A PROJECT REPORT ON

HYDRAULIC POWERED ROBOTIC ARM

Submitted by

AMIT KUMAR BEJ	**AJU/201289**
VIKASH KUMAR YADAV	**AJU/201291**
ARPIT RAJ	**AJU/201322**

ARKA JAIN UNIVERSITY
JHARKHAND
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ARKA JAIN University
Jharkhand (Jamshedpur)

CERTIFICATE

This is to certify that project entitled "**HYDRAULIC POWERED ROBOTIC ARM**" has been submitted to the Department of Mechanical Engineering, ARKA JAIN University, Jharkhand by following student of Mechanical Engineering.

AMIT KUMAR BEJ	**AJU/201289**
VIKASH KUMAR YADAV	**AJU/201291**
ARPIT RAJ	**AJU/201322**

Prof. Ashwini Kumar

(Asst. Dean)

ARKA JAIN UNIVERSITY JHARKHAND

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Thank You All,

AMIT KUMAR BEJ	AJU/201289
VIKASH KUMAR YADAV	AJU/201291
ARPIT RAJ	AJU/201322

Abstract

Hydraulic robotic arm is a complicated system which coupled by mechanics and hydraulics', It is widely applied in all kinds of large engineering equipment's, such as concrete pump truck, bridge monitor truck, arm frame of crane, etc. The arm system of the hydraulic robotic arm multi-body is redundant freedom, strong nonlinear, coupled with rigid and flexible characters. So it is of great theoretic value and real engineering significance to study the am system of the robotic arm. In this theme, the movement of flexible hydraulic robotic arm and hydraulic cylinders dynamic model of the driving system and the arm system is built with Lagrange Equation and Virtual Work Theory. And the dynamic differential equation is built with the driving force of the hydraulic cylinder as the main force. With the track programming and the optimization method, the are separately analyzed with flexible multi-body dynamics, and the mechanical hydraulic IS dynamic converse problem of the arm end track is researched, so as to get the optimized rotation angle when the arm end reaches the expected point. By using the PD control theory, without decoupling and rank-decreasing, only with feed back from the hydraulic system to realize the close loop control of the arm end position, pose and movement, the relationship between the hydraulic system and the end position & pose isstudied, so that the flexible distortion is reduced and the liberation is restrainedThe simulation result prove that the movement equation built by this way can clearly describe each dynamic character of the mechanical arms.

CONTENTS

CHAPTER:- 1

INTRODUCTION

Hydraulic robotic Arm is a system which coupled by machine and hydraulic . It is widely applicable in all kinds of large engineering equipment's such as a arm frame of crane. The arm system of the redundant freedom ,strong nonlinear coupled with rigid and flexible characters . In hydraulic robotic arm the dynamic differential equation is built with the driving force of the hydraulic cylinder as the main force By using the PD controlled theory without de coupling and rank decreasing only with feedback from controlled of the arm and position pose and movement the relationship between the hydraulic system and the end position and pose studied . The simultaneous result prove the movement equation built by this way can clearly describe each dynamic character of the mechanical arm .

A hydraulic drive system is a drive or transmission system that uses pressurized hydraulic fluid power hydraulic machinery . The term hydrostatic refers to the transfer of energy from flow and pressure the kinetic energy of the flow.A hydraulic drive system consist of parts . The generator (e.g :- a hydraulic pump) Driven by a electric motor , a combustion engine valve filters ,piping etc.(to guide and control the system); and the actuator (e.g:- a hydraulic motor or hydrauliccylinder) to drive the machinery .

INTRODUCTION ABOUT THE MECHANISM

A robotic arm which is hydraulic operated and controlled by syringes filled with some fluid It consist of various part connected to each other in a pre designed manner which areguided in a constrained way to obtained required output .

1.1 APPLICTION

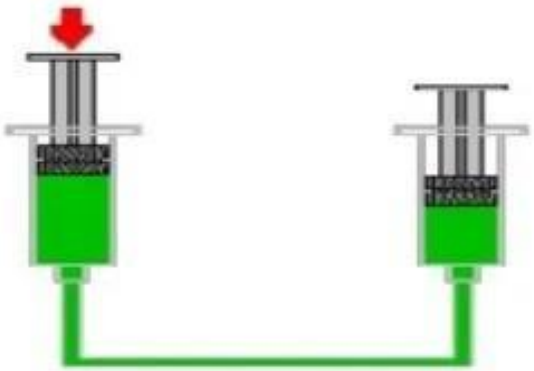
These arms are used in assembly lines mega factories to assemble various part ofa productand also to paint vehicles . They are also used in earth movers to pickup heavy weight and keep them where required .same principle is being used in JCB's automobile lifters ,etc.

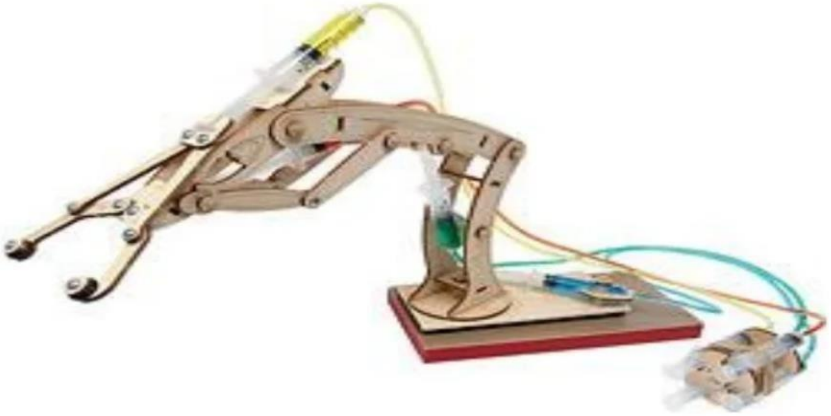
1.2 PARTS

In the mechanism each part has been provided with certain degree of freedom to move in a constrained way to guide other parts and also pick up small weight items and to place themWherever required . The complete mechanism consist of fixed vertical links . To its free end to it is connected or batter to say hinged another horizontal level link which is free to oscillate about that hinge in an up down way of motion . To this link is connected a slotted type mechanism which consist of slotted box which itself can oscillate about it hinge and its sliding link which can come out of the slot to have the slider like motion . To this slider is connected a surface underneath which are attached 4 spoons acting as arm to pick up items .the entire mechanism is fixed on a rack and pinion type mechanism to allow degree of freedom of the mechanism as a whole to rotate by 130 degrees .

1.3 Hydraulic actuation

All the movements above are controlled hydraulic by syringes attached to each one
The hydraulic supply acts like arm's heart and muscles .it provides the energy
to pushing,pulling, turning and lifting





CHAPTER :- 2

PRINCIPLE OF HYDRAULIC ROBOTIC ARM

Pascal's law is the basic of hydraulic drive systems. As the pressure in the system is theSame , the force that the fluid gives to the surroundings is therefore equal to pressure x

Area .in such way ,a small piston fells a small force feels a small force and a large piston Feels a large force. The same principle applies for a hydraulic pump with a small swept Volume that asks for a small torque. Combined with a hydraulic motor with a large swept Volume that givesa large torque. In such a way transmission with a certain ratio can be built

Most hydraluic drive systeam make use of hydraulic cylinders. Here the same principle is used a small torque can be transmitted into a large force . By throttling the fluid between the generation part and the motor part or by using hydraulic pumps and the motor part or by using hydraulic pumps and or motors with adjustable swept volume , the ratio of the transmssion can be changed easily . In case throttling is used, the efficiency of the transmission is limited in case adjustable pumps and motors are used , the efficiency ,however ,is very large in fact up to around 1980 , a hydraulic drive system had hardly any compition from the adjustable drive system .

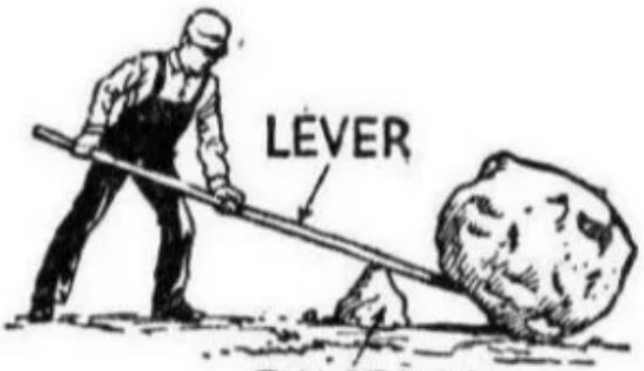
Nowadays, electric drive systems using electric servo motors can be controlled in an

Excellent way can easily complete with rotating hydraulic drive systems hydraulic cylinders are in fact without competition for linear forces. For these cylinders hydraulic systems will remains of interest and if such a system is available it is and logical used this system for the rotating drive of the cooling system also. An important advantages of a hydraulic drive is itshigh power density: the mass of a hydraulic drive is several times smaller than the mass of an electric drive of the same power.

2.1 PASCAL'S LAW

INTRODUCTION

Earlier, weights were lifted using pulleys, levers, block and tackles, etc. Movements for a ship's rudder or steering a vehicle where achieved by mechanicallinkages like cams, levers, couplings, and gears which made the system complicated. These manual or mechanical methods of operation had several limitations. They also involved huge man power and long working hours for a particular job. As the population and technology increased exponentially, thedemand for quicker and easier to operate equipment increased. To cater to this need, hydraulic machines were introduced.



Man lifting a stone with a lever 6

2.2 PASCAL'S PRINCIPLE AND HYDRAULICS

2.2.1Pascal's Principle

Blaise Pascal was a French mathematician, physicist and religious philosopher who lived in the mid-seventeenth century. He made some significant observations aboutfluid and pressure. He noticed that the shape of a container had no effect on pressure. He also noticed that pressure applied to an enclosed fluid is transmitted undiminishedto every part of the fluid, as well as to the walls of the container. When it says "enclosed fluid," that means that in order for Pascal's Law to be true, you have to be looking at a liquid in a closed container.

