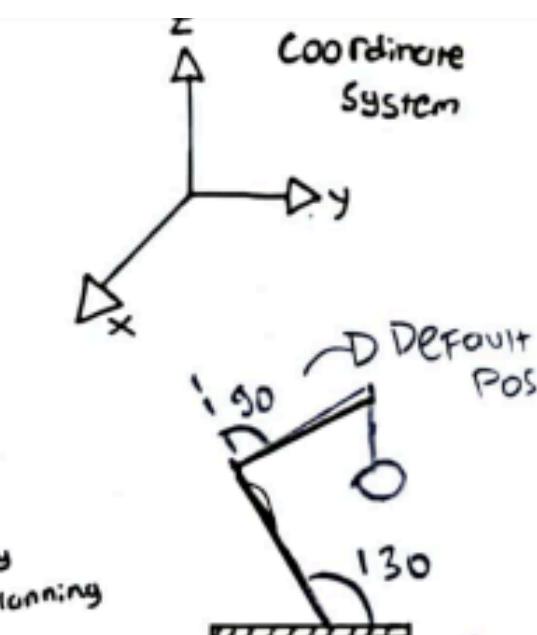
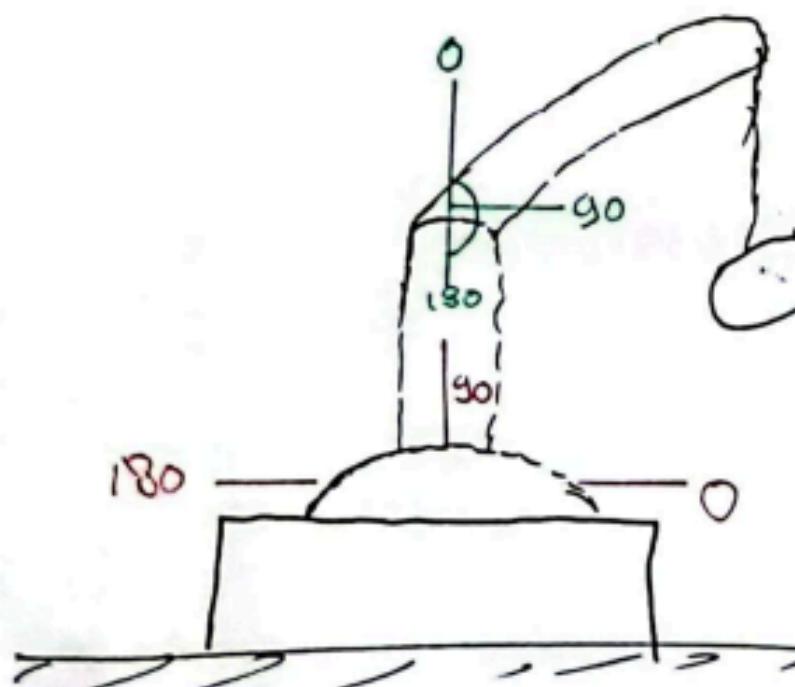
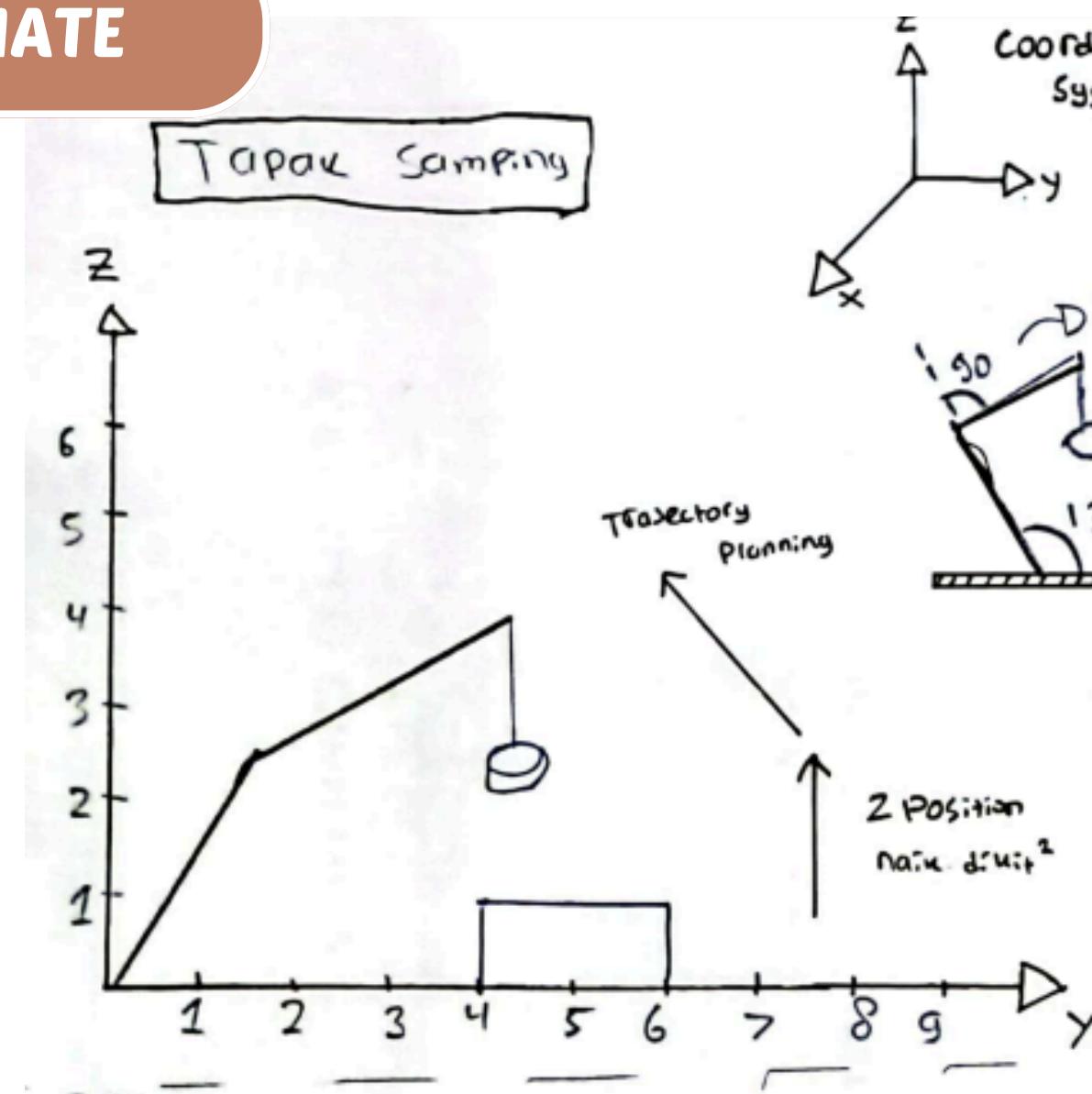
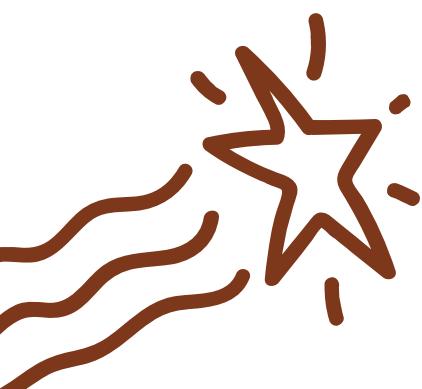
$$c = \sqrt{a^2 + b^2}$$

