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Automated Robotic Arm Mechanism

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ABSTRACT

Robotic arms are widely used in industries, manufacturing lines and other industrial purposes. Robotic arms are used to implement complex industrial automation functionality which only humans can achieve. These functionalities include picking up a part and placing it horizontally into another machine or picking parts and placing it in packing boxes and more. So here we propose the design and fabrication of a fully automated robotic arm that can automate various industrial tasks. Our system consists of an assembly of mounts and parts designed to hold motors in place in order to achieve desired movement.

1. INTRODUCTION

The term robot comes from the Czech word robot, generally translated as "forced labour", this describes the majority of robots fairly well. Most robots in the world are designed for heavy, difficult to manufacture in work. They handle tasks that are difficulty, dangerous or boring to human beings. The most common robot is the robotic arm. This robotic arm is type of mechanical model arm, it is usually programmed, like of a human arm may be the sum total of the mechanism or may be part of a more complex robot. The links of such a manipulator are connected by joints allowing either rotational motion (such as in an articulated robot) or linear displacement.

2. OBJECTIVE

- To control the displacement of the robotic arm so that, the aim can be used to pick and place elements from any source to destination.
- To design the specified parts with proper dimensions in Solid work software model.
- To implement a robotic arm with 5 degrees of freedom. To Fabricate and design of the particular robotic arm.

3. LITERATURE REVIEW

1.Design and Analysis of Pick and Place Robot. By **(S. Mohanavelan, M. Madhan Kumar, K. Mohanprabhu, M. Narendhiran, B. Om Adhavan, 2019)** after every one of the forces and limit conditions were connected plots of stress and deformation were examined and ends were made about the plan. This paper focus on the design, analysis and calculation of various components that is necessary for pick and place robot.

2. **(Ali Roshanianfard*, Noboru Noguchi)** Robots can be used to reduce the risk involved with human physical intervention, especially in hazardous environments. They can approach locations of interest to report sensory data and to show more detailed views of a suspicious area.

4. DESIGN SPECIFICATIONS:

1. Degree of Freedom: 5
2. Payload Capacity (Fully Extended): 100gm
3. Maximum Reach (Fully Extended): 25cm
4. Rated speed (Adjustable): 0-0.3 m/s
5. Joint speed (Adjustable): 0-60 rpm
6. Hardware interface: USB
7. Control Software: computer interface (GUI)
8. Shoulder Base Spin: 180°
9. Shoulder Pitch: 180°
10. Elbow Pitch: 180°
11. Wrist Pitch: 180°
12. Wrist spin: 180°
13. Gripper Opening (Max): 8cm

Base : Made up of Acrylic Sheet

- Process : Laser Cutting

Shaft : Made up of Aluminium rod of dia 10mm

- Process : Lathe Machining, Drilling

Linkages : Made up of Aluminium

- Process : Laser Cutting

Servo Motor : MG966R

Nut and Bolts : M3, M4 Nut and Bolts, Locknuts

Gripper Arm : Made up of Aluminium

- Process : Laser Cutting

Type of Gear : Spur Gear

5. DESIGN CALCULATION OF ROBOTIC ARM

5.1 The values used for the torque calculations:

W_D = 0.020 kg (weight of link DE)

W_C = 0.030 kg (weight of link CD)

W_B = 0.030 kg (weight of link CB)

L = 0.1 kg (payload)

$C_M = D_M$ = 0.043 kg (weight of motor)

L_{BC} = 0.06 m (length of link BC)

L_{CD} = 0.06 m (length of link CD)

L_{DE} = 0.03 m (length of link DE)

$\Sigma F_y = (L + W_d + D_m + W_c + C_m)g\text{-}Cy = 0$ …….. (1)

$C_y = (0.236\ kg)\ 9.8\ m/s^2 = 2.31N$ ……...(2)

$\Sigma F_y = (L + W_d + D_m + W_c + C_m + W_B)g\text{-}C_B = 0$ ..…(3)

$C_B = (0.266kg)\ 9.8\ m/s^2 = 2.6N$ ……(4)

$\Sigma M_C = -(W_C L_{CD}/2) - W_D(L_{CD}+L_{CE}/2)$ ……(5)

$-L(L_{CD}+L_{DE}) - D_M(L_{CD}) + M_C = 0$

$\Sigma M_B = -L(L_{BC}+L_{CD}+L_{CE}) - W_D(L_{BC}+L_{CD}+L_{DE}/2)$

$-D_M(L_{BC}+L_{CD}) - W_C(L_{BC}+L_{CD}/2)$

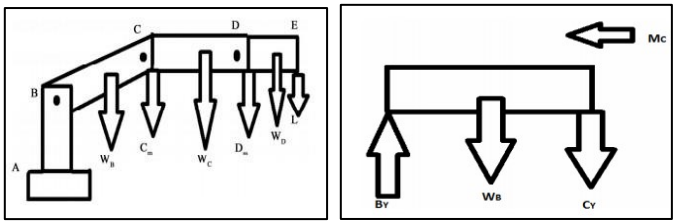
$-C_M(L_{BC}) - W_B(L_{BC}/2) + M_B = 0$ ……..(6)

Using above formula, Find

M_C = 0.126 Nm ……(7)

M_B = 0.2634 Nm ……(8)

Figure 1: Force diagram of robot arm and link CB.



6. CONCLUSIONS

The proposed concept of pick and place robot using Arduino is implemented by Microcontroller it is founded that, the robot so implemented has the ability to locate itself to the location where the object to be lifted is available with the help of chassis and 4 DC motors. Further depending upon the controlling action provided to servo motor it lifts the object and locate at the same required destination

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