2.2.2 Pascal's Principle and Hydraulics

Hydraulic systems use incompressible fluids, such as oil or water, to transmit forces from one location to another within the fluid. Hydraulics are used in most breaking systems. Pascal's law states that when there is an increase in pressure at any point in a confined fluid, there is an equal increase at every other point in the container. Therefore Pascal's law can be interpreted as saying that any change in pressure applied at any given point of the fluid is transmitted undiminished throughout the fluid.

2.2.3 How do Hydraulics Work?

Imaging if you have a U-tube filled with water and pistons are placed at each end, pressure exerted against the left piston will be transmitted throughout the liquid and against the bottom of the right piston. The pressure that the left piston exerts against t6hewater will be exactly equal to the pressure the water exerts against the right piston.

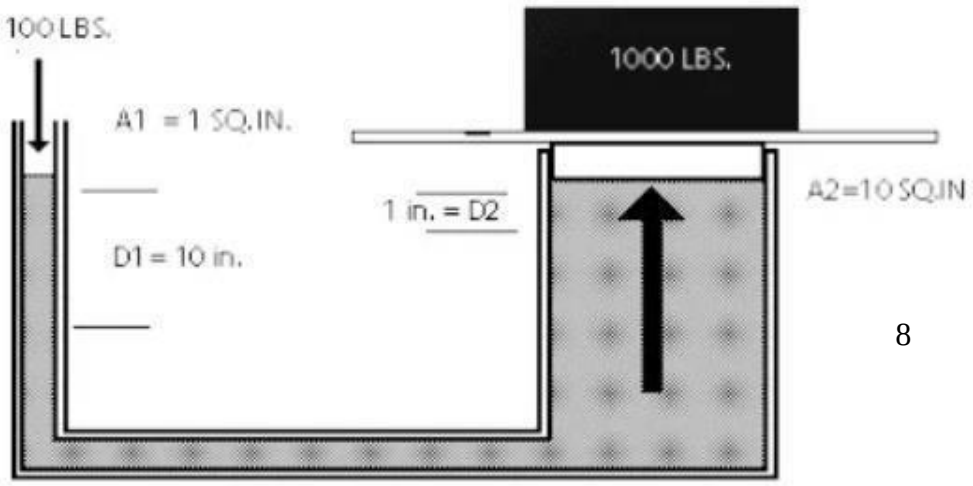
Now suppose the tube on the right side is made wider and a piston of a larger area is used; for example, thepiston on the right has 10 times the area of the piston on the left.If a 1 N load is placed on the left piston, an additional pressure due to the weight of the load is transmitted throughout the liquid and up against the larger piston. The additional pressure is exerted against the entire area of the larger piston. While the pressure exerted is the same, since there is 10 times the area, 10 times as much force is exertedon the larger piston. Thus, the larger piston will support a 10 N load - ten times the load on the smaller piston.

2.2.4 Pascal's Law and Mechanical Advantage -Pascal's law allows forces to bemultiplied.

Generally, the mechanical advantage is calculated as:

MA = (the distance over which force is applied) + (the distance over which the load is moved)

Applied to the system shown below, such as a hydraulic car lift, Pascal's law allows forces to be multiplied. The cylinder on the left shows a cross-section area of 1 square inch, while the cylinder on the right shows a cross-section area of 10 square inches. The cylinder on the left has aweight (force) on 1 pound acting downward on the piston, which lowers the fluid 10 inches. As a result of this force, the piston on the right lifts a 10 pound weight a distance of 1 inch.



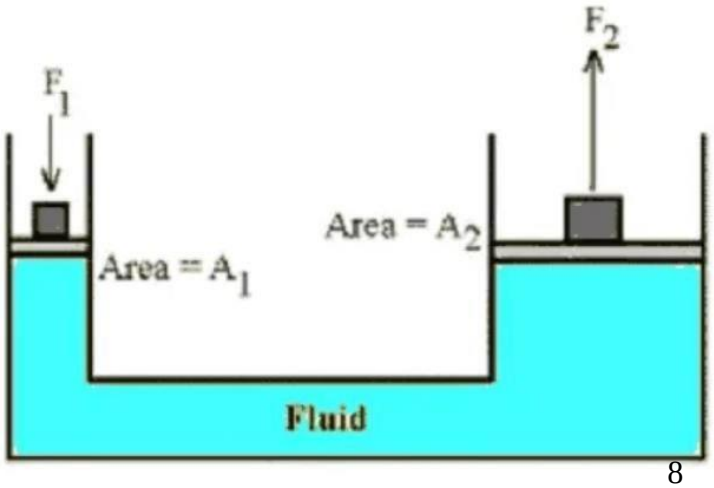
The 100 pound load on the 1 square inch area causes an increase in pressure on the fluid in the system. This pressure is distributed equally throughout and acts on every square inch of the 10 square inch area of the large piston. As a result, the larger piston lifts up a 1000 pound weight. The larger the cross- section area of the second piston, the largerthe mechanical advantage, and the more weight it lifts.

The formulas that relate to this are shown below:

Area1/Area2= Distance moved 2/Distance moved 1

This system can be thought of as a simple machine (lever), since force is multiplied. The mechanical advantage can be found by rearranging terms in the above equation to:Mechanical Advantage(MA)=D1/D2=A2/A1

For the sample problem above, the MA would be 10:1 (10 inches/ 1 inch or 10 square inches /1 square)



2.3 APPLICATIONS OF PASCAL'S LAW

Gases are easy to squash: everyone knows how easy it is to squeeze a balloon. Solids are just the opposite. If you've ever tried squeezing a block of metal or a lump ofwood, with nothing but your fingers, you'll know it's pretty much impossible. But what about liquids? Where do they fit in? You probably know that liquids are an in-between state, a bit like solids in some ways and a bit like gases in others. Now, since liquids easily flow from place to place, you might think they'd behave like gases when you tiredto squeeze them. In fact, liquids are virtually incompressible- much like solids. This is the reason a belly flop hurts if you mess up your dive into a swimming pool. When yourbody smacks into the pool, it's because the water can't squeeze downwards (like a mattress or a trampoline would) or move out of the way quickly enough. That's alsowhy jumping off bridges into rivers can be very dangerous. Unless you dive correctly, jumping off a bridge Into water is almost like jumping onto concrete.

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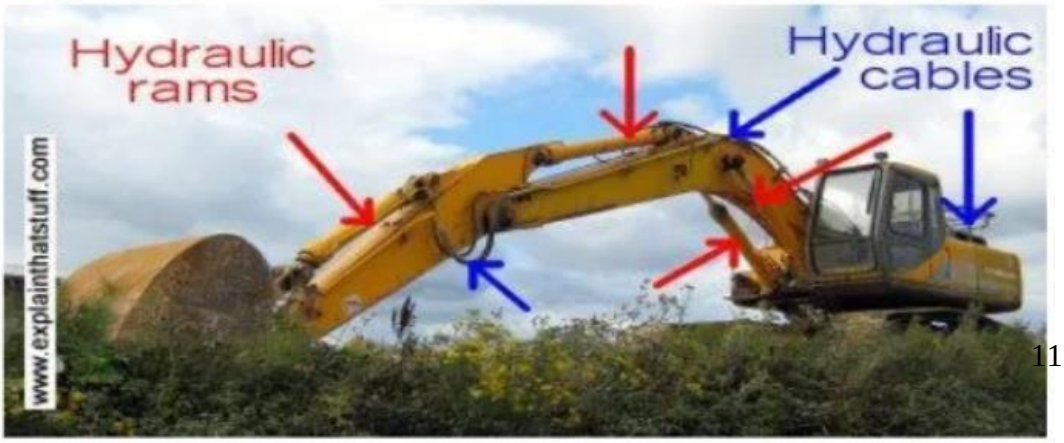
The fact that liquids don't compress easily is incredibly useful. If you've ever fired a water pistol (or a squeezy washing-up liquid bottle filled with water), you've used this idea already. You've probably noticed that it takes some effort to press the trigger of a water pistol (or to squeeze water from washing-up bottle). When you press the trigger (or squeeze the bottle), you're having to work quite hard to force the water out through a narrow nozzle. You're actuallyputting pressure on the water-and that's why it squirts out at a much higher speed than you move the trigger. If water weren't incompressible, water pistols wouldn't work properly. You'd squeeze the trigger and the water inside would simply squash up into a smaller space-itwouldn't shoot out of the nozzle as you'dexpect. If water pistols (and squeezy bottles) can change force and speed, that means (instrict scientific terms) they work just like tools and machines. In fact, the science of water pistols powers some of the world's biggest machines- cranes, tipper trucks, and diggers.

2.4 Hydraulics in practice

You can see hydraulics at work in this digger. When the driver pulls a handle, the digger's engine pumps fluid into the narrow pipes and cables (shown in blue), forcing the hydraulicrams (shown in red) to extend. The rams look a bit like bicycle pumps working in reverse. If you put several rams together, you can make a digger's arm extend and move much like a person's-only with far greater force. The hydraulic rams are effectively the digger's muscles.



Here's another example: a hydraulic hedge-cutter on the back of a tractor. The cutting head needs to be sturdy and heavy to slash through hedges and trees and there's no way the driver could liftor position it by hand. Fortunately, the hydraulic controls do all that automatically: with several hydraulic joints, a bit like a shoulder, elbow, and wrist, the cutter moves with as much flexibility as a human arm.