$$\theta_1 = \phi \pm \alpha$$

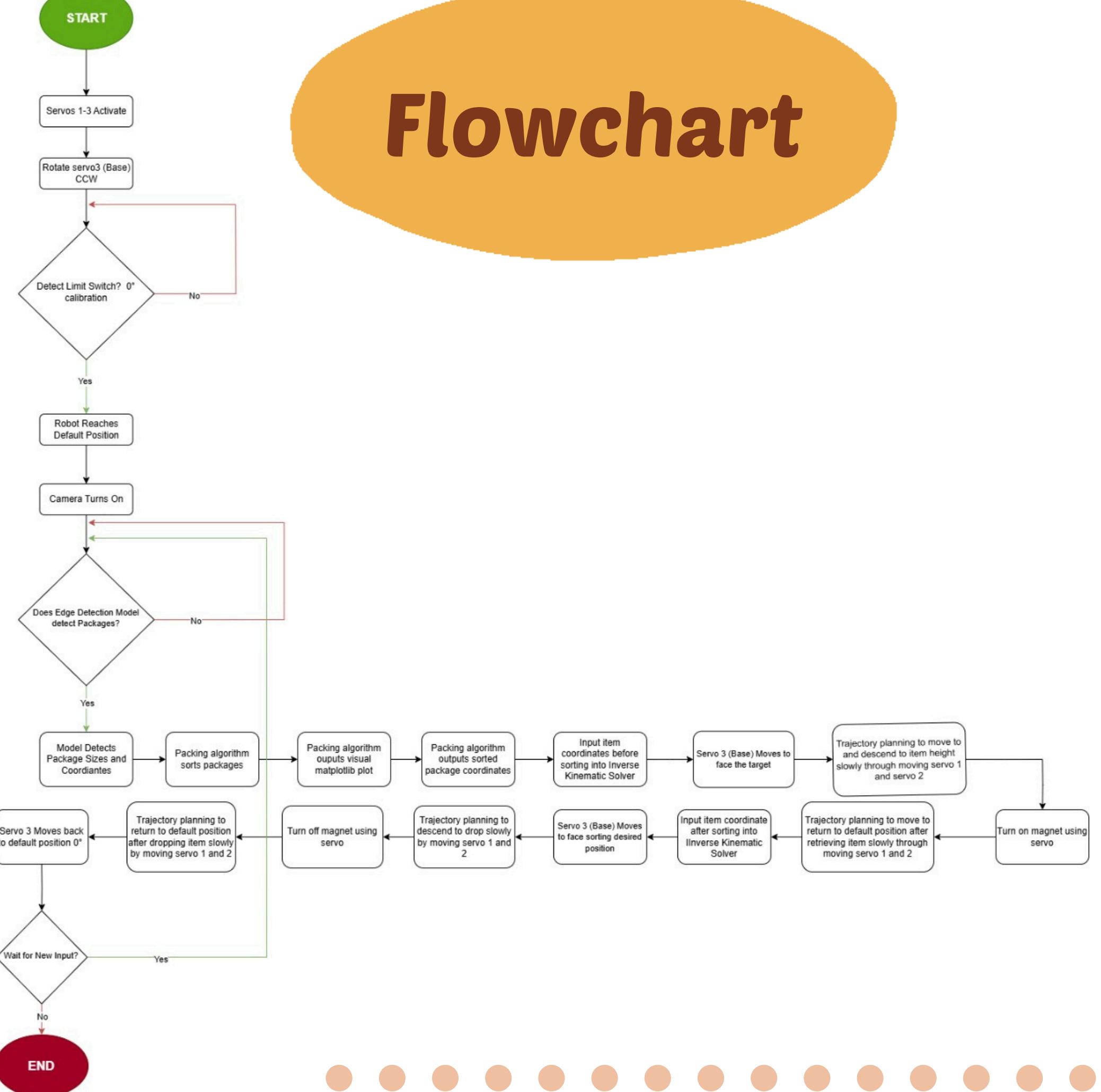
$$\theta_2 = \pm(\beta - \pi)$$

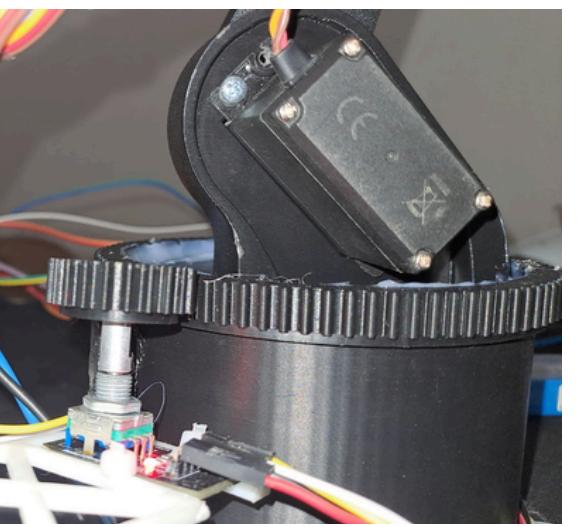


ROBOT COORDINATE



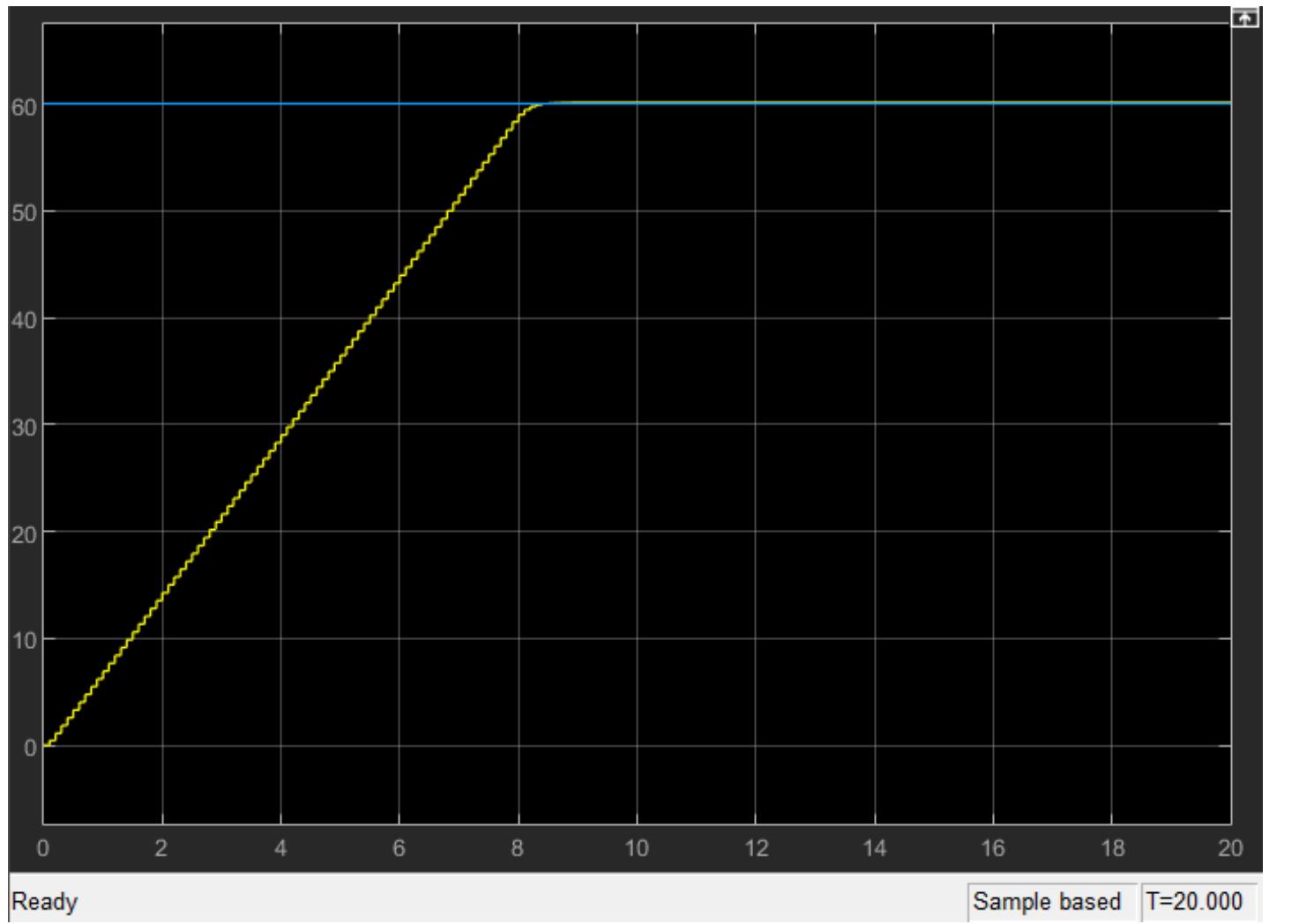
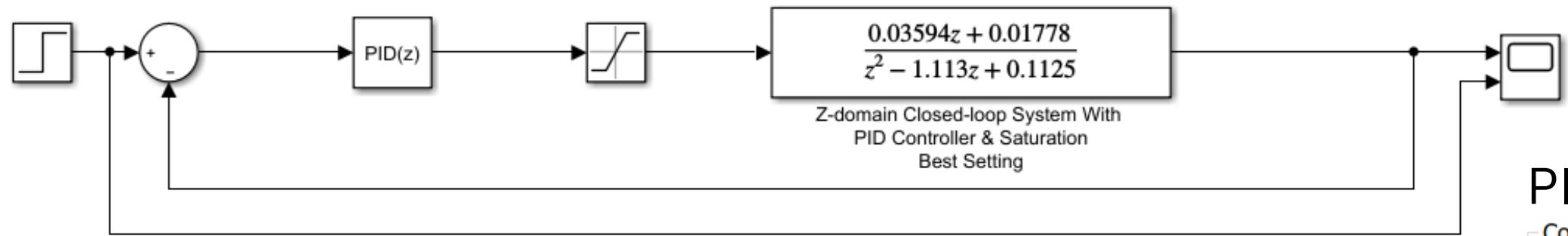
Flowchart





