DESIGN AND FABRICATION OF MULTIPURPOSE ROBOTIC ARM

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Abstract:

Robotic arms are highly used in industries, manufacturing units and for other industrial operations. Robotic arms are made to do complex industrial automation operations which only humans can do. These functionalities of the robotic arm include picking up a object or component and placing it horizontally into another machine for other operations or picking component and placing it in packing box and more. So here we propose the design and fabrication of a semi automated robotic arm that can be automated to do various industrial operations. Our system consists of an assembly of components and parts designed to hold motors in place in order to get required movement. And Also it contains a gripper with gear arrangement in order to achieve gripping function according to the rotation of motor. This mechanism helps us to understand the working and control flow of industrial robotic arms .

Key Words:

Complex industrial automation, picking up and placing, automated robotic arm, gripper

1. INTRODUCTION:

A multipurpose robotic arm is a mechanical device, it can be programmed, with similar functions to a human; the multipurpose robotic arm can be the cluster of the mechanism or can be the part of a more other complicated robots. The links are connected by joints allowing either revolutionary motion or linear (forward) displacement movement. These links can be considered to form a kinematic chain. The terminal of the kinematic chain of the link is called the end effecter and it is replication to the human hand

2. MATERIALS:

NAME OF THE MATERIAL	TYPE OF MATERIAL	QUANTITY	COST OF MATERIAL
1. ARM	ALUMINIUM	4	1000/-
2. SHAFT	TUBE ROD	2	150/-
3. WORM GEAR	PLASTIC	1	350/-
4. SPUR GEAR	PLASTIC	1	350/-
5. GRIPPER	PLASTIC	1	800/-
6. WAIST	IRON	1	2000/-
7. WIRE AND SWITCHES	COPPER&PLASTIC	4	500/-