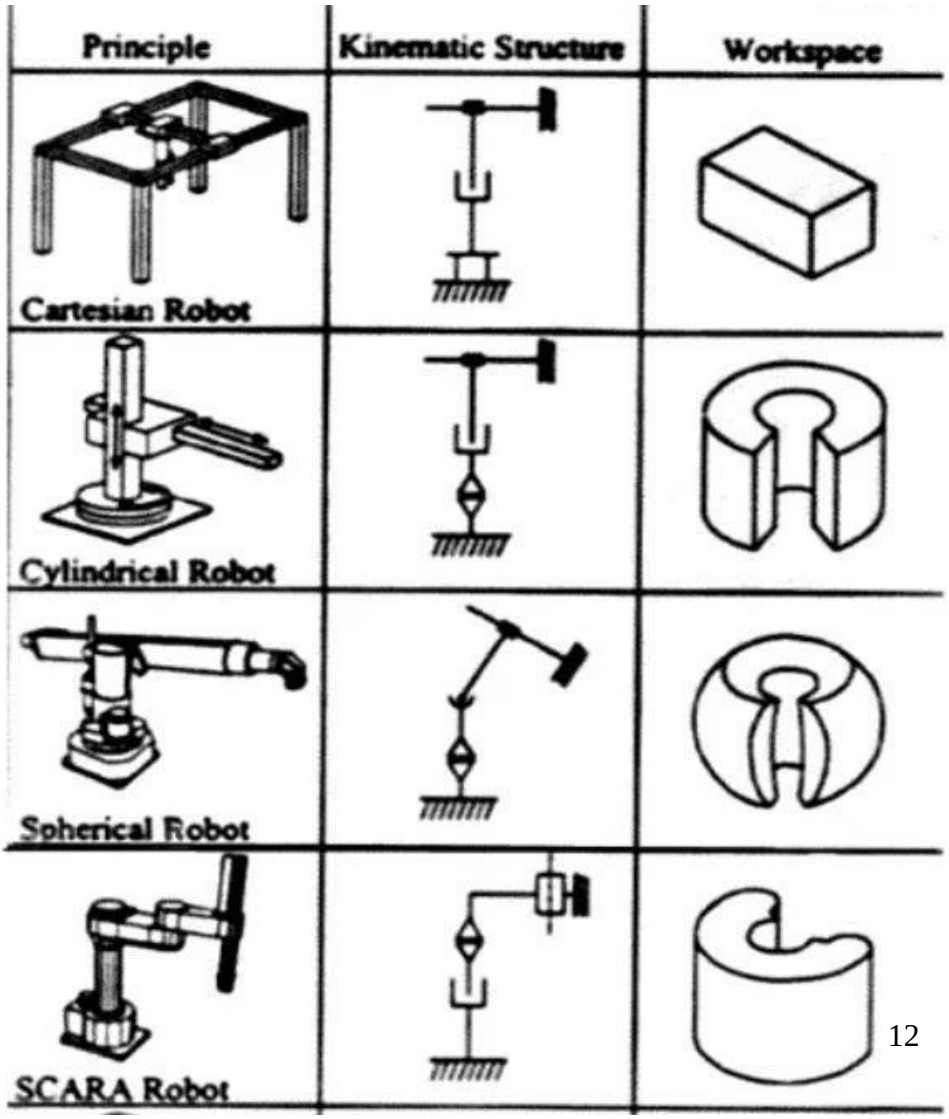
Different models of Hydraulic Arm:

2.5 Robot Power

• The power for a robotic arm can either be electric, hydraulic, or pneumatic.

• Hydraulics is putting liquids under pressure

• Pneumatics is putting gases under pressure. The power supply acts like the robot's heart and muscles. It provides the energy for pushing, pulling, turning and lifting.



CHAPTER :- 3

CLASSIFICATION OF ROBOTIC ARM INTRODUCTION

INTRODUCTION

In that work, it has been explained the classifications of the robotic arms which have used hard, dangerous and high level sensitive works, according to unrestraint levels, power supply which is used by the joint accelerators, control methods, sharpness grades and codification with double letters. According to those classifications, it has been explained the specifications of the robotic arms, usage fields, working spaces, advantages and handicaps against each other

EXPOSITION

Robot has a meaning of slave or working in Czech and Slovak languages. Robotic means the science of robot and it's named firstly by Issac ASIMOV. Robots are very functional manipulatorswhich are projected for moving some materials, hand tools or special equipments by giving thena series of preplanned duties. Need of industrial robot and their use is increasing by computer supported conception and parallely computer supported production. Most important feature that separates the robot from the other machines is; robots can be programmed several times and they have control system that provides to do more complex processes near by mechanic systems. In a word, robot is an industrial manipulator controlled by computer. Robot science is a branch of instruction that contains several engineering as electric and electronic engineer, mechanical engineer, computer engineer and math engineer. In examples; mechanical engineering is curious about robots dynamical and statically constitution, computer engineering is interested in software part of robots and electric engineering is concernedwith perceptional concept of robots.

All the robots have a working space as to their organs and joints. That working space is the open place where robot's extremity functionary can move freely. By the help of robot manipulator's joint changes extremity functionary's position according to main shaft and find of inclination is forward kinematics; bye the position and inclination knowledge of extremity functionary, found of joint changes of robot manipulator is reverse kinematics. Kinematics is interested in act of objects. Robot's strength sped and acceleration analysis can be made by robot kinematics. A robotis composed of prismatic (sliding) or revolving kind of joints which can move freely by themselves and organs which combine the joints each other, revolving joint, (Fig. 1.) allow srevolving between two organs. Prismatic joint, (Fig. 2.) allows linear movement joint angle is re-movement that consists of revolving in revolving joint. Joints slip is re-movement that consists of linear movement between organs in prismatic joint. Joint angle is the joint changeability in revolving joints, joint slip is the joint changeability in prismatic joints.

Fig (2) Prismatic joint

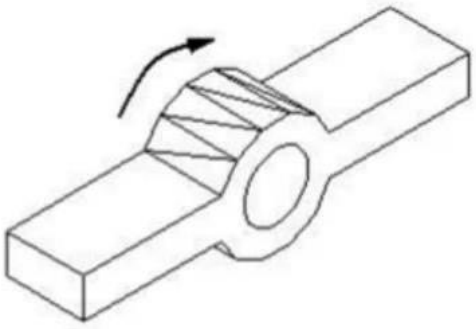


Fig. (1) Revolving joint

Manipulators are accepted as open-tipped kinematics chain of bounded rigid things. While onetip of the chain is bound to main environment, the other tip is bound to tip functionary. Consequently, action of manipulator is ever all of movements of each organs according to the others. Expressions which constitute this kinematics chainconsist of homogeny transformation matrix that includes the location and inclination of robot for determining the manipulator movement, it is necessary to determine the inclination and location of rigid thing in space.

Inclination of rigid thing in Cartesian space, transformation matrix and the location of rigid thing are founded by locating vector. Six lack of restriction degree is enough for reaching at an any point in three dimension space. Redundance becomes at robots whose lack of restriction degree is more than six. Redundance can be defined as the place which is hatched by two different joints at the some time.

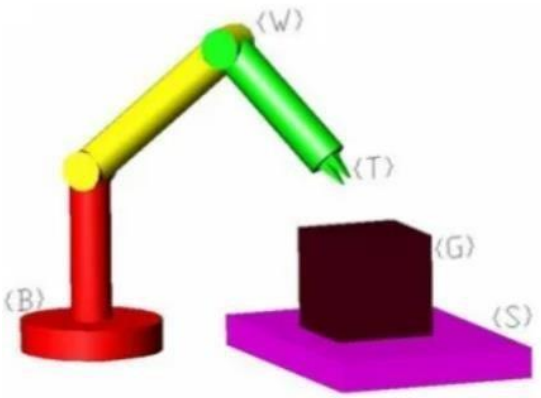


Fig. Robot and working space

Basic frame {B} inactive part of robot, in other words, first hoop of kinematics chain. Station frame {S} the frame where robot makes all actions. Wrist frame {W} it is the last organ of manipulator and the last ring of the chain.

Tool frame {T} a suitable component is placed according to action that we want the robot to do.

Goal frame (G} the frame which is onto thing where the robot is going to operate.

3.1. Classification of robots

Robots are principally classified in two groups as serial and parallel robots. Serial robots are formed from a row of joints and organs which combine these joints each other. (Fig. 4.) Serial robots have an extensive working space and a few amounts of mechanical parts. Parallel robots come together more parallel organs between main frame and last functionary. (Fig. 5.) When these two robots are compared with their rateof carriable mass to mechanic constitution mass jobs and parallel robots are used for bigmass jobs.

Fig. 4 Serial robot

Fig. 5 Parallel robot

Robots can be classified in five different classes according to their lack of restriction rate, source of power used for revolving joints, control methods, sharpness degree and two letter code.

3.1.1. Robots according to lack of restriction rate

Robots which are used industry are generally these six lack restriction rate robots. While classifying the robots according their lack of restriction rate, it's looked fort he functions of first three organs.

For example;

If first there organs have a prismatic joint, this robot is Cartesian robot. (Prismatic Prismatic Prismatic- PPP)

If the first organ has a revolving joint but the second and third have prismatic joint, this robot cylindrical robot. (Revolute Prismatic Prismatic - RPP)

If the first two organs have revolving, third organ has a prismatic joint and all joints are parallel to each other; this kind of robot is Scara robot. (Revolute Revolute Prismatic- RRP)

If the first two organs have revolving joint and the third organ has a prismatic joint this robot is spherical robot. Also if first three organs have revolving joint, this robot is revolving robot.

