© 2018 IJSRSET | Volume 4 | Issue 4 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Design & Analysis of Pick and Place Robot

Yogesh G.Ugale, Gopal R. Ugale, Akash B. Dhote, Sagar S.Dawange, Nikhil G.Vase , Shrutika R.Ghodke, Prof.Pramod S.Wankhede

Mechanical Engineering, Siddhivinayak Technical Campus School of Engineering & ResearchTechnology, Khamgaon, Maharashtra, India

ABSTRACT

Now a days industries are moving from current state of automation to Robotization, to increase productivity ,reduce human efforts and to deliver uniform quality products. The industrial robots of today may not look the least bit like a human being although all the research is directed to provide more and more anthropomorphic and humanlike features and super-human capabilities in these.One type of robot commonly used in industry is a pick & place robot or simply a robotic arm. It is an open or closed kinematic chain of rigid links interconnected by movable joints. In some correspond to with joint at shoulder and elbow. At end of arm a wrist joint connects an end effector which may be a tool and its fixture or a gripper or any other device to work.

Keywords : Robotization, Anthropomorphic, Super-Human, Manipulator

I. INTRODUCTION

Robotics is the branch of Engineering Science & design, manufacturing & calculating various stresses on robot links & joints. Robotics is related to electronics, mechanics, and software. Robotics research today is focused on developing systems that exhibit modularity, flexibility ,redundancy, fault-tolerance, a general and extensible software environment and seamless connectivity to other machines, some researchers focus on completely automating a manufacturing process or a task, by providing sensor based intelligence to the robot arm ,while others try to solidify the analytical foundations on which many of the basic concepts in robotics are built.

In this highly developing society time and man power are critical constrains for completion of task in large scales. The automation is playing important role to save human efforts in most of the regular and frequently carried works. One of the major and most commonly performed works is picking and placing of jobs from source to destination.

The pick and place robot is a microcontroller based mechatronic system that detects the object, picks that object from source location and places at desired location. For detection of object, infrared sensors areused which detect presence of object as the transmitter to receiver path for infrared sensor is interrupted by placed object.

1.1 DEGREE OF FREEDOM (DOF)

The degrees of freedom, or DOF, are a very important term to understand. Each degree of freedom is a joint on the arm, a place where it can bend or rotate or translate. You can typically identify the number of degrees of freedom by the number of actuators on the robot arm. Now this is very important - when building a robot arm you want as few degrees of freedom allowed for your application.DOF nothing but the number of independent relative motion that the robot can perform.

Our robot arm can also be on a mobile base, adding additional DOF. If the wheeled robot can rotate, that is a rotation joint, if it can move forward, then that is a translational joint. The robot is driven by a dedicated control system bulid on modular principle. It consists of 6 joint controllers coordinated by a host processor. The robot controller is equipped with serial interface to communicate with external devices.