Concept used in project

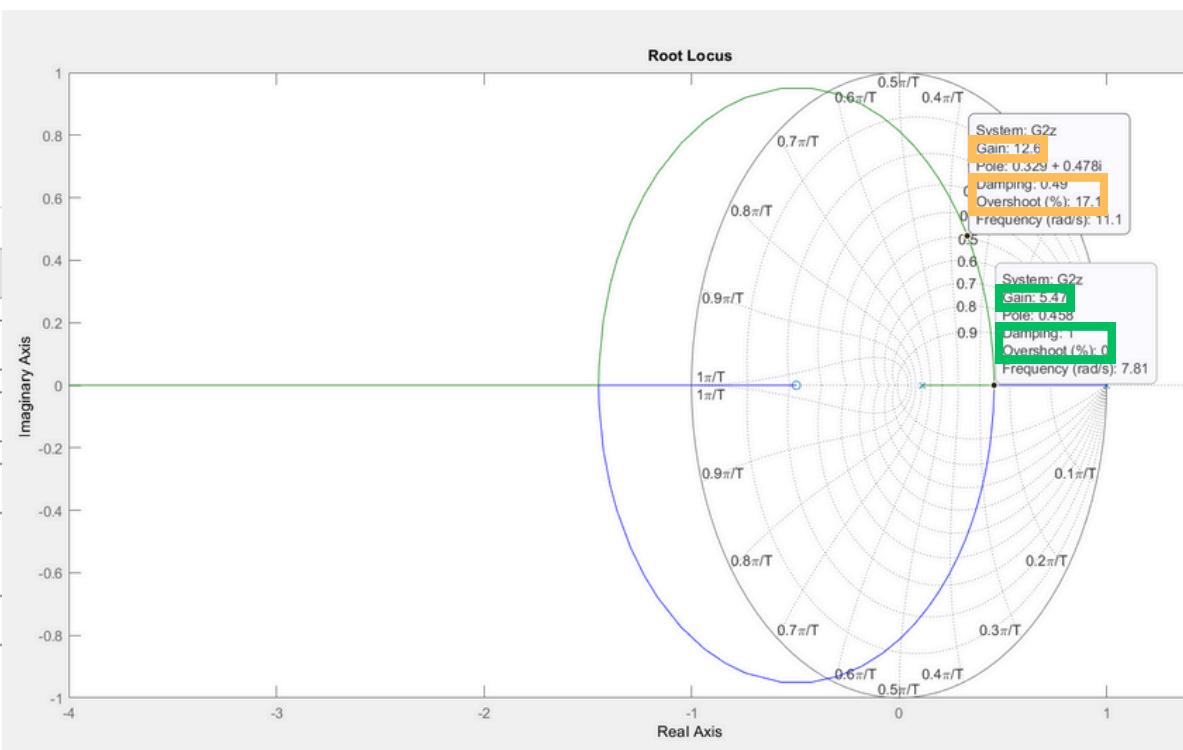
control
system



PID Settings

Controller parameters

Source: internal
Proportional (P): 5.47
Integral (I): 0
Derivative (D): 0
 Use filtered derivative
Filter coefficient (N): 100