3.1.1.1. Cartesian robot

The robot which is projected as being prismatic joint of first three joints is Cartesian manipulator. That kind of robot has the least kinematics order. Although their mechanical constitution is well- made (strong) their activity skills in working space are quite Lowe Cartesian kind of manipulators are mostly used for carrying the thingsfrom somewhere to somewhere that have a high capacity and weight

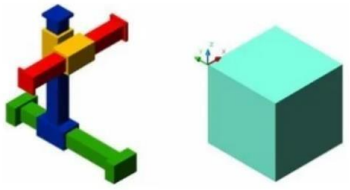


Fig. 6 Cartesian robot and working area

3.1.2. Cylindrical robot

A kind of manipulator which is constituted from joints that first joint is revolving. the second and third joints are prismatic kinds. Although their mechanical constitution is well-made, their wrist location line changes according to horizontal action. So as Cartesian robots, they are used for carrying the things that have high capacity and weight. Hydraulic cylinder is usually used as movement at prismatic joint.

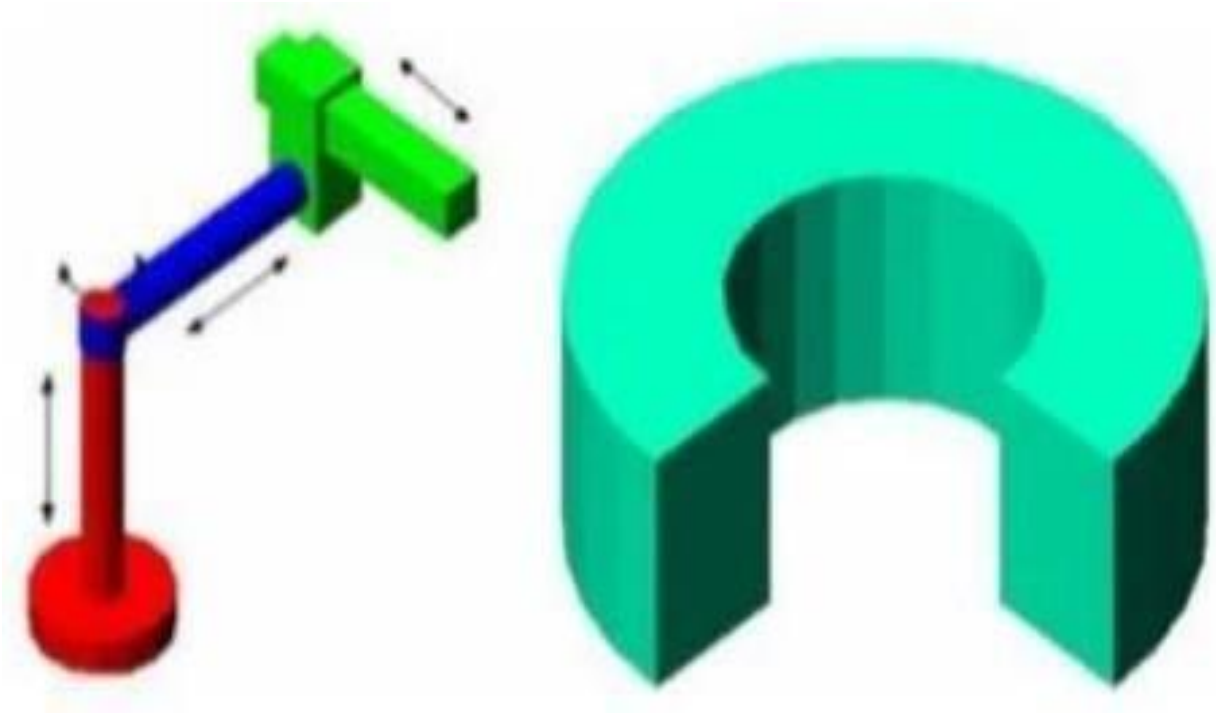


fig.7 cylindrical robot and working area

3.1.3. Spherical robot

is not well-done than Cartesian robot, their activity skills in working space are rather In spherical manipulator, first two joints are formed by revolving joints and the third joint is formed by prismatic joint. Although their mechanical constitution high.

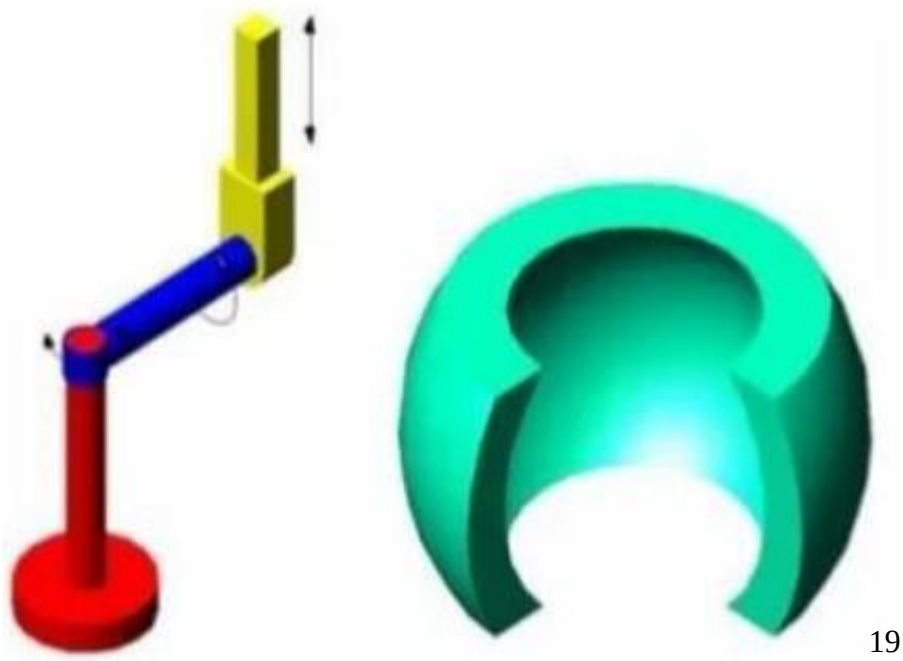


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fig.8 spherical robot

3.1.4. Revolving robot

Manipulator whose first three joints have revolving joints is revolving manipulator. These robots have the highest activity skills in working space. It is the most skillful manipulator. In Project of the manipulator human arm was referenced

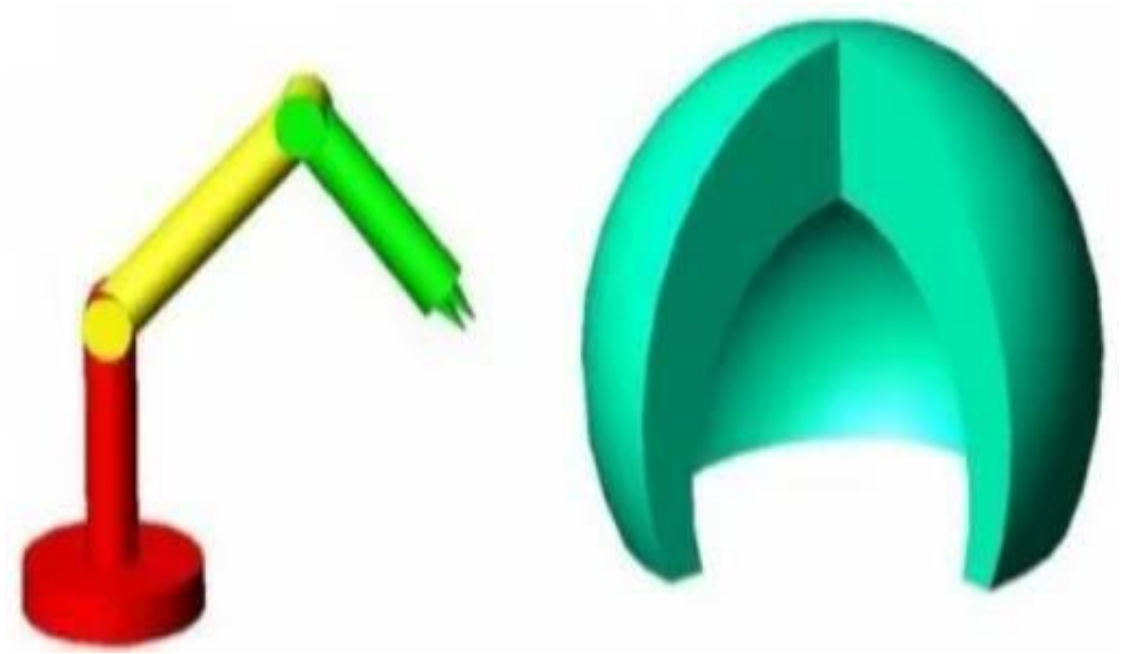

fig.9 revolving robot and working area

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Robot	Advantages	Disadvantages
cartesian	1.Their kinematics equation simple mechanical constitution are well made . 2.In each point of the working space, their huge sized activity skills are same . 3.It is easy to add new thing because they have a simple kinematics constitution.	1. Size of working space is similar than robot size . 2. Robot can't reach own main body 3. It is difficult to protect the prismatic joints from dust in environment.
cylindrical	1. Because the main frame is revolving speed of tip functionary is high . 2. hey have an extensive working space as to cartesian robot .	1. They have small working space as to spherical robot . 2. Huge size of activity skill change according to arm length
Spherical	1. They have an extensive working space	1. Due to their kinematics equation are complex their control is difficult too 2. Huge size of activity skills are different at each point
Revolving	1. They have very extensive working space 2. it is easy to move the joints whose all are revolving .they are very pliant and fast.	1. Huge size of activity skills are different at each point 2. Due to their kinematics equation are complex their control isdifficult .

3.2. Robots as their controlling methods

Robots are classified in two groups as their controlling.

3.2.1. Robots controlled from a point

There isn't a determined working area for these kinds of robots. Lack of restriction degree is

smaller than six and they usually used for carrying a thing from somewhere to

somewhere. Robotis used by an operator.

3.2.2. Continual trajectory controlled robots

These kinds of robots are controlled as following a pre-determined trajectory. Robot is programmed by operator before start using. During the run of robot, operator doesn't interfere it this kind of robots periodically repeats the programmed action.

