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Pick and Place Robotic System for Thermostat Radiator Cap

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Abstract:

Conceptual Mankind has constantly strived to give life like qualities to its relics trying to discover substitutes for himself to complete his requests and likewise to work in a nature. The prevalent idea of a robot is of a machine that looks and works like a person. The treatment of materials and components to pick and place are generally found in manufacturing plant mechanization and mechanical assembling. The system is extremely paramount to kill human failures and to get more exact work. It can likewise spare the expense in long haul and help to take care of issues and errand that isn't possible, for example, on time temperature territory tight region and substantial burden things. This task is a fundamental improvement and change of a pick and place system, where it will be planned on the premise Cartesian coordinate system. The arm will move on a level plane to get and hold the article starting with one base and place it then onto the next base. A 2-Jaw gripper is intended to pick and place with adaptability.

Key words: Automation, Cartesian co-ordinate, Pick and Place, Work Envelope

1. Introduction

A programmable, self-controlled gadget comprising of electronic, electrical, or mechanical units is characterized as a robot. All the more for the most part, it is a machine that replaces a living executor for doing diverse capacity. Robots never get tired; they can work in physical conditions that are uncomfortable or even risky; they can work in airless conditions; they don't get exhausted by redundancy; and they can't be occupied by the current workload and thus are attractive for different work works as opposed to people. This article is focused around the exploration venture which is a self-sufficient robot to be utilized within sequential construction system for lifting an item and putting it in the mechanical production system. The robot is capable enough, and dependable to work in wild conditions where people can't work for quite a while. This robot is utilized as a part of the mechanical production system for picking and putting the article in the sequential construction system. The most critical reasons that are cohorted in introducing of mechanical systems in sequential construction system are;

- Saving work costs.
- Increased level of value & effectiveness.
- Ability to work in any non-nature.
- Improved consistency & adaptability.

The robot which we have made is totally autonomous and keen. We will utilize pneumatic force for this robot. The thought is to make a programmed robot, free of human interface. This Robotic system is plausible for little scale processing and neighborhood commercial ventures. The system diminishes the expense of processing, and lessens the labour, human workload and is very dependable. A robot comprises of the accompanying parts;

- End Effectors - like "arms", "hands", "grippers" etc.
- Sensors –these parts acts like faculties of the robot and discover item position and covert object data into codes that a workstation can perceive.
- Computer –it acts like a mind of a human body for an automated system.
- Equipment – Other instruments and mechanical segments needed for automated system.
- Characteristics- the qualities that makes robot exceptional from normal hardware are those which deal with their own particular not obliging human interface, their affectability nature's domain ,their versatility to diverse frenzied conditions and their errand situated approach for producing overwhelming inflexible modern robots are needed. They perform exceptionally tedious errands and weakness undertakings by straightforward customized control.

2. Design Considerations

Contemplations are taken in system execution, system design, system detail and in distinctive segment of the robot for legitimate outline of the Cartesian coordinate system. Robot achieve, work envelope, load limit and reach are recognized in system details. In system design its drive setup, joint travel extent, number of degrees of opportunity is recognized. System speed, exactness, accuracy, repeatability and part life are taken into contemplations for its execution. The configuration of robot structures and joints, actuators, its transmission and wiring and steering of links and hoses is carried out in subtle element and by utilizing fitting systems.

3. Configuration of Reliable Mechanical Joints

To have relative movement in the middle of two connections or arms of a robot, a joint is needed. A joint gives controlled relative movement amidst two arms or connections of robot i.e. include and yield. Ordinarily one level of flexibility is given by a joint. The different joints accessible are direct joints, orthogonal joints, rotational joint, turning joints and spinning joints. The direct joint is most straightforward of the joints to be fabricated. Thus straight joints are utilized. Straight joints are savvy and simple to fabricate and thus best suited for our motivation. At the same time on the premise of quality and weight to be lifted different pivoted joints are utilized.

4. Manipulator Design

A controller can achieve distinctive positions and places in the mechanical production system It could be mounted to the track or suspended to the track. It is needed for development of materials, questions in the mechanical production system. It includes two segments in particular the body or arm and the wrist assembly.

4.1. Design of Body

Body is needed for situating of the item inside the robot work envelope. In this way by fitting designing ideas and systems, weight and expense of the body could be minimized. The arm is made of diverse parts and afterward these segments are gathered together for upgraded outline to diminish weight and expense of the body. Cartesian co-ordinate system is best suited for our motivation and thus it is chosen.

4.2. Design of Wrist Assembly

It changes the introduction of the article in the robots work envelope. In the wrist assembly an end effector is connected Wrist get together has three degrees of opportunity which are pitch, move and yaw. For straightforwardness of the pick and place provision and supplanting the complex assembling of the wrist assembly, the end effectors are specifically welded to the plate. Pneumatic cylinder is utilized for movement of the end effector. This lessens the expense of the robot.

4.3. Robot Design Configuration

The prerequisites specifically, less floor region, correctness, ease, straightforward in operation and development must be fulfilled by this Cartesian co-ordinate robot(Figure 1). Cartesian co-ordinate robot including pivotal movement in X-hub, longitudinal movement in Y-hub and sidelong movement in Z-pivot is chosen for our motivation .Hence by utilizing this setup, the arm moves to and fro in the X-hub and it has all over movement along Z-hub.