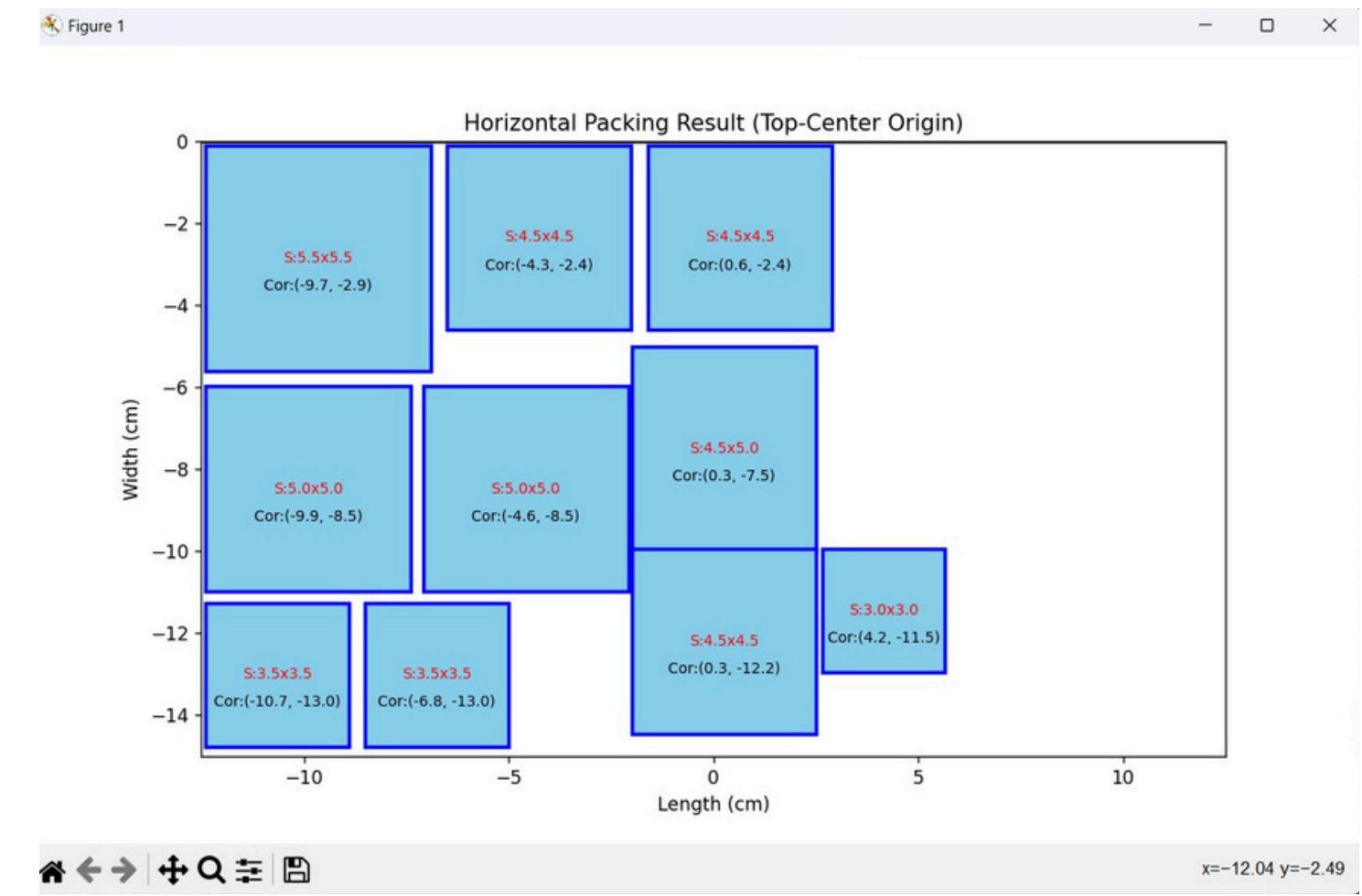
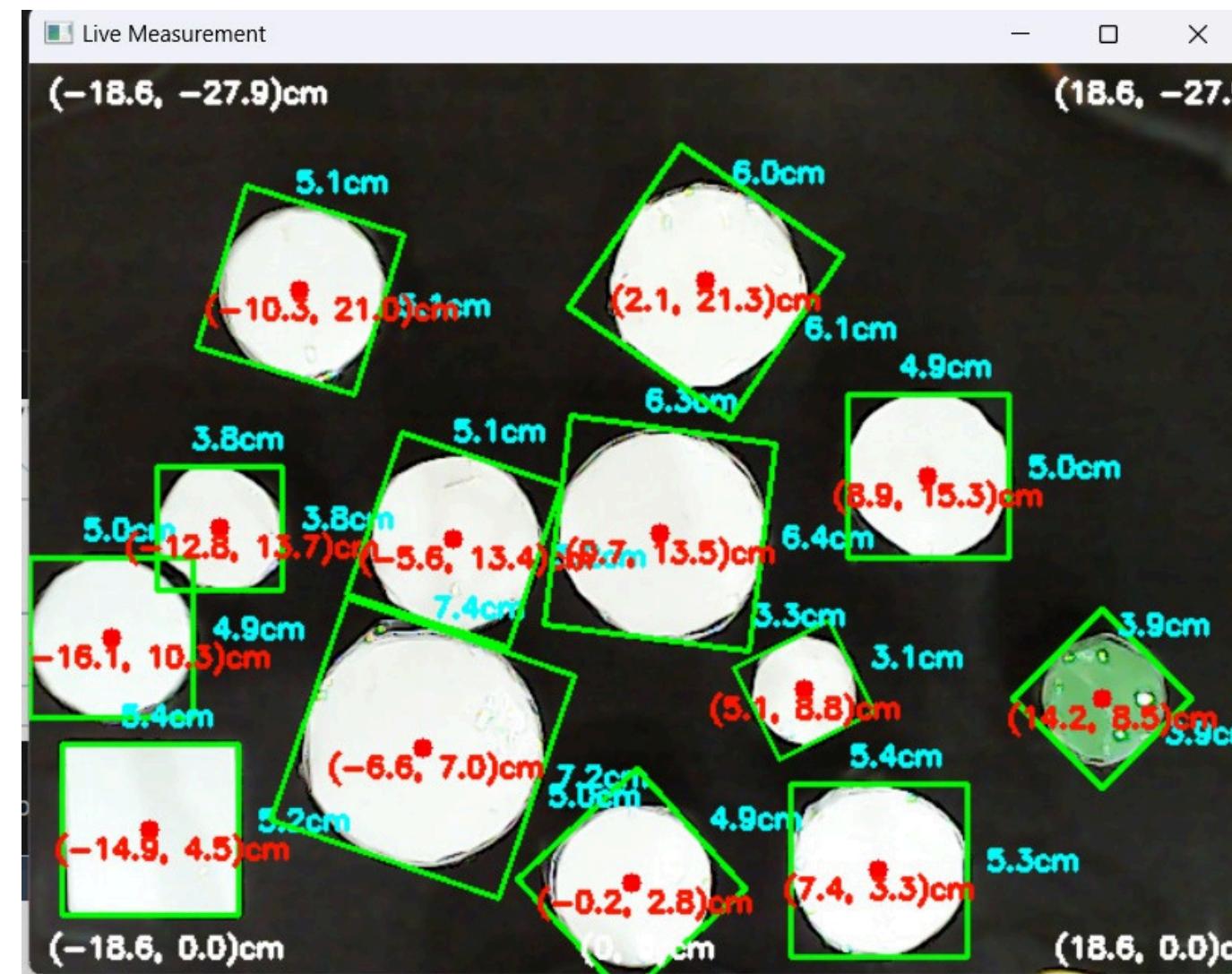
