



# FABRICATION OF PICK AND PLACE ROBOT

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**Abstract:** Robotics playing a vital role in the modern technology a robot can be defined as a mechanical device programmed to perform a manipulative task under automatic control. Due to technological advancement robot has become an integral part of automation in a manufacturing process. Because of rapid advancement in technology, automation is must in all areas of manufacturing and in human comfort. The project mainly concentrated on the fabrication of pick and place robot. It consist of circular base, vertical arm, horizontal arm, these items are actuated by separate pneumatic cylinders. This movement of pneumatic cylinders is controlled by control unit. The pick and place robot is mainly used for picking and placing the components or objects in an automated industrial line where quick handling of materials is mandatory.

**Keywords:** Pneumatic cylinder; solenoid valve; motor; battery; timer circuit; frame word;

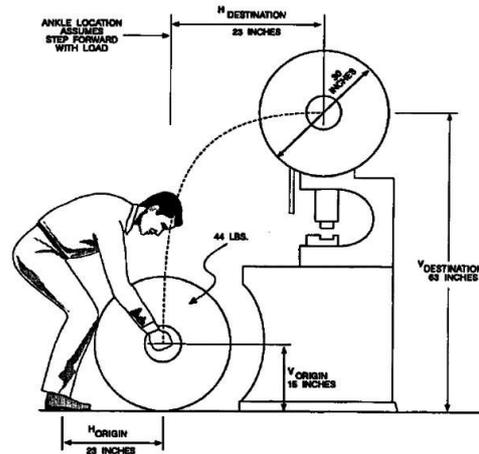
**Introduction:** An industrial robot is a general purpose, programmable machine possessing certain anthropomorphic characteristics. The most typical anthropomorphic or human like, characteristics of a robot is its arm. This arm, together with the robots capacity to be programmed, make it ideally suited to a variety of production tasks, including machine loading, spot welding, spray painting and assembly. The robot can be programmed to perform sequence of mechanical motions, and it can repeat that motion sequence over the over until programmed to perform some other job. In manufacturing industries, the pick and place robot was invented to be used to solving and accomplishing most of task that cannot done by human being and also to be faster and pinch the production time.

**Need for automation:** Robotization can be accomplished through PCs, water power, pneumatics, apply autonomy, and so on. Of these sources, pneumatics frames an alluring medium for minimal effort mechanization. The principle points of interest of every single pneumatic system are economy and effortlessness. Mechanization assumes a critical part in large scale manufacturing. For large scale manufacturing of the item, the machining operations choose the succession of machining. The machines intended for creating a specific item are called exchange machines. The parts must be moved naturally from the receptacles to various machines consecutively and the last segment can be put independently to package. Materials can likewise be over and again exchanged from the moving transports to the work place and the other way around. These days all the assembling procedure is being atomized with a specific end goal to convey the items at a quicker rate.

- To increase the efficiency of the plant to reduce the work load
- To reduce the production cost to reduce the production time
- To reduce the material handling to reduce the fatigue of workers
- To achieve good product quality, etc

**Material handling:** Material handling involves short-distance movement within the confines of a building or between a building and a transportation vehicle. It utilizes a wide range of manual; semi- automated, and automated equipment and includes consideration of the protection, storage, and control of materials throughout their manufacturing, warehousing, distribution, consumption, and disposal. Material handling can be used to create time and place utility through the handling, storage, and control of material, as distinct from manufacturing, which creates form utility by changing the shape, form, and make up of material.

**Manual handling:** Manual handling refers to the use of a worker's hands to move individual containers by lifting, lowering, and filling, emptying, or carrying them. It can expose workers to physical conditions that can lead to injuries that represent a large percentage of the over half a million cases of musculoskeletal disorders reported in the U.S. each year, and often involve strains and sprains to the lower back, shoulders, and upper limbs.



Manual Material Handling

**Automated handling:** Whenever technically and economically feasible, equipment can be used to reduce and sometimes replace the need to manually handle material. Most existing material handling equipment is only semi- automated because a human operator is needed for tasks like loading/unloading and driving that are difficult and/or too costly to fully automate, although ongoing advances in sensing, machine intelligence, and robotics have made it possible to fully automate an increasing number of handling tasks.