TABLE 1.1

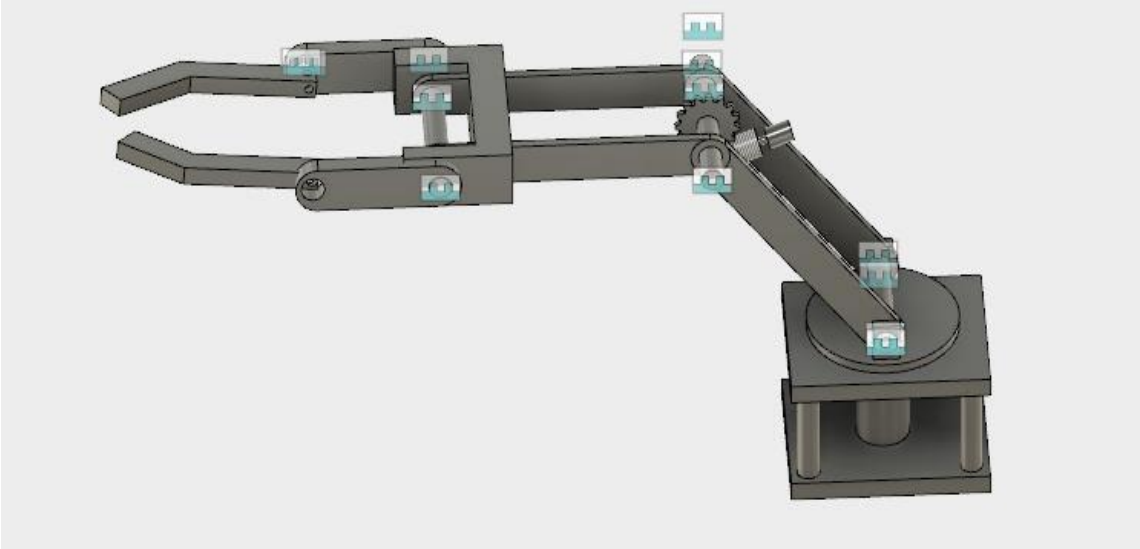

FIGURE 1.1

FIGURE 1.2

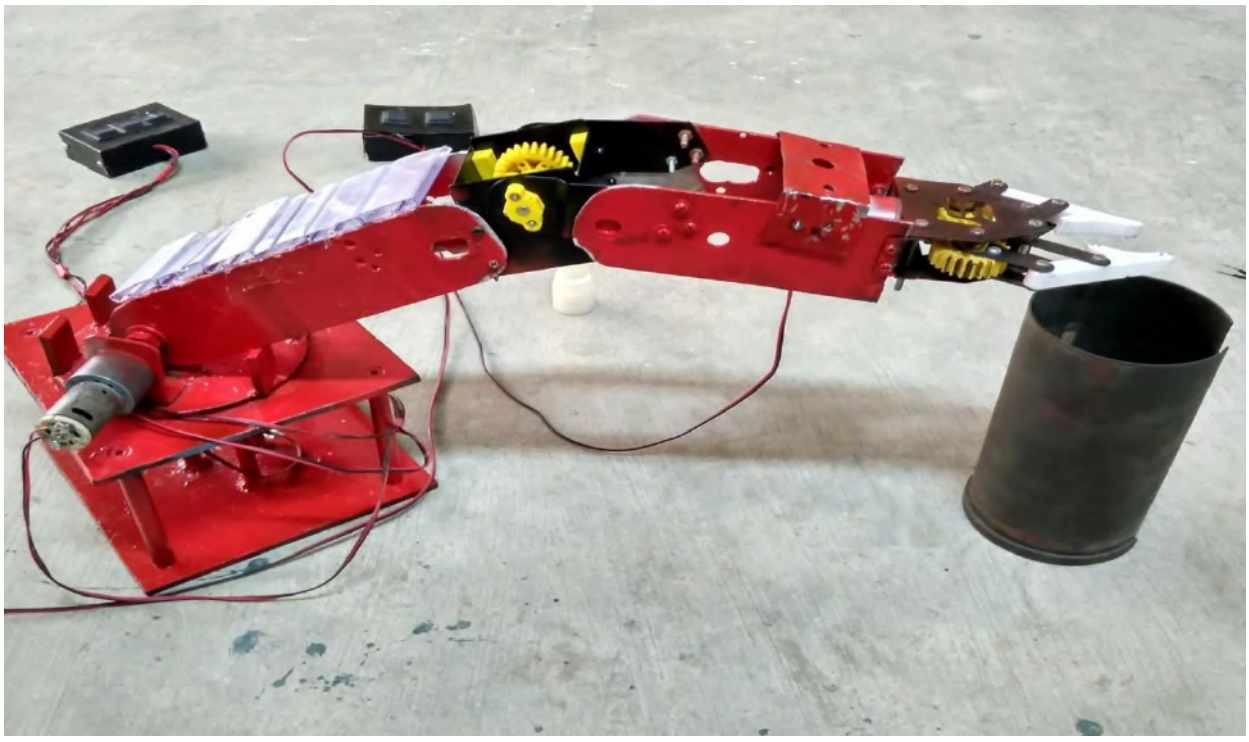

FIGURE 1.3

3. METHOD:

To pick a object and placing it in correct position is one of the major tasks done by the multipurpose robotic arm. The robotic arm will works normal gear mechanism. This mechanism is controlled by forward and backward switches. To start it first we need to be clear in the object to be picking and placed. And also we need to know the distance at which the object to be placed. The robot will start working by using the switches. First the arm will rotate towards the object by giving the supply to the motor at the bottom .Then the supply is given to the gear mechanism by which the arm is lowered and then the supply is given to the gripper motor and gripper opens and then it holds the object the holder object is then can be placed by giving supply to different motors according to requirement.

4. DISCUSSION:

- The main usage of robots is to perform the operations which causes harm to the human
- It is Less in cost when compare to other robotic arms.
- It should do various operations such as pick and place, drilling, grinding and spray painting
- Compact in size and easy replacement of parts
- Comfortable to control and programmable
- Good performance and accuracy
- It works according to industrial application.

5. ANALYSIS:

- **Capacity of load:** Minimum 100g to 500g
- **Total operation time:** Maximum 5 minutes for pick and place.
- **Lifetime of structure:** By assuming daily usage it will withstand up to 5 years
- **Manufacturing capital cost**: Rs.5000/- (welder, metal cutter, shop tools)

5.1 Manual Control

This type of control is an extra option for our system that useful in specific positions. In case of mandatory positions that the inverse kinematics mode cannot calculate their valid angles, we may use the manual control instead. Basically, manual control consists of a series of analog inputs, such as potentiometers, that are connected with the microcontroller which will interpret the values and send a command to the servo driver. In order to implement this, a control board, as shown in , should be built to work as an interface with the user. Possible implementation includes a teaching feature where the microcontroller stores positions in memory and by a keypad or a series of switches we may recall these position

Table 1. Motor angle ranges.

Motor	Angle Range
Motor A	130˚
Motor B1	135˚
Motor B2	140˚
Motor C	142˚
Motor Attack Angle	125˚

5.2 Current Consumption

The current consumption depends on the load and the type of motion of the robotic arm. In the current study, there are 4 levels of current consumptions:

- Low (from 0 to 200 mA). This consumption takes place when the robot is at rest (not motion case).

- Normal (from 200 to 500 mA). This happened when the robot arm is moving with capability to go to the target without needs of great torque.
- High (from 500 mA to 900 mA). This range is rea-ched at the beginning of carrying loads. By overcoming the initial moment of inertia for loads, the normal range takes a place.
- Over current (more than 900 mA). The load is too hea-vy and the motor cannot move at all. For being under this condition for more than one minute, the motor will burn, *i.e.* it is not possible to be used any more.

5.3 Maximum Load

These results were obtained using different weights; a bag of corn was used with a scale to determine bag' weight. Results carried out by using the robot arm to pick up the bag and move it to specific positions. **Table 2** presents the current consumption at different weights of bag of corn. From **Table 2**, it can be seen that the robot can move without problems at loads lower than 50 grams. At loads 60 grams, the robot arm start having difficulties and after passing 80 grams severe condition occurred where ire-versible damage could be happened in motors.

FINDINGS:

Even though the working model of the robotic arm is fabricated and used, there is a need to be further work in the project which has not been done. There are a many ideas where the loss of energy and man power can be reutilized and the new design can be recreated for high performance. Some of them are as follows:
Lot of accidents happening in the industry and there are still some small scale industries which cannot afford those costly robotic arms. so our aim is to do robotic arm at very low prize so that middle and small scale industries can afford

6. RESULT:

- It is less in cost
- It eliminates the human effort.
- Good finish and accuracy.
- Smooth working and easy handling.
- It is programmable

7. CONCLUSION:

From the above mentioned project, it can be concluded that the "Multipurpose robotic arm" is a robot very widely used yet very required for doing various operations of industry. The medium scale industries and small scale industries can afford this robotic arm because of its low cost and accuracy. This is done mainly on focusing to increase the production rate of medium and small scale industries .It gives the safe environment to the workers by implementing these robots in doing the hazard operations . The cost of maintenance is a less and it is easy in replacement and compact in size

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