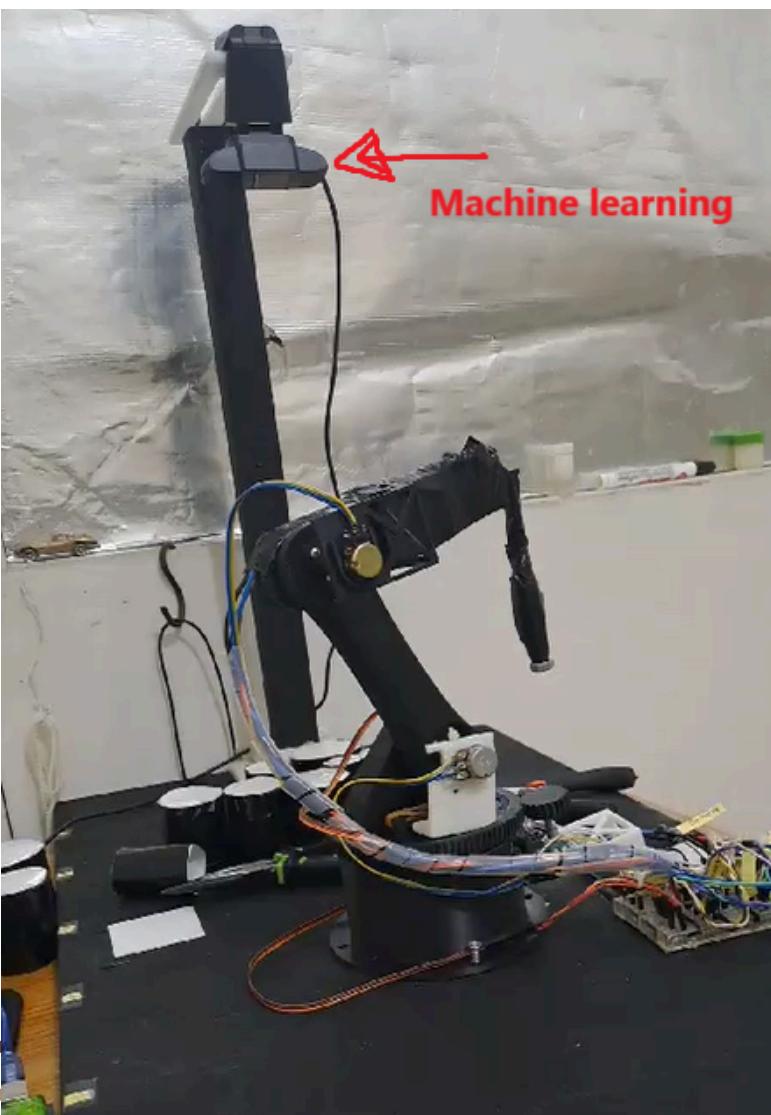
Saturation Settings