Robotic Material Handling

**Robotization:** Robotics is the branch of mechanical engineering, electrical engineering, electronic engineering and computer science that deals with the design, construction, operation, and application of robots, as well as computer systems for their control, sensory feedback, and information processing. These technologies deal with automated machines that can take the place of humans in dangerous environments or manufacturing processes, or resemble humans in appearance, behavior, and/or cognition. Many of today's robots are inspired by nature contributing to the field of bio inspired robotics. The concept of creating machines that can operate autonomously dates back to classical times, but research into the functionality and potential uses of robots did not grow substantially until the 20th century.

Throughout history, it has been frequently assumed that robots will one day be able to mimic human behaviour and manage tasks in a humanlike fashion. Today, robotics is a rapidly growing field, as technological advances continue; researching, designing, and building new robots serve various practical purposes, whether domestically, commercially, or militarily. Many robots do jobs that are hazardous to people such as defusing bombs, mines and exploring shipwrecks. Robotic devices are used in all aspects of our world. Whether in automation for factories and businesses, personal prosthetics, or used for off world exploration in space and on other planets, we rely on robotics every day to reduce the costs of products and services and to make our lives easier. The ability to control, modify and update these robotic devices remotely is crucial.

**Necessity of robot:** Robot is an integral part in automating the flexible manufacturing system that one greatly in demand these days. Robots are now more than a machine, as robots have become the solution of the future as cost labour wages and customers' demand. Even though the cost of acquiring robotic system is quite expensive but as today's rapid development and a very high demand in quality with ISO (International Standard Organization) standards, human are no longer capable of such demands. Research and development of feature robots is moving at a very rapid pace due to the constantly improving and upgrading of the quality standards of products.

**Construction of robots:** There are many types of robots; they are used in many different environments and for many different uses, although being very diverse in application and form they all share three basic similarities when it comes to their construction: Robots all have some kind of mechanical construction, a frame, form or shape designed to achieve a particular task. For example, a robot designed to travel across heavy dirt or mud, might use caterpillar tracks. The mechanical aspect is mostly the creator's solution to completing the assigned task and dealing with the physics of the environment around it. Form follows function.

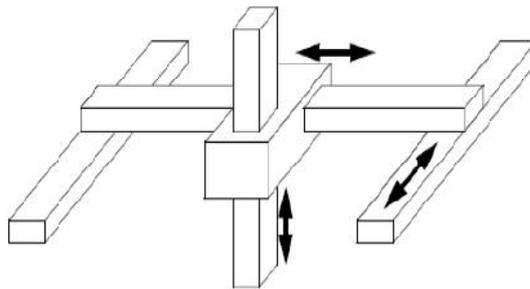
All robots contain some level of computer programming code. A program is how a robot decides when or how to do something. In the caterpillar track example, a robot that needs to move across a muddy road may have the correct mechanical construction, and receive the correct amount of power from its battery, but would not go anywhere without a program telling it to move.

#### Laws of robotics:

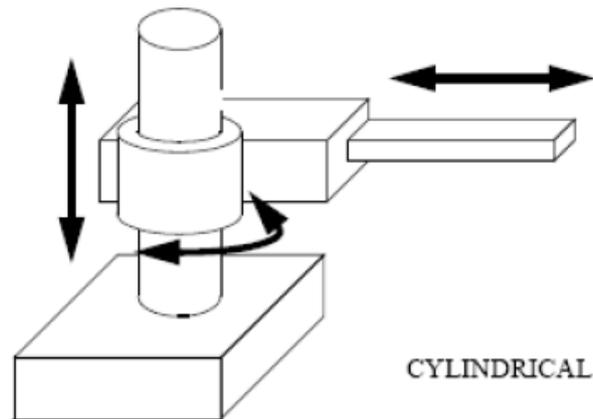
- Law Zero: A robot may not injure humanity, or, through inaction, allow humanity to come to harm.
- Law One: A robot may not injure a human being, or, through inaction, allow a human being to come to harm, unless this would violate a higher order law.
- Law Two: A robot must obey orders given it by human beings, except where such orders would conflict with a higher order law.
- Law Three: A robot must protect its own existence as long as such protection does not conflict with a higher order law.

#### Robot based configuration:

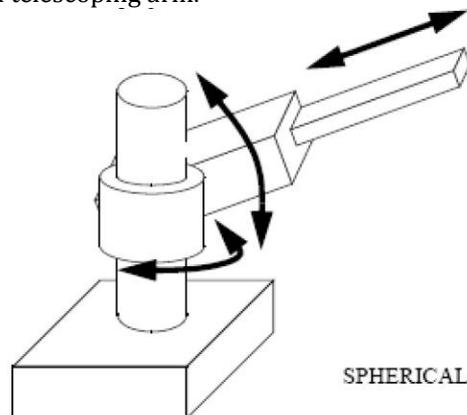
**Cartesian Configuration:** A robot which is constructed around this configuration consists of three orthogonal slides, as shown in fig. the three slides are parallel to the x, y, and z axes of the Cartesian coordinate system. By appropriate movements of these slides, the robot is capable of moving its arm at any point within its three dimensional rectangular spaced work space.