3.3 According to the power source that is used by robot movementers

Because the robots ought to do job which is given, it is important to stir the joints in an appropriate order. Joint activity in these robots is achieved by electric motors, pneumatic cylinderand hydraulic cylinders.

3.3.1. Stirring up with electric motor

Special envisagement electric motors are used for stirring up the joints of this kind of robots. Because of the circular action of engine shaft, it's usually used for activity of revolving joints. So, Dc servo type motors whose revolving angle can be decreased under 1", are used fort his arm. Dc servo type motors that they have redactor provide high torque with low voltage. It is easy to control.

3.3.2. Stirring up with hydraulic cylinder

This kind of robots joints are stirred with hydraulic cylinder. It is usually used to activate the prismatic joints because of the constitution of cylinder. They are used at hard Works in industry that they provide a high torque with low energy.

Because their performance is not linear, their control is more difficult than electric engines.

3.3.3. Stirring up with pneumatic cylinder

These kinds of robots are alike to hydraulic cylindrical robots, but their control is difficult. Because, air is used in pneumatic cylinder and air presume is not enough to provide the flux ofcylinder but their constitution is simple. As hydraulic cylinder robots,these kinds of robots areused for activity of joints.

3.4. Robots according to their sharpness degree

It is separated into three groups as straightness, replacement, and resolution

3.4.1. Resolution

It is known that robots are controlled by control system. It is the arability of changing for the signals that is sent to control system. For example; a robot whose joints are placed by servomotor has a high. While a robot whose joints are placed by hydraulic cylinder has a low.

3.4.2. Straightness (Accuracy) .

There is a software which was prepared for the control for robots by their control systems. We can control the robot by programmer it with this software of the program of tip functionary.

3.4.3. Replacement (Interconvertibility)

Replacement is a special feature of robot that robots tip functionary comes to the same pointdoing the jobs.

3.4.4. Classification made by two letters coding

Huang and Milenkovic have improved a code formed from two letters for describe the robottypes. According to that, first letter explains the property of first joint

and the revolving comparing the second one. The second letter explains the third joint and therelationship between second and third point

Used letters and symbols S: slipping, slide (Fig. 10A)

C: upright turning at slipping axis (Fig. 10B)

N: upright turning at turning axis (Fig. 10C)

R: upright turning to slipping axis or parallel to turning axis (Fig. 10D)

fig 10b symbol used at two- latter coding

Huang and Milenkovic have used sixteen unit of two-letter combination for robotorgans. All these compositions are useful and they aren't different. A useful organ must have an extensive sized activity skill in three dimension space; difference is that each organ is different from theother categories.

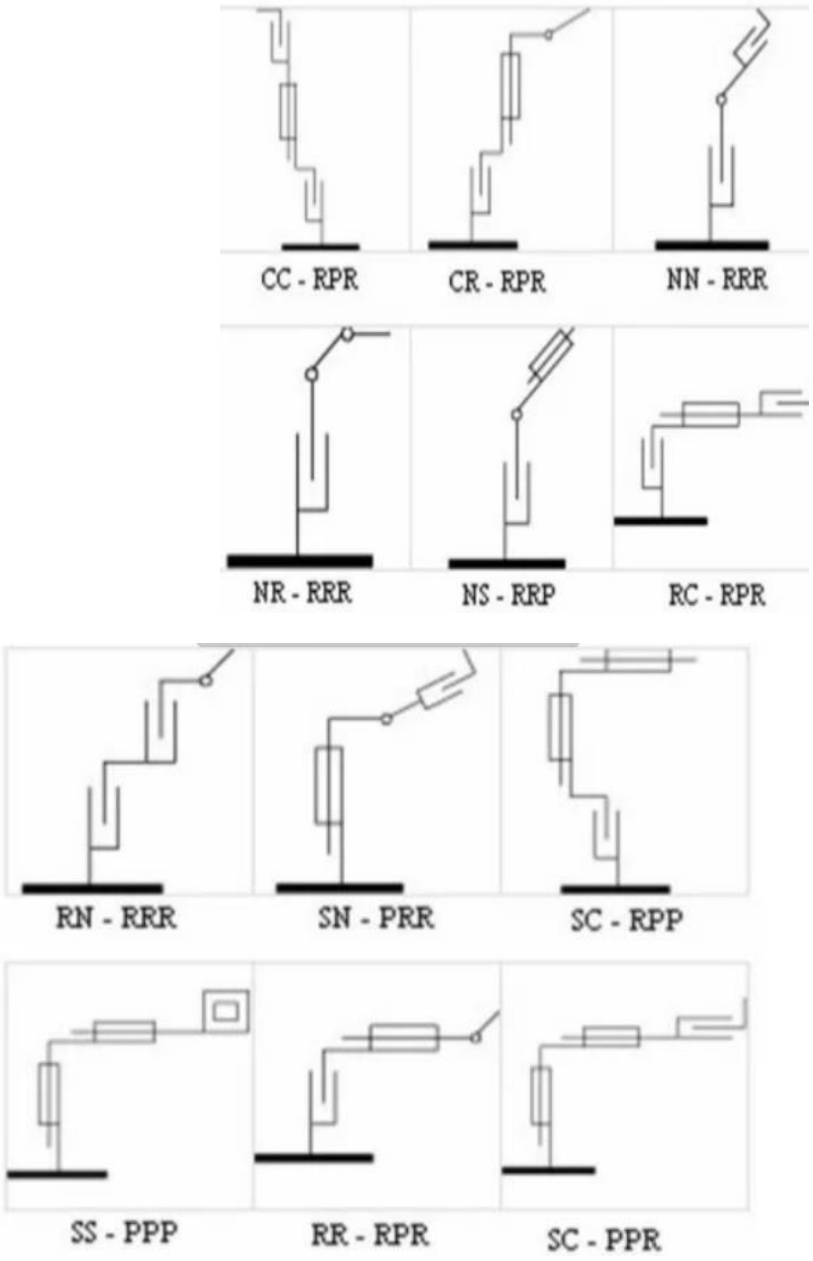

Fig11 symbolic figures which identifies the robot at two latters

Huang and Milenkovic haven't found useful the codes; CN, NC, RS and SR. RS and SR robots are usually used in industry although they don't find useful and different. The reason that these two robots don't find useful and different is because they rake the same area with CS robot.

3.5 Imitation

Imitation or simulation is an animation of physical activity by the help of programs which are necessary at computer atmosphere before acting a physical activity. Robot programs are tested with imitation programs before testing on true robots. There are advantages of testing the programs. If robot programmesare loaded to robot before testing by the help of imitation, robot can damage itself or environment. For this reason, testing robot programs (after software) provides timeand Money. A good robot imitation programmer could model's the position of organs, inclinations and environment.

3.5.1. Classification of robot imitation programs

It is separated in two class as online or offline.

3.5.2 Online programming

Online programming is realized when the robot is at production position. It is used to reach thetip functionary of robot at determined point.

3.5.3 Offline programming

Programming is done before producing the robot in offline programming and robot is produced after programming. This type of robots are wed at repeating process. If we want to do other action with the robot, first we delete the old program and it is programmed again.

CONCLUSION

In that work, it has been explained the structure of four types of robotic arms (manipulator) which have constituted the industrial robotic arms, working spaces, advantages and handicaps against each other. Furthermore, the work has revealed the classifications of the industrial robotic arms according to unrestraint levels, powersupply which is used by the robotic accelerators, control methods, sharpness grades and codification with double letters.

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CHAPTER:- 4
CONCEPTUAL DESIGN & METHODOLOGY

CONCEPT

The basic concept used behind the operation is PASCAL's LAW. This law states that when a pressure is applied at one point of a fluid contained in a constrained volume, then the pressure due to that force is equally transmitted to all the points of the fluid, which are acted upon by thesame pressure. Using the same principle, we applied pressure to fluid in syringe which is transmitted to other end of tube which is connected to a syringe. This motion of the syringe is used to move the links or parts of the mechanism which are attached to respective syringes.

CONCEPTUAL DESIGN

1.) The slotted mechanism used in the design, increases its complexity but at the same timeincreases its efficiency, ability, area of coverage.

2.) Rack and pinion mechanism used to provide rotatory motion does its work smoothly withoutany jerks or shocks and giving more degree of rotation and thereby increasing the area of effect.3.) To increase overall stability and to avoid roll over or unbalancing due to torque or extra weight in the front part, suitable counter weight is used in the rear portion of the mechanism.

4.) Soap water having least compressibility and high efficiency is used as a fluid in syringes.

METHODOLOGY

All the dimensions of the parts including their weights, their required job, are decided effectivelyto obtain overall dimensions of the mechanism and allow required degree of freedom and to obtain required motion and do the required task.

This motion of the syringe is used to move the links or parts of the mechanism which are attached to respective syringes. All the dimensions of the parts including their weights, their required job, are decided effectively to obtain overall dimensions of the mechanism and allow required degree of freedom and to obtain required motion and do the required task

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CHAPTER:- 5
DEVELOPMENT OF MODEL

5.1 Material used:

1. Cardboard - - 90*110 sq. cm
2. Hard cardboard for arms (links) - -3*50 sq. cm
3. Syringes (10 ml) - - 8 Pcs.
4. Wires (Aluminium) - -50 cmlong
5. Wood sticks for joints and connections 10 sticks6. Tie - - 16
7. Vinyl tubes 100 cm
8. Paper tape
9. Glue gun with refills
10. Fevi-quick
11. Spray paint (yellow)
12. Old battery

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5.2 Components

5.2.1. Hydraulic Cylinder

A Hydraulic cylinder (also called a linear hydraulic motor) is a mechanical actuator that issued to give a unidirectional force through a unidirectional stroke. It has many applications, notably in engineering vehicles. Hydraulic Fluids Petroleum Based Synthetic fire resistant water based fire- resistant. Hydraulic cylinder as shown in fig 1.