Upper limit:

12

Lower limit:

-12



Concept used in project

TIMELINE KERJA

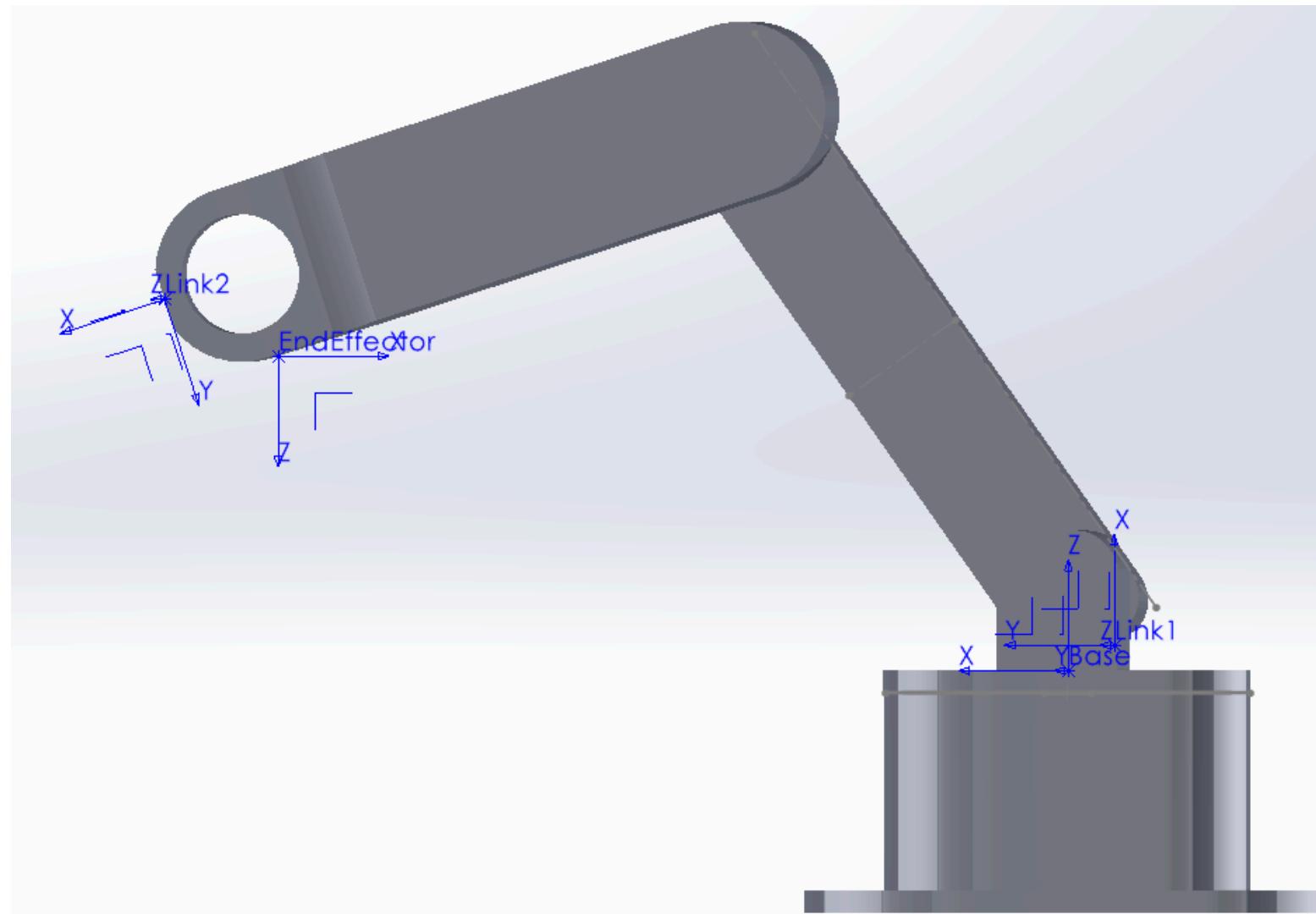
October : Mengubah konsep robot dari menggunakan pipa menjadi full 3D printing.