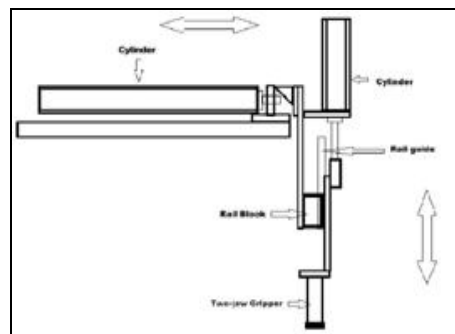


Figure 1

5. Design of End Effector

The arm is utilized just for situating the article while its the end effector that has association with the item. The end effector is recognized as the hand of the robot. The different end effectors are mechanical, grinders, welders and, adhesive, magnetic and vacuum. For our motivation we are utilizing Two jaw mechanical gripper because of geometry of the item to be lifted. This gripper utilizes pneumatic power as the inciting force for holding the item and is practical.

6. Movement of the Robot

For the robot to arrive at diverse areas and perform the undertakings it need to move in pivot. Along these lines depending up on the necessity pneumatic cylinder is utilized for the picking and putting the item in the sequential construction system. The obliged air is supplied from the compressor. Here pneumatic is utilized with straight development of cylinder. In this way essentially decreasing the expense of the robot.

7. Pneumatic Circuit

A pneumatic rationale system is for the most part used to control the modern robots. Since electronic circuits are not utilized therefore exact and faultless pneumatic circuits are composed and actualized. Consecutive circuits are outlined so that every cylinder is impelled at legitimate arrangement and are additionally kept dynamic for the craved time of time. This the main test in an ease automated arm is outlining of the pneumatic circuit.

8. Material Selection

Material choice is a standout amongst the most imperative variables in diminishing the expense of the robot. Materials are chosen in such a path, to the point that there is no bargain in least outline prerequisite. Here to we decide to utilize the give press a role as it has high quality, simple weldability and minimal effort. Gripper is made of mellow steel to get legitimate quality and to accomplish simple machining operations. The easier body and the base is made of iron with a specific end goal to give the obliged stabilizer so that the dependability of the robot in not lost. Contingent on the weight to be lifted the material determination fluctuates. However to diminish the expense and simplicity of assembling we can utilize iron if weight contemplations are not introduce.

9. Drive System

The drive picked focused around

- the power utilization
- repeatability
- positional precision
- stability
- speed of operation
- reliability
- cost

Out of Hydraulic, electrical and pneumatic; Pneumatic drive make utilization of compacted air which is promptly accessible and non-combustible. Pneumatic drives are of lighter development.

Preferences of utilizing Pneumatic drive

- freely accessible from air
- easily transportable in vessel and channels
- clean system. It has self purifying properties.
- the weight, speed and strengths could be controlled effortlessly

10. Calculations

10.1. Selection of end effector cylinder

Vertical Cylinder

S = 100mm

Load = 10kg or $10 \times 9.81 = 98.1\text{N}$

Weight = Load/Area

$$= L / (\pi \cdot d^2 / 4)$$

$$= 98.1 / (3.147 \cdot 0.032^2 / 4)$$

$$= 1.22 \text{ bar}$$

Where, L = load (N)

S = Stroke length (mm)

d = diameter of cylinder (mm)

Since the accessible standard cylinder for 100mm stroke of FESTO is of width 40mm and stroke length 100mm, the cylinder utilized for the end effectors are chosen with the measurements of 40mm x 100mm.

10.2. Selection of body cylinders

Horizontal Cylinder

S = 250mm

Load = 18kg or $18 \times 9.81 = 176.58\text{n}$

Weight = Load/Area

$$= L / (\pi \cdot d^2 / 4)$$

$$= 176.58 / (3.147 \cdot 0.040^2 / 4)$$

$$= 1.509 \text{ bar}$$

Since the accessible standard cylinder for 250mm stroke of FESTO is of width 40mm and stroke length 250mm, the cylinder utilized for the end effectors are chosen with the measurements of 40mm x 250mm.

10.3. Selection and counts of end effector

Due to the geometry of the article to be moved, Two- Jaw Gripper is utilized as an end effector.

$$F_g = \frac{m \cdot (g + a) \cdot \tan \alpha \cdot s}{2 \cdot \mu}$$

Where,

m = weight to be lifted and weight of outer grippers = 1.5kg

S = element of safety = 3

g = acceleration because of gravity = 10m/s^2

a = acceleration because of element activity = 0.044m/s^2

μ = coefficient of friction = 0.35

α = angle of V-gripper finger = 45 degrees

$$F_g = \frac{1.5 \cdot (10 + 0.044) \cdot \tan 45 \cdot 3}{2 \cdot 0.35}$$

$$= 64.57\text{N}$$

By alluding to the FESTO index, as indicated by the holding power obliged and the weight to be lifted parallel two jaw gripper is chosen of HG 25 .(Figure 2).

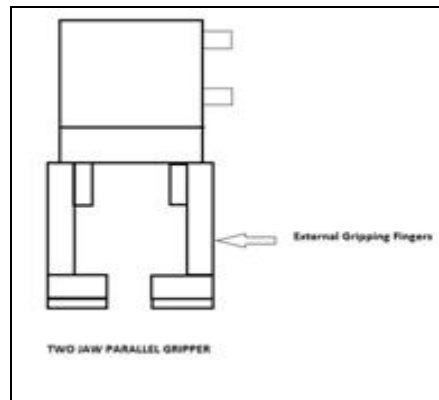


Figure 2

11. Conclusion

The outline and assembling of a Cartesian co-ordinate system robot for the development of the given By-product has been performed viably. The operation and working of the different segments of the robot and end effector has been tried and the obliged adjustments have been carried out. The given target of planning a Cartesian co-ordinate system robot for powerful development of the result in the mechanical production system has been achieved. The robot has satisfied the necessities that must be met similarly affectability, correctness, exactness, unwavering quality, inflexibility.

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