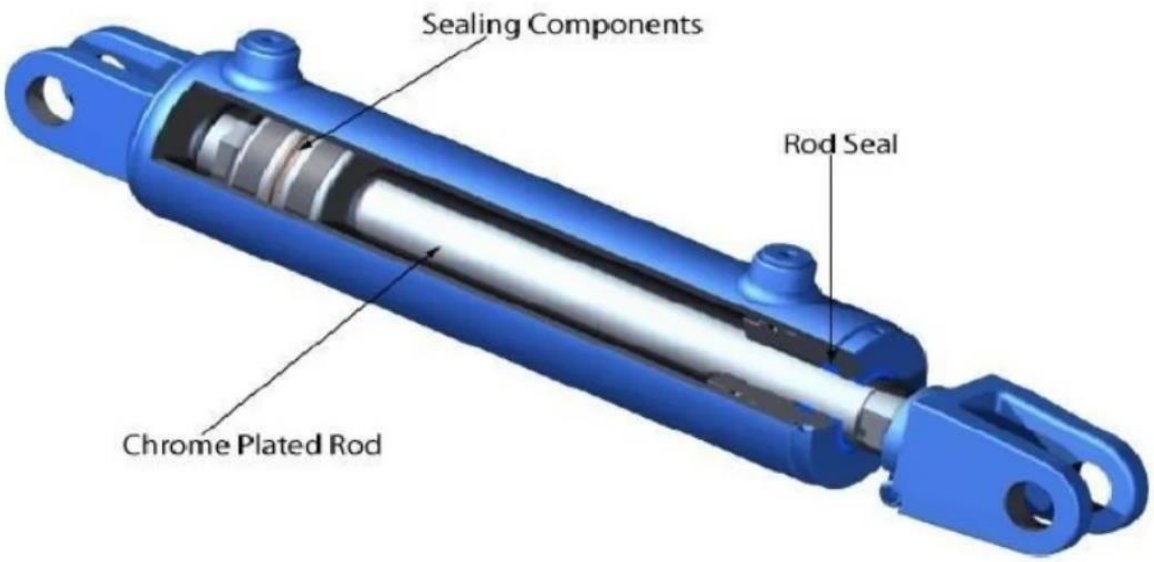

Fig 1

By here in this project we used the syringe for substitute of the cylinder because of the cost of the project and it's a model and in future it's elaborate and use for industrial purpose or reality then in this model the hydraulic cylinder are used. Syringe as shownin fig 2.

Fig 2

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5.2.2FLUIDLINESANDFITTINGS

The control and application of fluid power would be impossible without suitable means of transferring the fluid between the reservoir, the power source, and the points of application. Fluidlines are used to transfer the fluid, and fittings are used to connect the lines to the power source and the points of application

TYPES OF LINES

Three types of lines is used in this system are pipe (rigid), tubing (semi rigid) and hose(flexible)

PIPES AND TUBING.

There are three important dimensions of any tubular product - outside diameter (OD), inside diameter (ID), and wall thickness. Sizes of pipe are listed by the nominal (or approximate) ID andthe wall thickness. Sizes of tubing are listed by the actual OD and the wall thickness.

SELECTION OF PIPES AND TUBING

The material, ID, and wall thickness are the three primary considerations in the selection of lines for a particular fluid power system. Since it determines how much fluid can pass through the line in a given time period (rate of flow) without loss of power due to excessive friction and heat. The velocity of a given flow is less through a large opening than through a small opening. If the ID of the line is too small for the amount of flow, excessive turbulence and friction heat cause unnecessary power lossand overheated fluid. • In our project we have used two sections of clear 1/8 I.D. Vinyl tubing of different lengths. Vinyl tubing as shown in fig 3.

Fig 3

Arms

Arms is the vital part of this vehicle one is base arm in which the whole structure of the arms are steady and second is the vertical arm in which the gripper and all small arms are fixed. • It is the base arm in which the whole structure are attached or fixed and by this arm the whole structure are stable. Base arm as shown in fig 4.

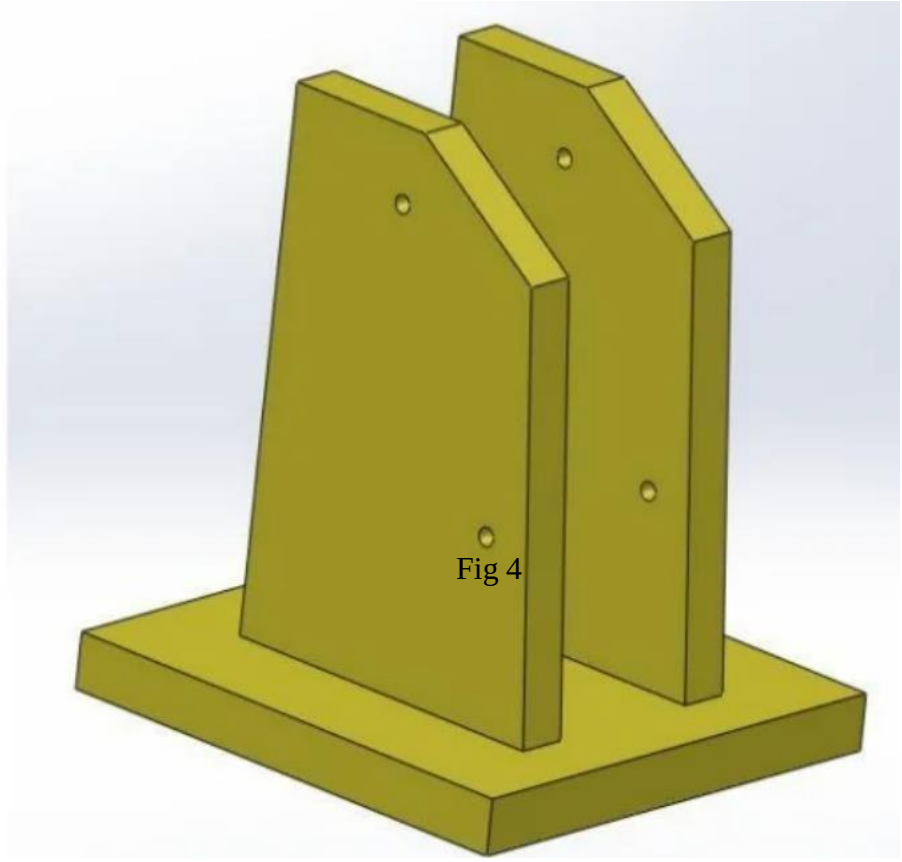


Fig 4

• it is the vertical arm or the gripper joining arm in this arm the gripper are joint by the screw andin for this arm the gripper is steady and the load carrying capacity is defined by this arm. Verticalarm as shown in fig 5.

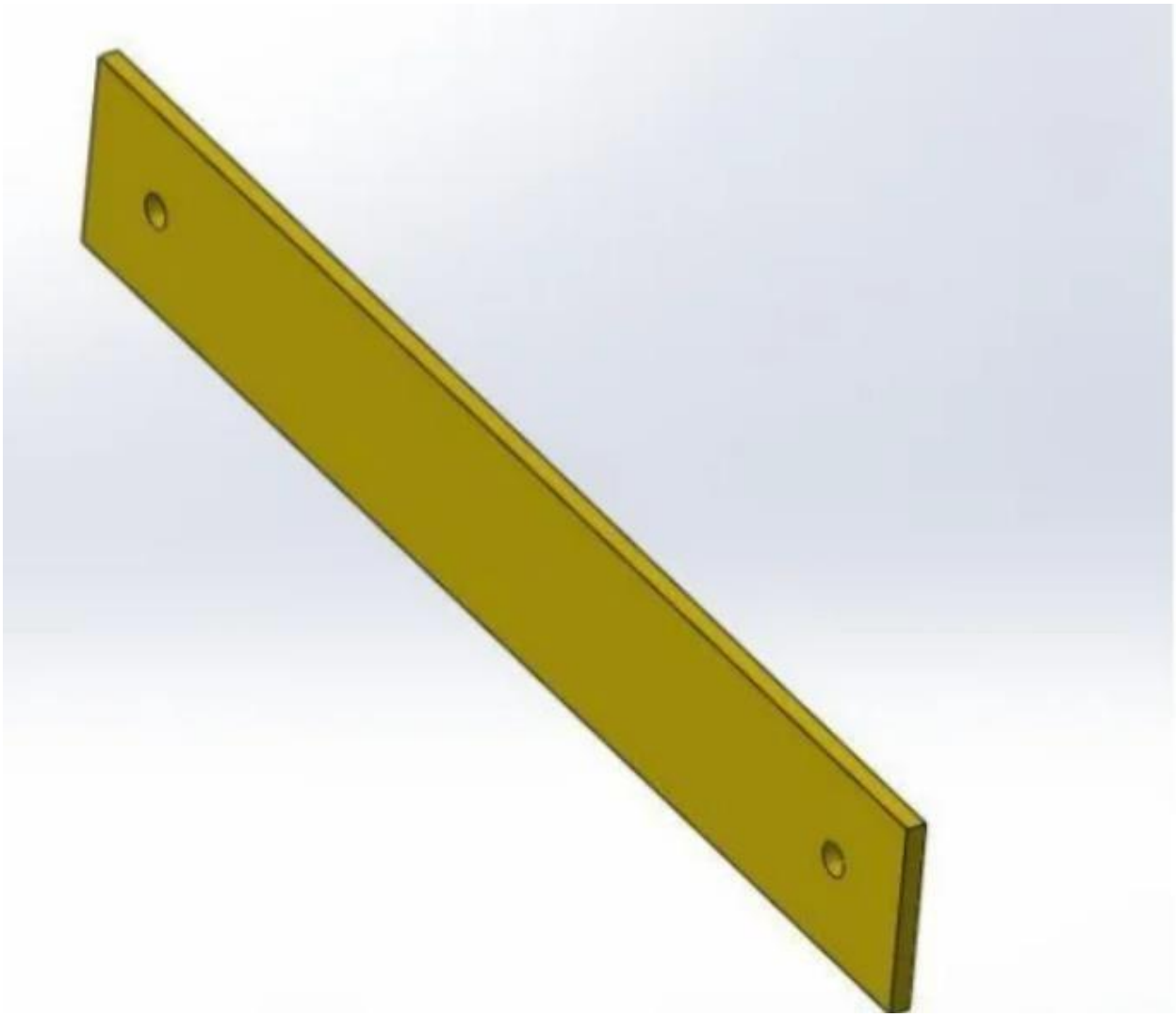


fig 5

Grippers

Grippers are used to grasp and hold objects. The objects are generally work parts that are to be moved by the hydraulic arm. These part handling applications include machine loading and unloading, picking parts from a conveyor, and arranging parts into a pallet . Depending on the mechanism used for the purpose of gripping they can be classified as:

1. Mechanical Grippers.
2. Adhesive Grippers.
3. Hooks, Scoops etc.
4. Vacuum Cups.
5. Magnetic Grippers.

Here in this model we used mechanical grippers & hook gripper.

