

Final Project

Pick and Place Robot

Syed Athar
UR2

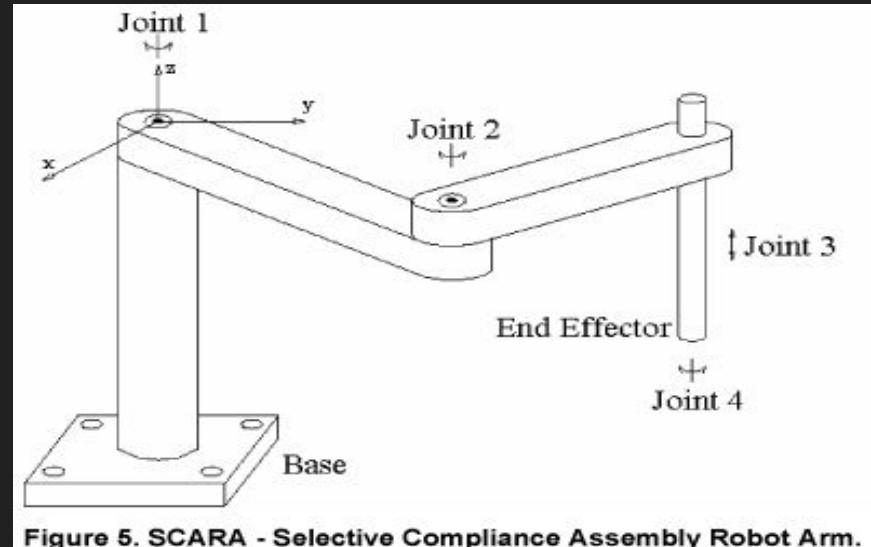
Objective

Build a fully automated robot arm that performs pick and place operation.

1. Picks a triangle; places it at 0 degrees.
2. Picks a square; places it at 180 degrees.
3. Freezes when it sees yellow.

Considered Designs

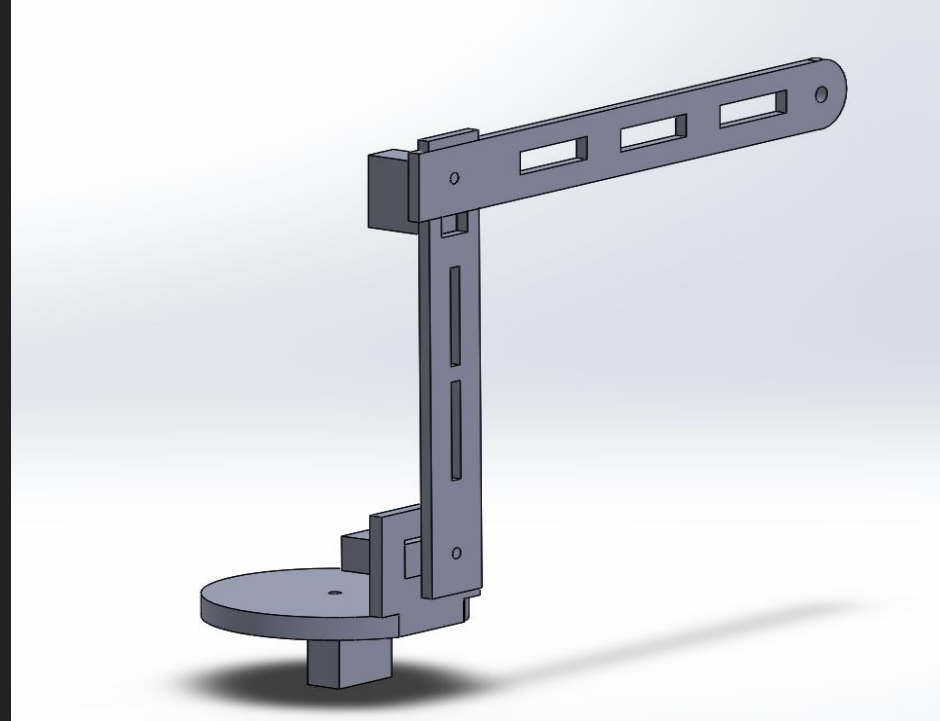
1. Robot arm with only linear translation.
2. Current design.



Proposed Design

Overview

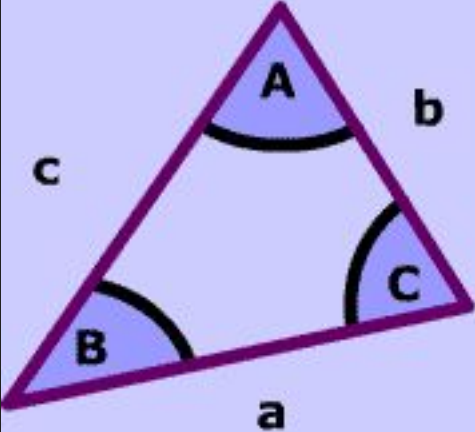
- 3 servo motors, each controlling the base, link 1 and link 2.
- Five 3D printed parts.
- Relatively durable and also light weighted.



Calculations

- Law of Cosines:

Law of Cosines



$$a^2 = b^2 + c^2 - 2bc \cdot \cos(A)$$
$$b^2 = a^2 + c^2 - 2ac \cdot \cos(B)$$
$$c^2 = a^2 + b^2 - 2ab \cdot \cos(C)$$

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Sensing & Actuation

- Detects the shapes using a webcam.
- Performs the angle calculations.
- Sends the angles from PC to Arduino as angles for the servos that were found through law of cosines.

Budget

3D Printed Parts	\$38
Servo Motors	\$36
Breadboard	\$10
Structural Components(i.e wood)	\$15
Arduino Uno*	\$10
Webcam*	\$20
Electromagnet	\$8
Jumper Wires	\$5
Total	\$142

Results & Reflection

- Currently not working
- A little more tuning in the codes will fix it.
- Mechanical design can be improved but it is OK.

Lessons Learned

- Mechanically designing the robot arm.
- A lot of new programming techniques.
- Software Engineering documentation.

Recommendations

- Really fun project to work on
- Don't procrastinate. Start early
- More deadlines in order to finish the projects in steps rather than doing all designing part in last two weeks.