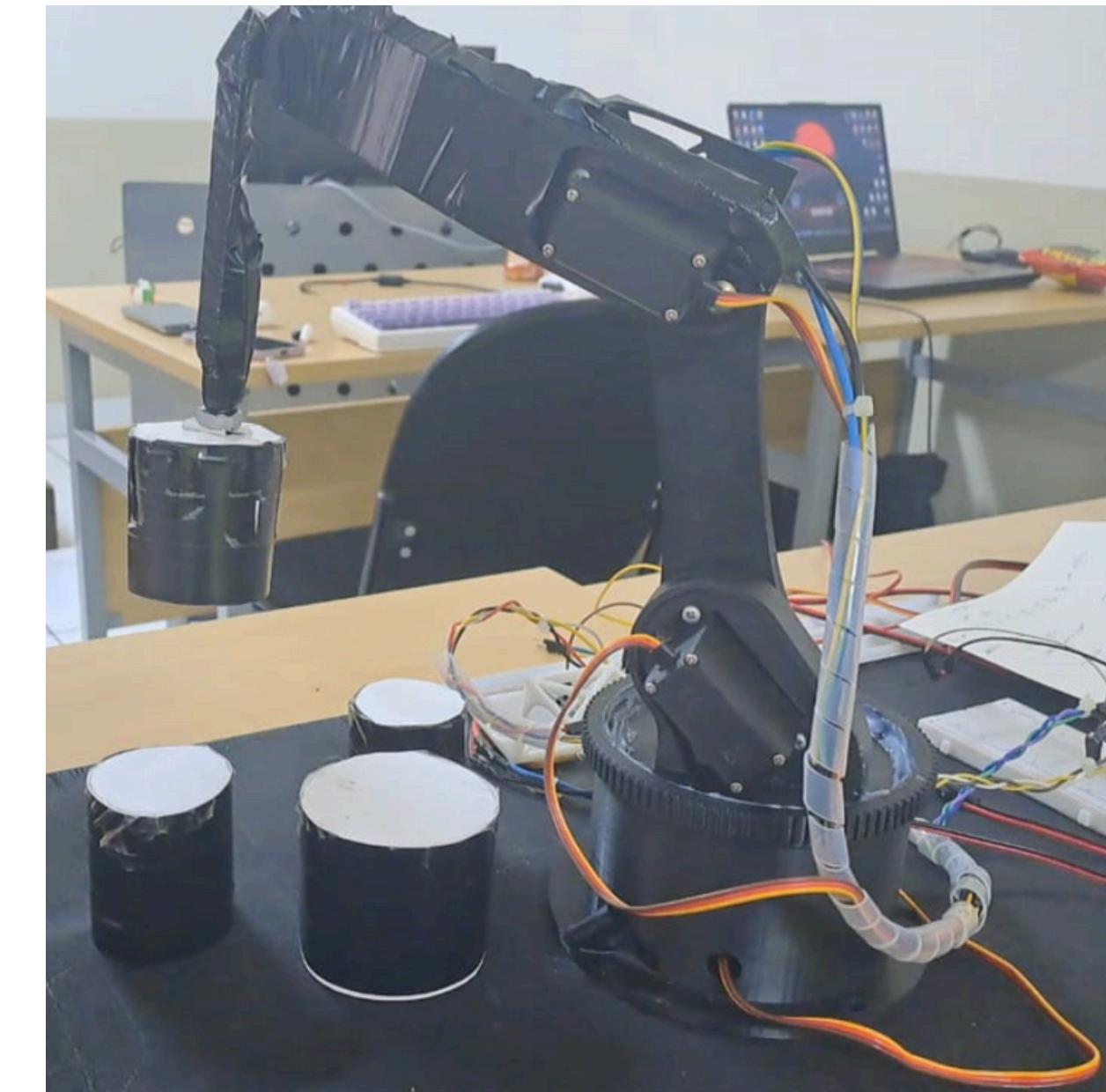
November : Merevisi ujung robot, memasang sensor-sensor di sendi robot, dan menjalankan machine learning dengan kamera.

December : Memasang gear pada base untuk dihubungkan ke rotary encoder dan menerapkan sistem kontrol PID pada basis robot.