- A mechanical gripper is used as end effector in a robot for grasping the objects with its mechanically operated fingers. In industries, two fingers are enough for holding purposes. As most of the fingers are of replaceable type, it can be easily removed and replaced. Mechanical gripper as shown in fig 6.
- A hook gripper is incorporated in an operation for picking up the containers of parts. Moreover, this type of grippers can be used in the part loading andunloading process in which the work parts hang from the ov erhead conveyors hook gripper as shown in fig 7.

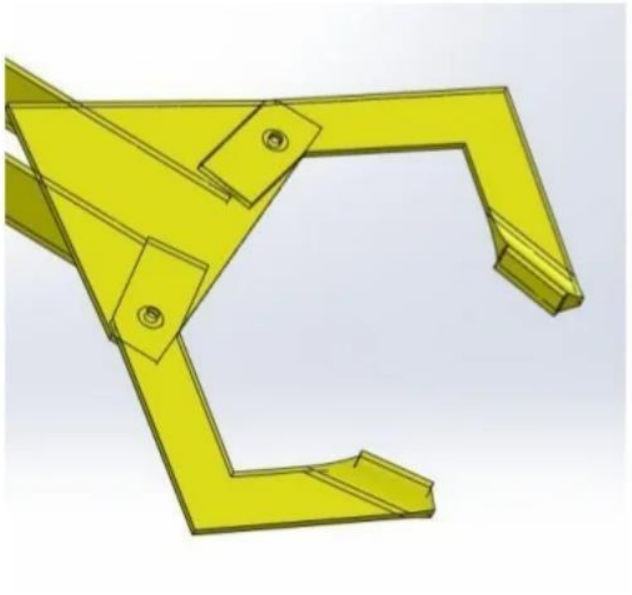


Fig. 6

Fig. 7

Chasis

This is the base or a chassis for which the two arms and whole body are fixed in this base. The base is made of steel and the lower hole the motor are fixed and in the motor shaft the wheels arefixed for this reason the vehicle or the hydraulic arm are move in anywhere and the motor are operated by manually so in anywhere the we used this.

Powder coated Metal chassis for robots. Easy to mount the motors on place by using normal motor mount nut. It can be used in skid steel configuration or differential configuration (2rear wheels + 1 front castor wheel). The body contains perforated holes for easy mounting of varioussize circuit boards and other mechanical components. Chassis as shown in fig 8.

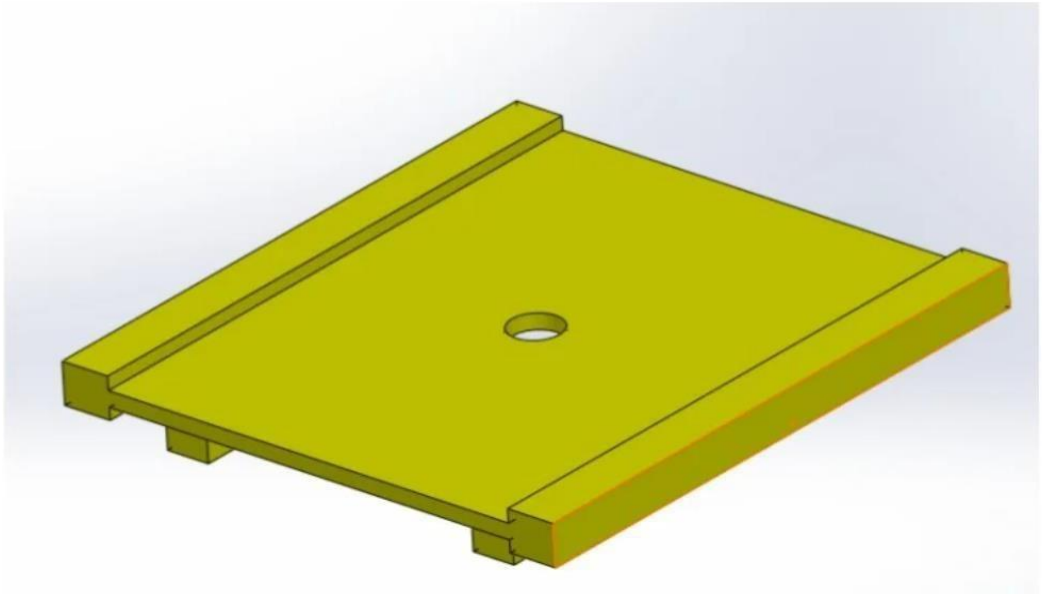


Fig 8

Lever

A lever is a machine consisting of a beam or rigid rod pivoted at a fixed hinge, or fulcrum. A lever is a rigid body capable of rotating on a point on itself. On the basis of the location of fulcrum, load and effort, the lever is divided into three types. It is one of the six simple machinesidentified by Renaissance scientists. A lever amplifies an input force to provide a greater output force, which is said to provide leverage. The ratio of the output force to the input force is the mechanical advantage of the lever.

A lever works by reducing the amount of force needed to move an object or lift a load. A lever does this by increasing the distance through which the force acts. You will see that levers neitherincrease nor decrease the amount of total effort necessary.

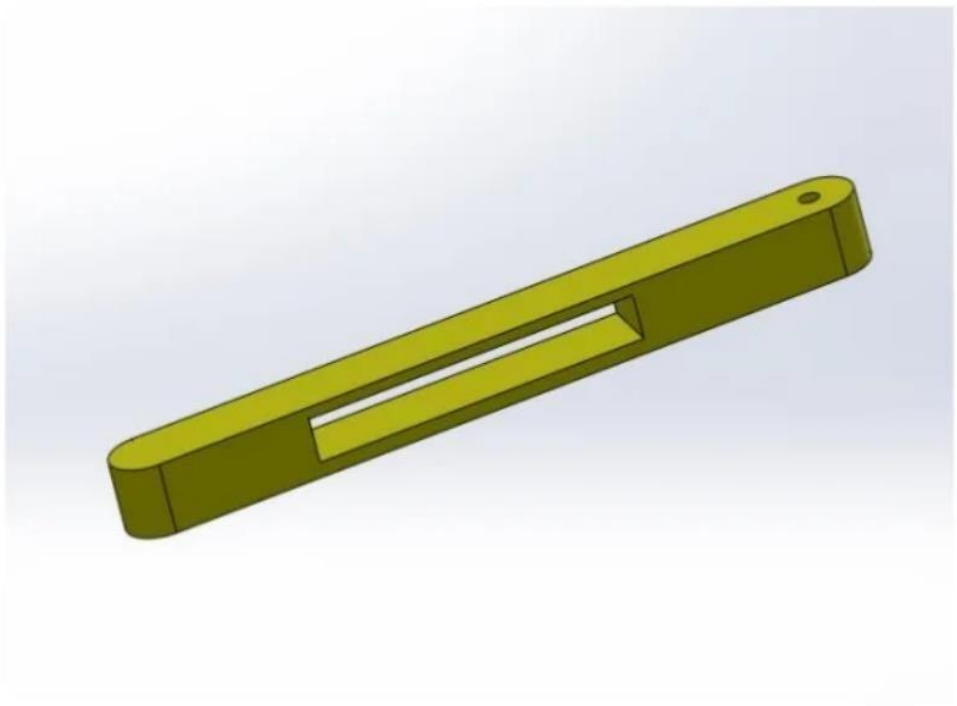
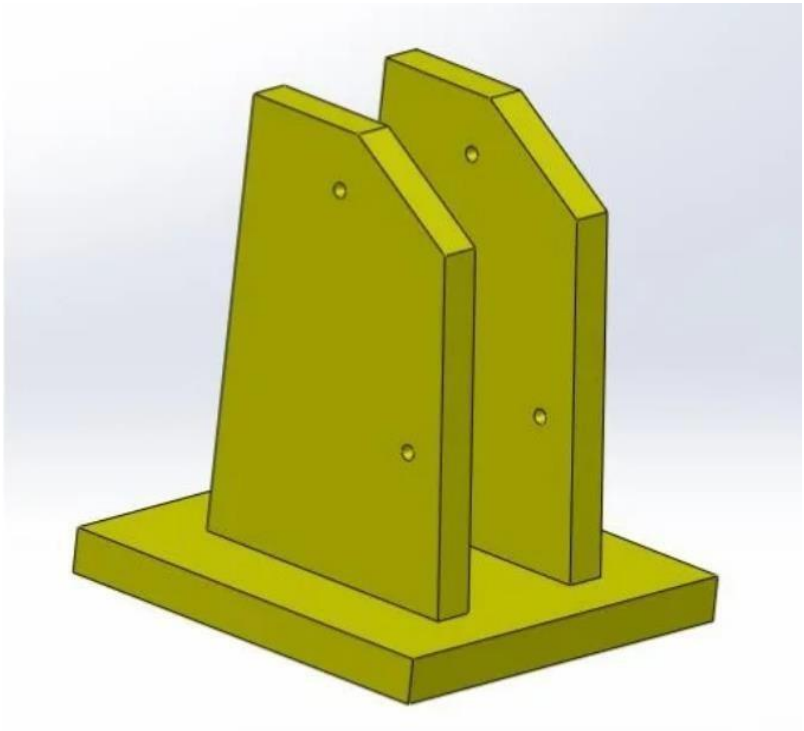