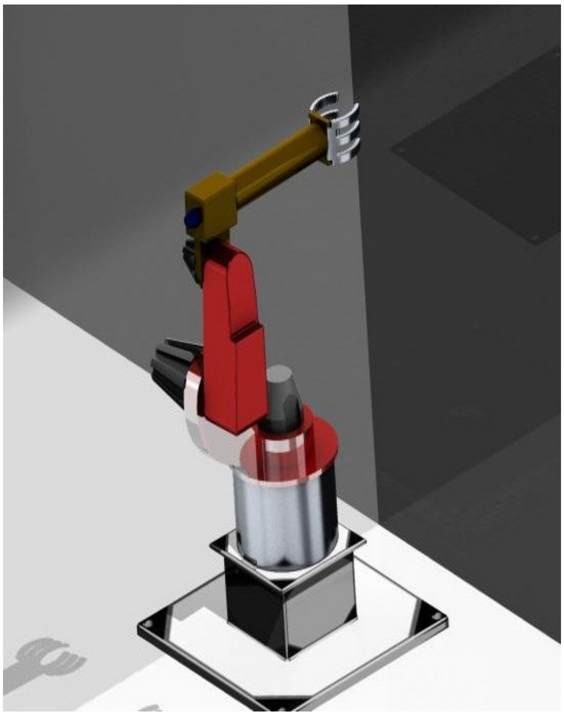

Figure 1. Pick and Place robot

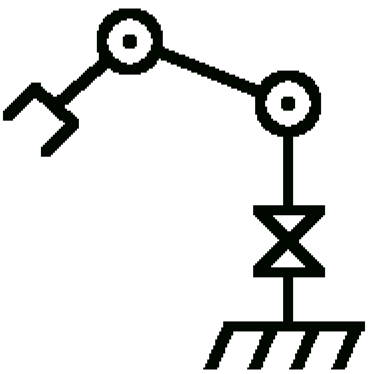

Figure 2. Robotic Joints

1.2 ROBOT WORKSPACE:-

The robot workspace (sometimes known as reachable space) is all places that the end effector (gripper) can reach. The work space is dependent on the DOF angle/translation limitations, the arm link lengths, the angle at which something must be picked up at, etc. The work space is highly dependent on the robot configuration.

Notice between each DOF there is a linkage of some particular length. Sometimes a joint can have multiple DOF in the same location. An example would be the human shoulder. The shoulder actually has three coincident DOF. If you were to mathematically represent this, you would just say link length

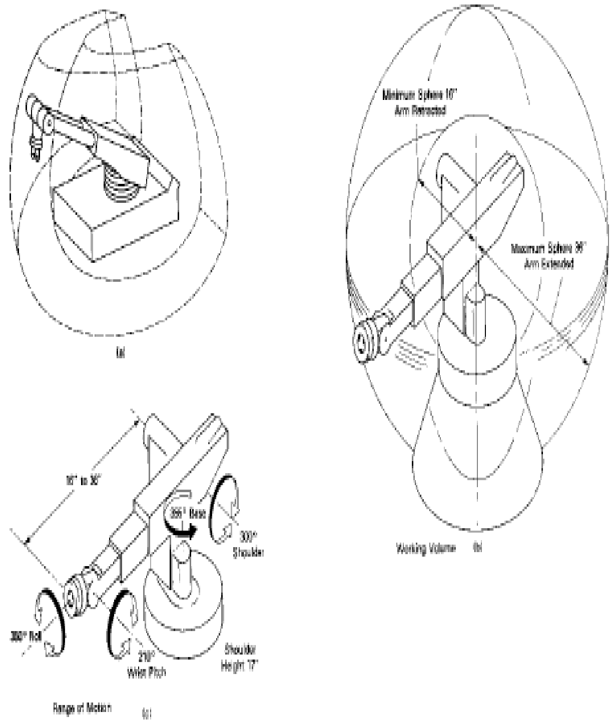

Figure 3. Industrial robot with a spherical workspace

1.3 ROBOT CONFIGURATION:-

Robotics is a special engineering science which deals with designing, modeling, controlling and robots' utilization. Nowadays robots accompany people in everyday life and take over their daily routine procedures. The range of robots' utilization is very wide, from toys through office and industrial robots finally to very sophisticated ones needed for space exploration. A large family of manufacturing equipment among the variety, which exists, is the one which supplies the motion required by a manufacturing process, such as: arc-welding, spray painting, assembly, cutting, polishing, milling, drilling, de-burring etc. Of this class of equipment, an increasingly popular type is the industrial robot. Different manipulator configurations are available as Rectangular Cylindrical, Spherical, SCARA, Revolute and Horizontal Jointed. The robot Arm determines the position of the wrist in 3D space. The mechanics of the robot Arm with 3 DOF depends on type of three joints & their arrangements According to Joint movements & arrangements of links, structural possible configurations are possible. They are,

1. Cartesian Configuration (Rectangular)
2. Cylindrical Configuration
3. Polar Configuration (Spherical)
4. Articulated / Jointed Configuration
5. SCARA

