

Study Of Hydraulic Power 3DOF Robotic Arm Control

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Abstract— Are you wonder about how cranes lift dead weight? Are you wonder about how jacks in works shop lift cars? Good, the answer is hydraulic systems. Hydraulic power, that deals with the generation, control and transmission of power using pressurized liquids. They convert a small input effort into the larger force to complete the work, like the fulcrum lever concept. The principle behind the hydraulic system is called Pascal law. The current work shows the fabrication & Position control of 3 DOF robotic arm made from Cardboard.

Index Terms—Fulcrum lever concept, Pascal Law, DOF, Cardboard.

I. INTRODUCTION

Namely fluid system is classified into two types called as fluid transport system & fluid power system. Fluid transport system is to transport/Deliver fluids from one place to another place to achieve some useful purpose like transport of water from water reservoir to houses. Fluid power is the technology that deals with the Generation, Control, and Transmission of power using pressurized fluids like oil is used in various construction and earth-moving equipment to accomplish the desired movements and hence to perform designed work.

Fluid power system further classified as two types called Hydraulic power system & Pneumatic power system. Hydraulic power is transmitted by the pressure and flow of liquids. The most common liquids used are petroleum oils. Pneumatic power is transmitted by the pressure and flow of compressed gases. The most commonly used gas is air.

The concept behind the hydraulic system is Pascal's law more similar to fulcrum & lever concept. Levers are used to lift heavy weights with least amount of effort. The same way Pascal's also used to lift heavy weight with smaller amount of force.

Pascal's law states, Pressure exerted anywhere in a contained incompressible fluid is distributed equally in all direction

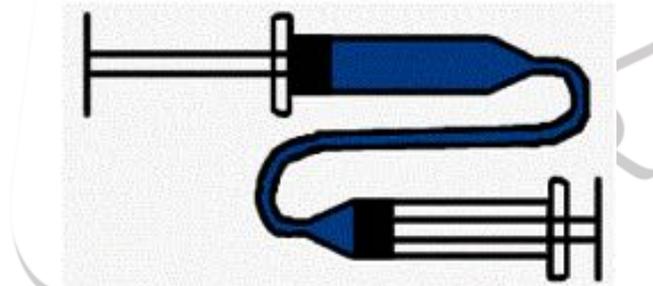


Fig1.1 Pascal Law

The current works encompasses a 3 DOF robotic arm to perform some pick & place operation for picking light weight components like Match box, Soda can, etc. The 3 DOF includes Rotating Base, Forearm & arm are actuated by Hydraulic syringe.

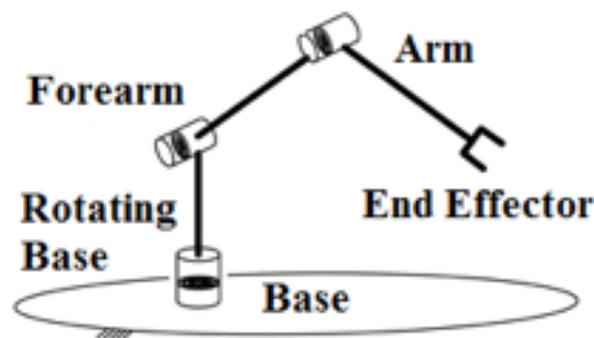


Fig 1.2 Robotic Arm config

II. TOOLS & MATERIAL

It should be noted that piece of wood, cardboard, or hard plastic may be used. The tools and material of this work can be listed as.

1. Eight plastic 10ml syringes with rubber piston,

2. Two rotating base cardboard piece (10.5 cm * 11.5 cm),
3. Two supporting platform cardboard piece,
4. Two forearm cardboard piece (19.5cm * 2.5 cm),
5. Two arm cardboard piece (23.5cm * 2.55cm),
6. Two gripper jaw cardboard piece,
7. Two Gripper body cardboard piece,
8. 10 Syringe piece spacer cardboard piece.

