JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

DEVELOPMENT OF CARTESIAN ROBOT

[1]Hariharaprasad,[2]Nishanth M,[3]Ranjith S,[4]Sonudas,[5] Naveen Krishna
[1,2,3,4]UG Students, [5]Assistant Professor,
School of Mechanical Engineering, REVA UNIVERSITY, Bengaluru, India.

ABSTRACT

The rapid development of robot-based automation technology provides convenience in a variety of processes, both in the aspect of improving the quality and quantity of the production process. One example of an industrial robot application of this system is a robotic manipulator with a Cartesian configuration type, which apply the system of drilling machine which is used as a drill aimed at objects in the form of a wooden object in the furniture industry.

Nowadays Robots play a vital role in Industries. In modern industrial manufacturing process consists of precise and fastest proceedings. The requirement graph for these industrial robots have always been an upward one. Faster robots with multiple functions to increase production and reduce manufacturing cost are the necessity of the day. Factors such as: better precision, accuracy and repeatability; maximum load carrying capacity and workspace and versatile operating environments are being given utmost importance during the development of any industrial robot.

Key Words: Cartesian Robot, Open Loop Control, Belt drives.

I. INTRODUCTION

A robot is a reprogrammable multi-functional manipulator designed to move materials, parts, tools, or specialized devices through variable programmed motions, all this for a best performance in a variety of tasks. A useful robot is the one which can control its movements and the forces it applies to its environment. Typically, robot manipulators are studied in consideration of their displacements on joint space, in other words, robot's displacements inside of its workspace usually are considered as joint displacements, for this reason the robot is analysed in a joint space reference. These considerations generate an important and complex theory of control in which many physical characteristics appear, this kind of control is known as joint control.

The joint control theory expresses the relations of position, velocity and acceleration of the robot in its native language, in other words, describes its movements using the torque and angles necessary to complete the task; in majority of cases this language is difficult to understand by the end user who interprets space movements in cartesian space easily. The singularities the boundary workspace are those which occur when the manipulator is completely stretched out or folded back on itself such as the end-effector is near or at the boundary workspace**.**

II. PROBLEM FORMULATION

It's necessary to understand that singularity is a mathematical problem that undefined the system, that is, indicates the absence of velocity control which specifies that the end-effector never get the desired position at some specific point in the workspace, this doesn't mean the robot cannot reach the desired position structurally, whenever this position is defined inside the workspace. This problem was solved by S. Ari moto and M. Takei in 1981 when they proposed a new control scheme based on the Jacobian Transposed matrix eliminating the possibility of singularities and giving origin to the cartesian control.

A great contribution to factory automation have been made by Industrial robots and enable a reduction in the workforce, but very few robots have been adopted in high value-added applications such as material removal processes.

The processes of machining usually include cleaning and pre-machining, etc., machining for high tolerance surfaces, painting and assembly. flexible automation based on Robotics is considered as an ideal solution for its programmability, adaptivity, flexibility and relatively low cost, especially for the fact that industrial robot is already applied to tend foundry machines and transport parts in the process. Moreover the large sized articulated robot IRB6400's stiffness would be 0.5N/m compared to 30N/m for a standard CNC machine.

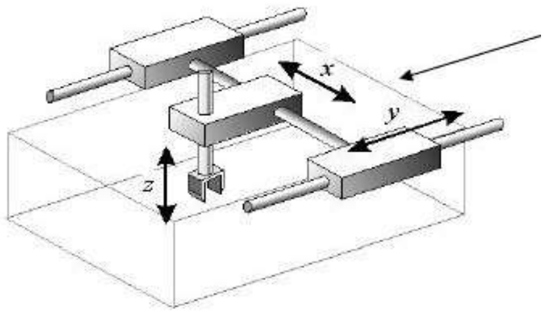
In order to achieve higher dimensional accuracy, the robot deformation due to the interactive force must be compensated. From many sources of errors of machine tools, the key contributors are thermal deformation and geometric errors are traditionally known. By studying a large amount of data by who reported that thermal errors could contribute as much as 70% of work piece errors in precision machining. As industrial robot has low stiffness, the force induced deformation of the robot structure is the single most dominant source of work piece surface error. Offline calibration strategies are often used to improve accuracy but it sacrifices operation cycle time. The surface error is measured and calculated to update the tool/work piece data of the next cut. Although offline calibration could improve robot path error as well as force induced error, the process cycle time is increased, mostly doubled. With force sensor attached on the robot wrist, force information is ready on real time. If an accurate stiffness model could be established, the force induced error could be compensated online by updating the robot targets.

The solution of the inverse kinematics problem, the most critical problems in robotics, must be obtained with high precision. For instance, closed-form solutions are not guaranteed for the algebraic methods, and closed-form solutions for the first three joints of the robot must exist geometrically when the geometric method is used. Similarly, the iterative inverse kinematics solution method converges to only one solution that depends on the starting point. Additionally, these traditional solution methods may have a prohibitive computational cost because of the high complexity of the geometric structure of the robotic manipulators. For these reasons, researchers have focused on solving the inverse kinematics problem using artificial neural networks. It is natural to apply the feedback scheme for the sensor based methods to continuously adjust the robot position until the position error is within the specified limit.

Although sensor based compensation methods offer higher position accuracy, they are very difficult to implement on an existing robot manipulator. Even it is possible to install the sensor, the final system cost would be expensive because of the sensor cost. This makes the sensor based methods more suitable for high accuracy discrete processes such as drilling, while the model based methods are better for continuous processes such as milling and roller hemming. The goal of this paper is to present a practical method to improve the machining accuracy through robot deformation compensation.