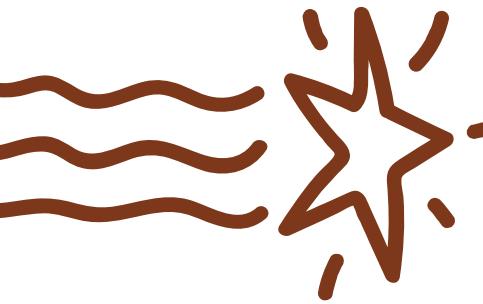
HARDWARE IMPLEMENTATION



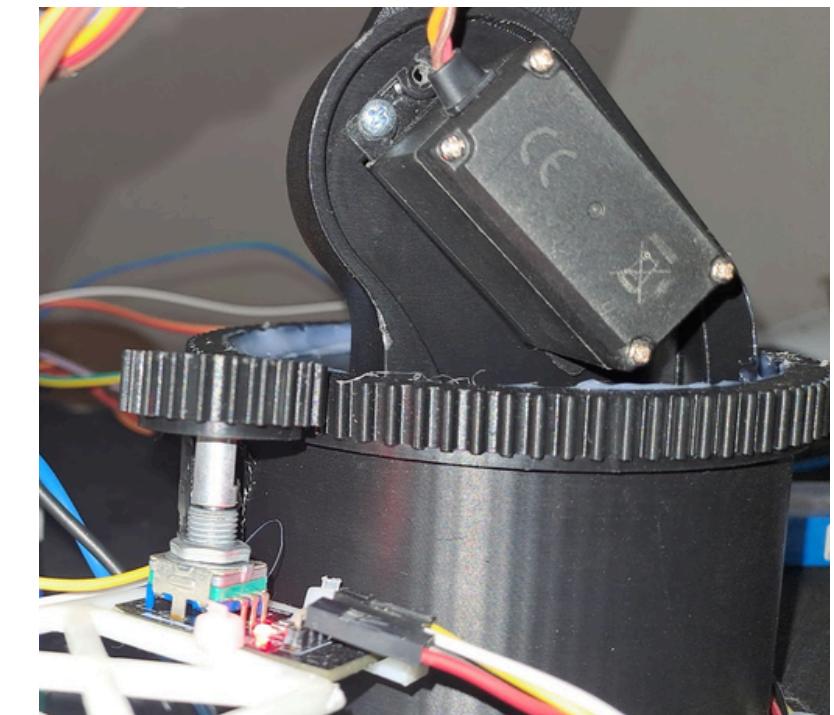
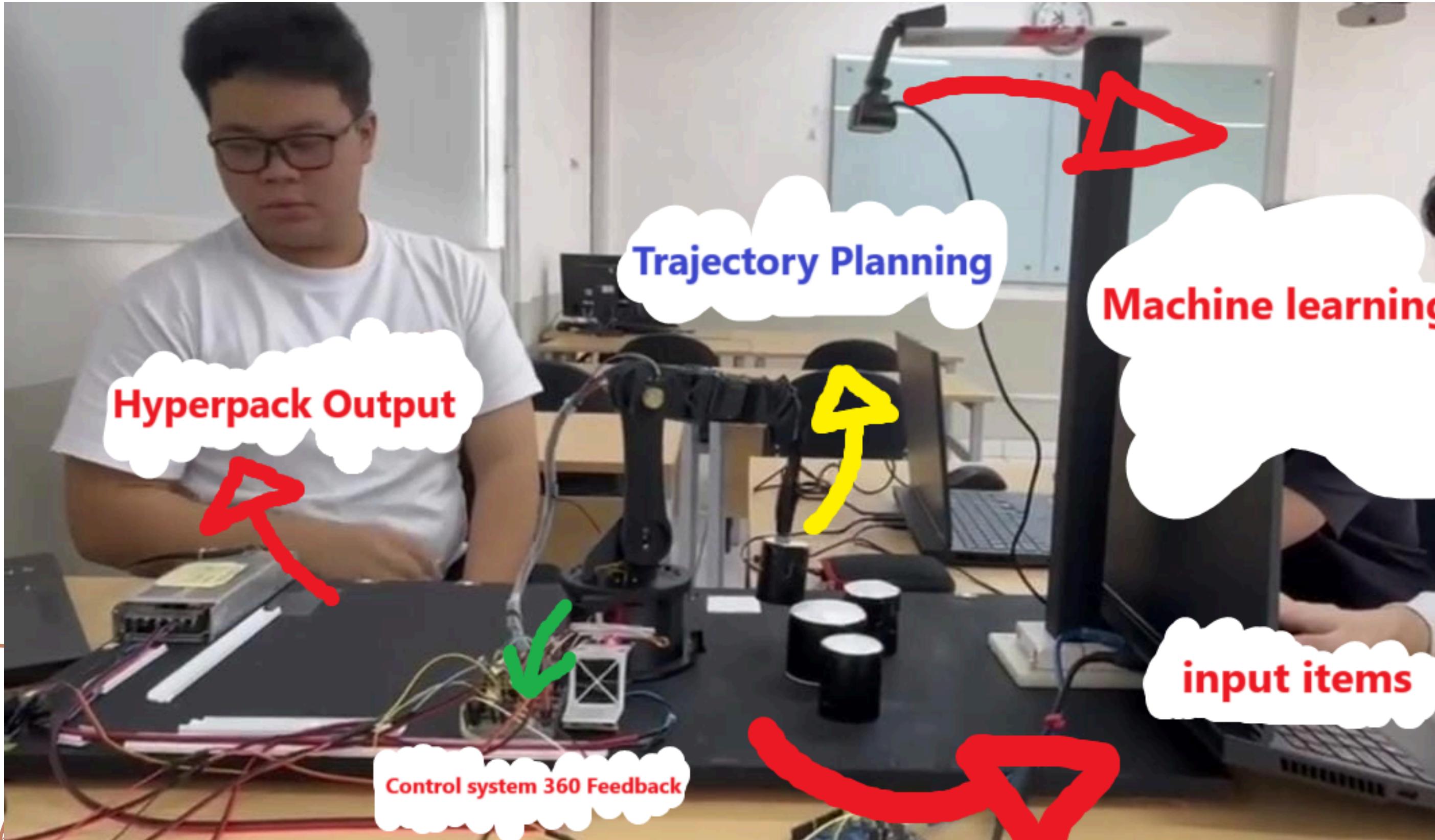
kinematics simulation



Real life assembly

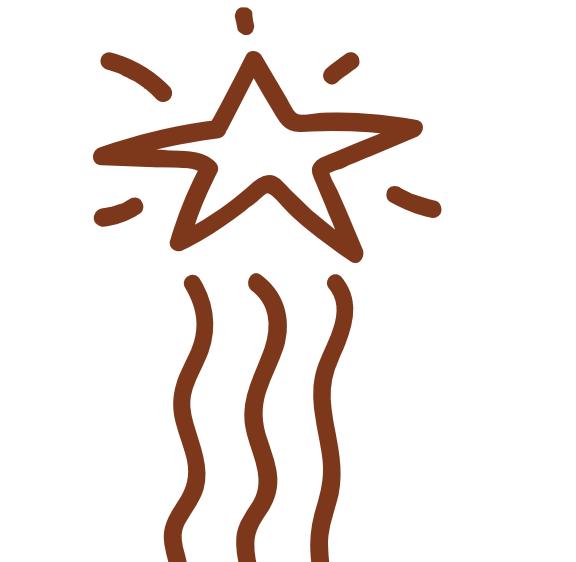
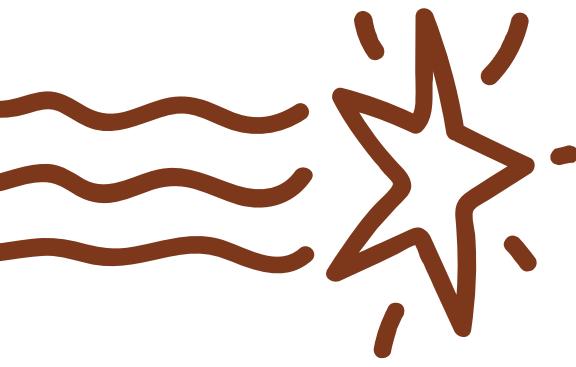


HARDWARE IMPLEMENTATION



RESULT

Goal	Achieved?	Additional comment
2 link arm reach items		the robot has a ±2 cm inaccuracy in the items
Magnet lift items		the magnet shouldn't be turned on more than 2 minutes or else it would over-heat and lose its magnetism
360 face the right angle		the base can accurately face in the item well with a bit offset from the base
Use servo to press magnet button		The servo is able to turn on the magnet, but at certain conditions button is not pressed, needs double checking
Use a single arduino		integrate 360 and 2 link needs 2 arduino because of control system's demand
Robot is fully automated		transfer data from machine learning to arduino requires some time to experiment or need the use raspberry pi.



**Thank
you**

Presented by kelompok 1