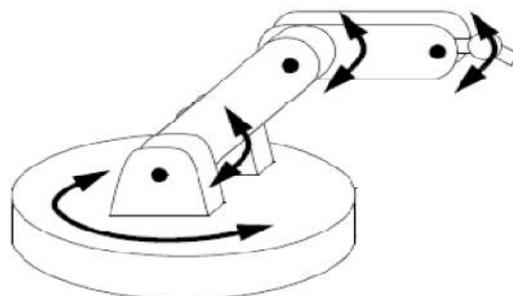
**Cylindrical configuration:** In this configuration, the robot body is a vertical column that swivels about a vertical axis. The arm consists of several orthogonal slides which allow the arm to be moved up or down and in and out with respect to the body.



**Polar Configuration:** This configuration also goes by the name “spherical coordinate” because the workspace within which it can move its arm is a partial sphere as shown in figure. The robot has a rotary base and a pivot that can be used to raise and lower a telescoping arm.



**Jointed-Arm Configuration:** It is a combination of cylindrical and articulated configurations. This is similar in appearance to the human arm, as shown in fig. The arm consists of several straight members connected by joints which are analogous to the human shoulder, elbow, and wrist. The robot arm is mounted to a base which can be rotated to provide the robot with the capacity to work within a quasi-spherical space.



#### Articulated/Revolute Configuration

**Problem statement:** Present day industry is increasingly turning towards computer-based automation mainly due to the need for increased productivity and delivery of end products with uniform quality. The inflexibility and generally high cost of hard-automation systems, which have been used for automated manufacturing tasks in the past, have led to a broad based interest in the use of robots capable of performing a variety of manufacturing functions in a flexible environment and at lower costs. The pick and place robot is a microcontroller based mechatronics system that detects the object, picks that object from source location and places at desired location.

**Proposed system:** Here we are planning to develop the pick and place robot for material handling purpose works with the help pneumatic system. This picks and place robot functions on the multiple axis.

**Objectives:**

- The aim of this work is to fabricate the pick and place robot for material handling.
- This robot should works on the pneumatic system.
- To increase the labor productivity by the redistribution of laborers in the industries.
- Reducing the cost factor and manufacturing time of a product.

**Material description**

**Pneumatic cylinders:** Pneumatic cylinder (known as air cylinders) is mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion.

Once actuated, compressed air enters into the tube at one end of the piston and imparts force on the piston. Consequently, the piston becomes displaced.

Although pneumatic cylinders will vary in appearance, size and function, they generally fall into one of the specific categories shown below. However, there are also numerous other types of pneumatic cylinder available, many of which are designed to fulfil specific and specialized functions.

Single acting cylinder

Double acting cylinder

**Single Acting Cylinder:** Single-Acting Cylinder The single-acting piston-type cylinder is similar in design and operation to the single-acting ram-type cylinder. The single-acting piston-type cylinder uses fluid pressure to provide the force in one direction, and spring tension, gravity, compressed air, or nitrogen is used to provide the force in the opposite direction. In this cylinder the spring is located on the rod side of the piston. In some spring-loaded cylinders the spring is located on the blank side, and the fluid port is on the rod side of the cylinder. A three-way directional control valve is normally used to control the operation of the single-acting piston-type cylinder. To extend the piston rod, fluid under pressure is directed through the port into the cylinder. This pressure acts on the surface area of the blank side of the piston and forces the piston to the right.



This action moves the rod to the right, through the end of the cylinder, thus moving the actuated unit in one direction. During this action, the spring is compressed between the rod side of the piston and the end of the cylinder.

**Double-Acting Cylinder:** Most piston-type actuating cylinders are double-acting, which means that fluid under pressure can be applied to either side of the piston to apply force and provide movement. This cylinder contains one piston and piston rod assembly. The stroke of the piston and piston rod assembly in either direction is produced by fluid pressure. The two fluid ports, one near each end of the cylinder, alternate as inlet and outlet ports, depending on the direction of flow from the directional control valve. working areas on the two sides of the piston. This actuator is referred to as an unbalanced actuating cylinder because there is a difference in the effective



**Solenoid valve:** It is an electro-mechanical device in which the solenoid uses an electric current to generate a magnetic field and thereby operate a mechanism which regulates the opening of fluid flow in a valve.