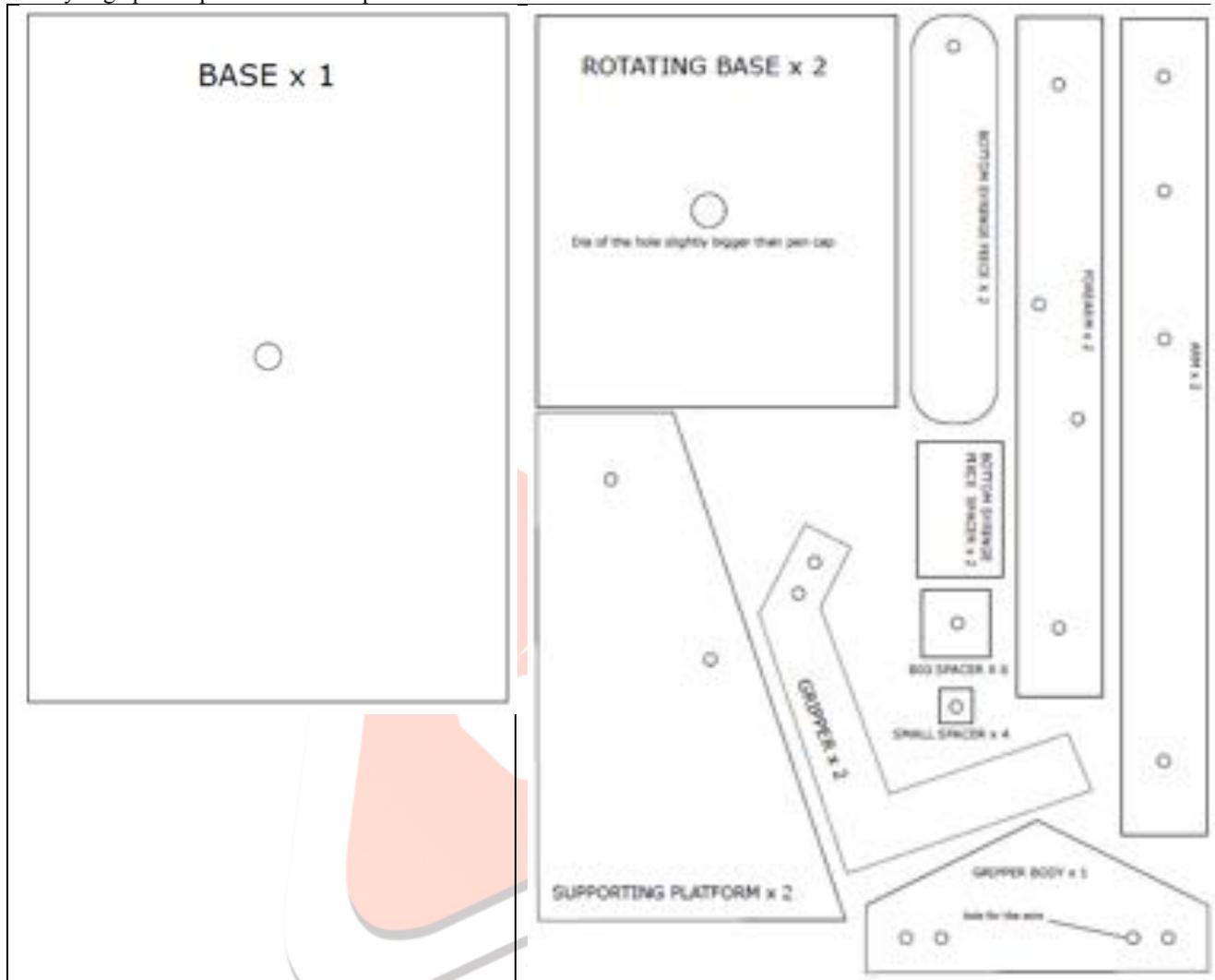


Fig 2.1 Template of cardboard robotic parts



Fig2.2 Cardboard pieces



Fig 2.3 Actuating syringes



Fig 2.4 X_Acto Knife



Fig 2.5 Gripper Piece parts

III. PARTS ASSEMBLY OF ROBOTIC ARM

Required holes on the cardboard pieces for assembling it to robotic arm is done by drilling machine. By inserting the battery on the holes of Base -1 & 2 parts of rotating base - 2 are joined to form the first DOF. Next forearm & arm parts are connected by barbecue sticks. Gripper body is attached to the arm by glue gun. Gripper jaw is attached to the gripper body through metal wire & barbecue sticks.



Fig3.1 Assembly Model of Robotic arm.

IV. POWERING UP ROBOTIC ARM THROUGH HYDRAULIC ENERGY

After the assembly of robotic model, colored water syringe is mounted in the system through corresponding drilled holes with the help of barbecue sticks. This will act as an actuator to make the joint movements.

The actuator syringes at joints are connected to the operating syringes through flexible hoses. The operating syringes are mounted in built in remote control platform for make the pick place operation easier.



Fig 4.1 – Working Model of 3DOF Hydraulic Robotic Arm

V. SYSTEM TESTING

The test were successfully applied to the model as follow by the below procedure,

- When pressing the respective operating syringe on the remote platform causes to lift the forearm through actuating syringe on it.
- When pressing the respective operating syringe on the remote platform causes to rotate the base through corresponding syringe on it.
- The same way arm & gripper are actuated.
- By following the above operating procedure hydraulic robot can pick & place the objects in the required position.

VI. Conclusion

The Design & Fabrication of Hydraulic power 3DOF Robotic arm is well performed a pick & place operation through a Hydraulic power system. For future development the hydraulic actuators can be replaced with electric motors to illustrate a precious position control of pick & place operation.

VII. ACKNOWLEDGMENT

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