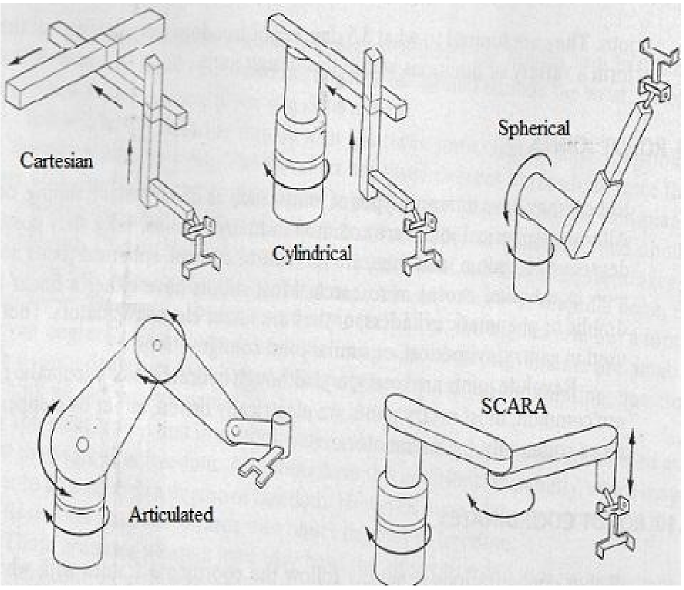

Figure 4. Robot Configuration

1.4 REQUIREMENT OF ROBOTICS

Isaac Asimov conceived the robots as humanoids, devoid of feelings, and used them in a number of stories. His robots were well-designed, fail-safe machines, whose brains were programmed by human beings. Anticipating the dangers and havoc such a device could cause, he postulated rules for their ethical conduct.

Robots were required to perform according to three principles known as ―Three laws of Robotics‖' which are as valid for real robots as they were for Asimov's robots and they are:

1. A robot should not injure a human being or, through inaction, allow a human to be harmed.
2. A robot must obey orders given by humans except when that conflicts with the First Law.
3. A robot must protect its own existence unless that conflicts with the First or Second law.

These are very general laws and apply even to other machines and appliances. They are always taken care of in any robot design.

II. LITERATURE REVIEW

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.[1] Throughout history, robotics has been often seen to mimic human behavior, and often manage tasks in a similar fashion. [3]Today, robotics is a rapidly growing field, as technological advances continue; research, design, and building new robots serve various practical or to people and mines. Their findings and suggestions are reviewed here.

The Robot Revolution states that there is three levels of the technologisation of work, Basic Machines (Simple and Engine),Complex Machines (Electrical, Electronic and Computing), and Sophisticated Machines (Anthropomorphic Robots).[2]In each case technologisation has brought benefits as well as disaster. [4]However, we are reaching a point where further technologisation can only exacerbate the global problems of mass unemployment, climate chaos and depletion of the world's resources and exceed the planet's capacity for recovery.

III. OBJECTIVES

The main objective of this paper is to design
of pick and place robot are as follows;-

- ✓ To reduce human efforts while loading and unloading heavy products in an industry.
- ✓ This robot can be used in any hazardous situations that affect human while working in an industries.
- ✓ Using of Human labour for the loading and unloading of the Batteries and also for packing purpose will consume more time.
- ✓ Even though Number of laborers is required more, the loading and unloading time should include allowances if laborers are considered.
- ✓ Moreover the work can be done easily using a single pick and place robot, which is used for both loading and unloading and pallezting purpose.

IV. ADVANTAGES AND APPLICATIONS

4.1 ADVANTAGES

Accuracy and Pick and Place Robots: Robots are outfitted with wide reaches and slim arms, steady repeatability and precise tooling – all of which allows them to be extremely accurate. This high precision capability makes them a good match for pick and place applications.

Flexible Pick and Place: One of the main advantages of robotics is flexibility. Pick and place robots are easily programmable. They are able to accommodate multiple changes in product shape and type. In addition, robots provide a high level of movement flexibility.

Increase Consistency with Pick and Place: Pick and place robot systems have the ability to improve product quality and cycle time. Robotic movements are regulated, so the results are always the same. Quality is improved because of this regularity. Furthermore, this consistency allows the processes to take place.