**Air compressor:** An air compressor is a device that converts power (using an electric motor, diesel, or gasoline engine, etc.) into potential energy stored in pressurized air (i.e., compressed air). By one of several methods, an air compressor forces more and more air into a storage tank, increasing the pressure. When tank pressure reaches its engineered upper limit the air compressor shuts off. The compressed air, then, is held in the tank until called into use. The energy contained in the compressed air can be used for a variety of applications, utilizing the kinetic energy of the air as it is released and the tank depressurizes. When tank pressure reaches its lower limit, the air compressor turns on again and re-pressurizes the tank.

**Electrical motor:** An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and winding currents to generate force in the form of rotation. Electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators.

**Battery:** An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smart phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work.

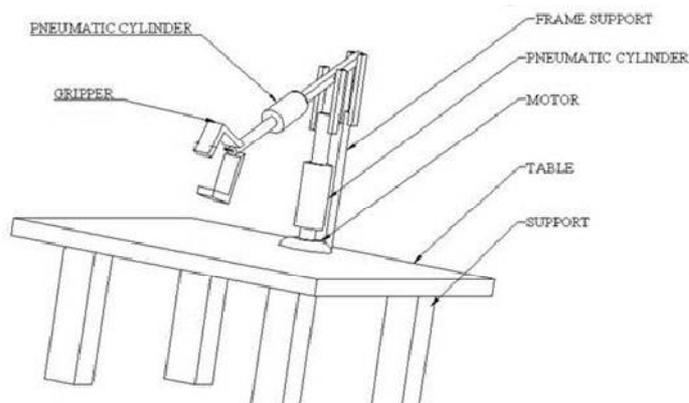
**Timer control circuit:** Timers were used in many applications in our day to day life. One can see the timers in washing machines, micro ovens etc. These devices uses timer to switch the loads for particular amount of time. Traditionally, various loads would have been manually controlled, i.e., the operator would turn ON the loads and after desired conditions met, the loads again would have been turned off by the operator.

**Applications of Adjustable Timer:** There are numerous real time operations which require time scale switching loads. Some of these are listed below.

- Cooler controllers
- Irrigation pump control
- Exhaust fan switching
- Industrial repetitive switching of loads
- Load shedding and control
- Automatic lubrication tools
- Traffic lights control
- Printing applications, etc.

**Frame structure:** Frame structures are the structures having the combination of beam, column, and slab to resist the lateral and gravity loads. These structures are usually used to overcome the large moments developing due to the applied loading. Framing, in construction, is the fitting together of pieces to give a structure support and shape. Framing materials are usually wood, engineered wood, or structural steel.

**Working principle:** The pick and place robot model consists of pneumatic cylinder, solenoid valve, timer circuit, electrical motor, etc.





The pneumatic cylinders are used for forward – reverse movement and material holding purpose. The solenoid valve is used to control the direction of compressed air inlet to pneumatic cylinder. The motion or movement of the pick and place robot is controlled by using a timer control unit. The object to be picked is taken by the gripper with the help of the pneumatic cylinder actuated by the control unit. Then the object is moved to the required motion with the help of a motor rotating certain degrees based on the input from the control unit. After reaching the destination, the object is placed by the movement of pneumatic cylinder. This operation will repeat continuously according to the signals received from the control unit which can be programmed with the help of a computer.

#### **Advantages:**

- Robotics and automation can, in many situation, increase productivity, safety, efficiency, quality, and consistency of Products
- Robots can work in hazardous environments
- Robots need no environmental comfort
- Robots work continuously without any humanity needs and illnesses.
- Robots have repeatable precision at all times
- Robots can process multiple stimuli or tasks simultaneously, humans can only one.
- Robots replace human workers who can create economic problems.

#### **Application:**

- Material handling
- Material transfer
- Machine loading / Unloading

**Conclusion:** This project is made with pre planning, that it provides flexibility in operation. This innovation has made the more desirable and Economical. This project "Design and Fabrication of Pick and Place Robot" is designed with the hope that it is very much economical and help full to many industries for material handling. This project helped us to know the periodic steps in completing a project work. Thus we have completed the project successfully.

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