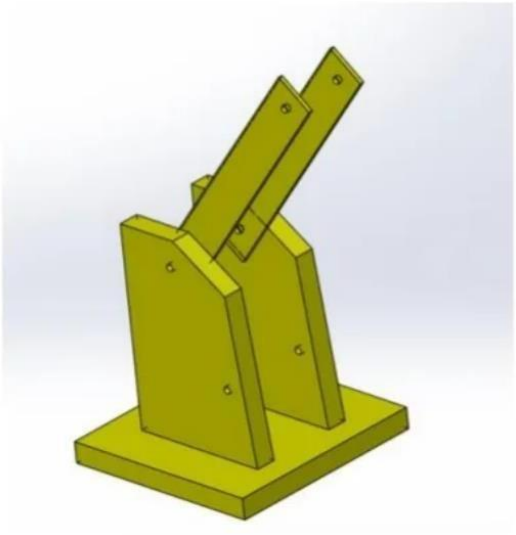
Fig. 9

- Firstly we take the some hard cardboard links and cut it for the arms. - Then take a cardboard base and the first arm fixed on the base for screw.
- After that make holes on the arm for fixed the arms. Then the arms are fixed by hard wooden sticks and also used washer for free movement of arms.
- There after take hard cardboard sheet for the small arms of the vehicle and cut the arms bymeasurement of and hole of this arm for both poles to fixed of the arms in the base structure. The holes are measured by the screw measurement.
- After that take two syringes and joint the syringes by a pipe and the pipe is fixed by theglue in the syringe nozzle. And leave it for one hour to permanently fix the glue.
- After that in this joint syringes feel up by the water to follow the Pascal's law. And it's essential that the water in the syringe without any vacuum or without any bubbles. - Lastthe water fell up syringes are fixed in the arms pressure of the water or hydraulic.
- At last to check the all joints and check the all movements of the robotic hydraulic arm and ready the robotic hydraulic arm is ready to use. In this way the robotic hydraulic arm is made.

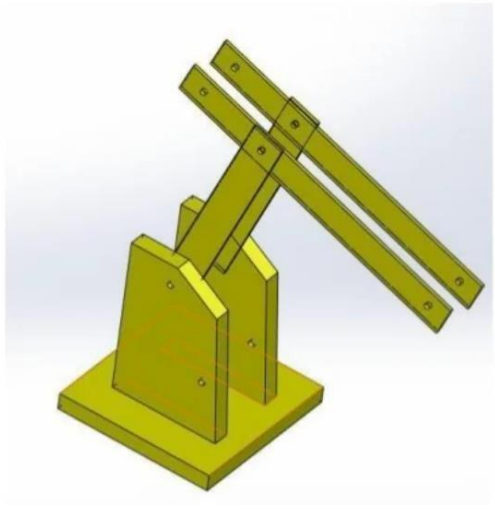
STEP 1



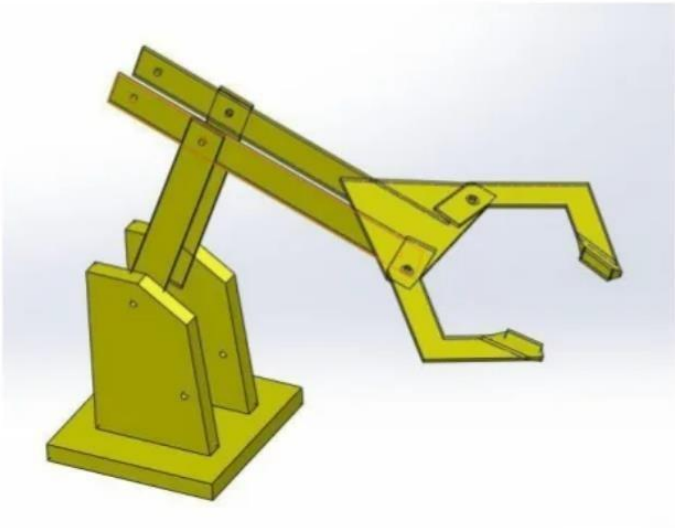
STEP 2



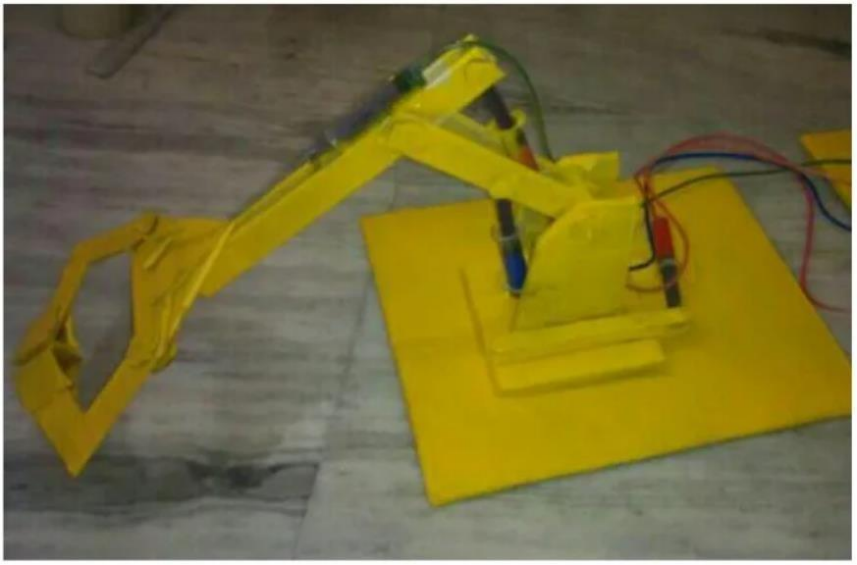
STEP 3



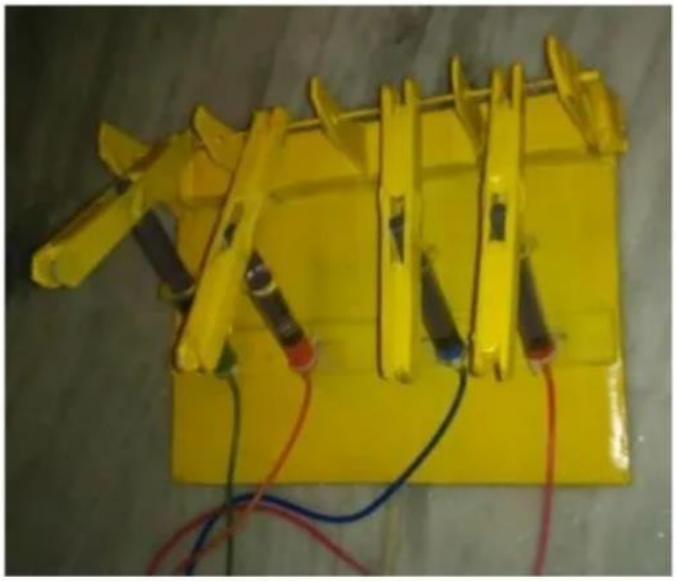
STEP 4



STEP 5



STEP 6



CHAPTER :-6
SAFETY PRECAUTIONS

• When pressing on the syringe system, be sure to press only the input plunger with your thumband hold the output syringe with your other hand to prevent the syringe from separation

• Do not use syringe as a "squirt gun".

• Wear safety glasses. • Follow all normal laboratory rules.

• Check each component before you set up your hydraulic system. Do not use damaged or worn components. Turn them in for repair or replacement.

• Lift slowly and check the load often

• Avoid standing in the line of force .Anticipate possible problems and take steps to avoid them.

CONCLUSION

Our design uses extremely simple ideas and mechanisms to achieve a complex set of actions and is intended to imitate the action of the operators. However, these hydraulic arms are expensive forsmall scale industries. If the major problem of high initial cost is addressed, a robotic hydraulic arm can be introducing in any industry to bring in automation. The mechanical links and parts that have been fabricated are extremely simple.

The prepared mechanism has been successfully constrained and executed to carry out the required work of picking up the weight of the object like table tennis ball and to put the min tothe placed at different location.

The Hydraulic Arm Will-

• Reach the greatest distance to deliver a given object.

• Pick up the heaviest possible object.

• Deliver the most objects in a given amount of time.

• Function in an assembly line. Have a system to weight the object it picks

up. Battle againstanother arm of an object. • Rotate as well as reach and grab.

• Dig and recover objects. So, we are confident that the people will understand and join us on the

quest to make our planet a pollution free place to live in.

FUTURE SCOPE

If more time and more efforts would have been put into the model, more complexities could havebeen brought out. Moreover instead of manual operation of syringes could have been replaced bypre-defined computer programs or merely by pressing the switch operated. Further, more varieties and more flexibility to add or replace any part according requirements can be done to improve its use and increase of usage and to make it more universal or flexible. As we know that the natural source of fuel is decreasing day by day, we need to remove our dependency on these sources with an alternative resource. We have to use some of alternative Energies like Solar Energy, in our vehicle.

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