Robots are Space-Efficient: Because they are designed with compact bases, pick and place robots are ideal if you are looking to conserve floor space. Robots can be programmed to move within strict work envelope limits – leading to even better use of space.

Robots Maximize Safety: Pick and place applications can be physically demanding. They are labor - intensive, repetitive, and monotonous. Depending on the weight and size of a part, moving it from one place to another can be very demanding work. Pick and place robots are unaffected by the stresses of the application. They are able to work without taking breaks or making mistakes.

Save with Pick and Place Robots: Incorporating pick and place robots can effectively cut your costs. Robotic precision and reliability allow for less wasted material and more efficient use of time. Plus, the initial investment in robots is quickly recouped – making pick and place robots an extremely cost-effective solution.

Cost-Effectiveness: The afore-mentioned features combine to lend a high degree of cost-effectiveness to such systems. Cost effectiveness also accrues from the fact that pick and place systems empower businesses to take up orders in bulk and thus aid business expansion and also reap the benefits of large-scale production.

V. APPLICATIONS

1 .Welding: This pieces together by applying molten weld metal.

2. Cutting: This is the process of applying thermal or mechanical energy to cut a work piece into a specific shape.

3. Assembly: This is the process of either adding components to form a single entity, or a fixing components to a base unit (e.g. to place components on a printed circuit board).

4. Material handling: This is the process of either packaging parts into a compartment (box) or loading, unloading parts from another station.

VI. CONCLUSION

After a period of hardworking we have —PICK AND PLACE ROBOT as a real working system in our hand. It will be really a good friend of users. It is very easy to use and user interactive. As we know robotic arm is implemented in the material handling operation. Still it has much functionality to be implemented and remaining functionalities

During this period we have been exposed to user-industrial application skills dealing with professional persons in Industry.

The final objective is to develop a Robotic Arm which will be able to lift a sensitive object safely. The arm will employ a closed loop control system using the force sensor as the input sensor and the computer or microcontroller as the controller and the controller will control the stepper motor. We used C to write the program which will control the drive circuit. The data acquisition for the force sensor was done by a data acquisition card (DAQ). The arm once completed will greatly assist in the automation of the land mine clearing process. Hopefully this will result in improving the speed with which displaced people can be relocated.

VII. REFERENCES

[1]. RK Mittal and IJ Nagarath "Robotics and Control" BITS Pilani, 2003

[2]. Ratheesh Rajan "Foundation Studies for an Alternate Approach to Motion Planning of Dynamic Systems" M.S.E., the University of Texas at Austin, 2001

[3]. Richard E. Pattis. Karel "The Robot: A Gentle Introduction to the Art of Programming". John Wiley & Sons, 1981.

[4]. R.H. Ahmade, J.W. Mamer, Theory and methodology "Routing heuristics for automated pick-and-place machines", Eur. J. Oper. Res. 117 (1999) 533-552.

[5]. M. Ayob, G. Kendall, "A triple objective function with a Chebychev dynamic pick-and-place point specification approach to optimise the surface mount placement machine", Eur. J. Oper. Res. 164 (2005) 609-626.

[6]. T. Gecks, D. Henrich, "Human-robot cooperation: safe pick-and-place operations", in: IEEE International Workshop on Robots and Human Interactive Communication, 2005, pp. 549-554.

[7]. W.E. Wilhelm, I. Arambula, N.N.D. Choudhry, "Optimizing picking operations on dual-head placement machines", IEEE Trans. Automat. Sci. Eng. 3 (1)(2006).

[8]. P.A.H. Goede, P.P.H. Verstegen, J.M.M. Van Gastel, "Design of a shuttle used in an innovative pick and place machine concept, in: Proceedings of the IEEE, International Symposium on Assembly and Manufacturing", Ann Arbor, MI, USA, 2007, pp. 135-140.

[9]. J.L. Ha, R.F. Fung, K.Y. Chen, S.C. Hsien, "Dynamic modeling identification of a slider-crank mechanism", J. Sound Vibr. 289 (2006) 1019-1044.

[10]. J.H. Holland, "Adaptation in Natural and Artificial Systems", The University of Michigan Press, Ann Arbor, MI, 1975