Enabling robots to pick and place items within cluttered and challenging environments has direct application to tries such as e-commerce, logistics and even agriculture. One of the main challenges associated with these difficult robotic manipulation tasks is the motion planning and control for multi-DoF (Degree of Freedom) manipulators. This can be difficult in scenarios where the environment is cluttered, dynamic and unstructured requiring large amounts of computational time to find a collision-free path in the configuration space of the manipulator. In this paper we argue that designing a manipulator which reduces the complexities of solving the motion planning problem can lead to robust and reliable solutions for real-world deployment. Robotics competitions are a great driver for developing robotic solutions that are reliable in real world scenarios. Design a robotic picking solution that can autonomously pick and place a variety of household items.

III. WORKING MODEL



Cartesian robots are used for pick and place work, application of sealant, assemblyoperations, handling machine tools and arc welding. It's a robot whose arm has threeprismatic joints; whose axes are coincidental with the Cartesian coordinators.

Cartesian robots are used for pick and place work, application of sealant, assembly operations, handling machine tools and arc welding. It's a robot whose arm has threeprismatic joints; whose axes are coinciden tal with the Cartesian coordinators

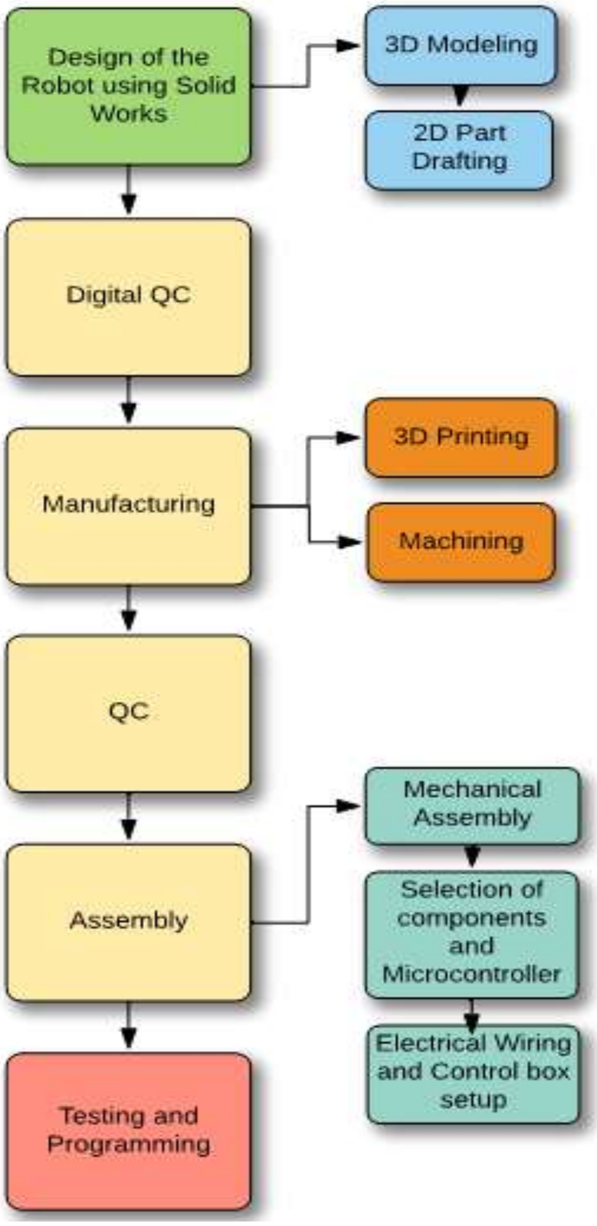


Fig:1- Flow Chart

IV. RESULTS & DISCUSSIONS

The aim of the project is to design low-cost, Python integrated open loop controlled Cartesian robot for the small and medium scale industries. Palletizing is one of the basic requirements of the production industry, Palletizing will be monotonous job for the humans. Hence robots are very essential for the repetitive jobs. Robot size will be X-300, Y-300, Z-200 all axis will be equipped with the Nema17 stepper motors. Belt drive will be used for the Transmission of x axis and Screw drive is used for Y & Z Axis. The reputability of the robot will be around 0.2mm.

REFERENCES

1. L. Sciavicco and B. Siciliano, Modelling and control of robot manipulators. Springer Science & Business Media, 2012.
2. D. Morrison, A. W. Tow, et al., "Cartman: The low-cost cartesian manipulator that won the amazon robotics challenge," Australian Centre for Robotic Vision, Tech. Rep., 2017.

3. Mohamed Naufal Bin omer , “ pick and place robotic arm controlled by computer.” International conference of WESAS , issue April 2007.
4. L. Sciavicco and B. Siciliano, Modelling and control of robot manipulators. Springer Science & Business Media, 2012.
5. Anusha Ronanki and M. Kranthi “Design and Fabrication of Pick and Place Robot to Be Used in Library” International Journal of Innovative Research in Science, Engineering and Technology Vol. 4, Issue 6, June 2015.
6. kensuke Harada “ An object placement planner for robotic pick-and-place tasks”, National institute of advanced industrial science and technology ASIT, volume4, issued may 2014.
7. R.V.Sharma , "work piece recognition and location of pick and place robot in SFMS" I.J. Image ,graphics and signal processing , 2014,4,9- 17.vol2, issue 3, 2011