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Modelling and 3D Printing of Industrial Robot Arm Wrist

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ABSTRACT: This project is about the concept of design and 3d printing of industrial robot arm wrist. The use of industrial robot arm wrist is increasing in various areas of industries. The aim of the project is to model and 3d printing of industrial robot arm wrist to eliminate the problem by the provision of wrist in which it suffices to operate only one drive unit in order to rotate only one operative member solely about the single preselected axis. The main principle of the wrist is to orient the endeffector. We used catia design software and the model is designed the designed model is converted to stl format data the converted data is sliced into slices by using ideamaker software and is transferred to 3d printing machine to print the model.

KEYWORDS: Industrial Robot Arm Wrist, End effector, 3D printing, catia software, ideamaker.

I. INTRODUCTION

Nowadays robots are increasing to perform various tasks in industries which are hazardous to humans not only hazardous but also to perform the tasks in less time with ease.

What is industrial robot arm wrist?

One particular type of industrial robot used in the prior art generally consists of a support unit, a base unit mounted on the support unit and rotatable about a vertical axis, a lower arm member mounted on the rotatable base unit and pivotal about a horizontal axis, an upper arm member mounted on the upper end of the lower arm member for pivotal movement about a horizontal axis, and a tool supporting unit universally connected to the upper arm member through a wrist construction.

Configurations of robot arm wrist

For industrial robot arm wrist there will be three configurations (Roll, pitch, Yaw)

Roll: It involves rotation of wrist mechanism about arm axis.

Pitch: It involves up and down movement of the wrist

Yaw: It involves left and right movement of wrist

Function of wrist

The end effector is attached at the end of wrist and it holds the tools such as gripper, vacuum, welding torch. It is used to move the endeffector in different directions according to work to be done of preselected axis. The wrist allows to control the movement of tool to move in selected direction and speed.



II. LITERATURE SURVEY

1. Design and perpetration of a veritably by precious and light weight wrist medium by V. perdereau, S. Ng, D. Wang. In this paper propose a colorful aspects while design of wrist. They deduced dynamic equations of wrist. System identification ways are employed to get a linearized fashion. Colorful control strategies are studied. It's shown that the input- affair feedback linearization fashion is not doable for these nonlinear dynamic equations. It's also shown that the application of conventional rigid body PID regulators on this proto- type is inadequate. A shadowing regulator which compensates for the flexible dynamics of the wrist is enforced with encouraging results. This regulator allows the end-effector to be placed at an arbitrary exposure with little vibration. The effect of the regulator is to make the wrist appear to have a much advanced structural stiffness. The biddable nature of this wrist allows simple force control strategies to be enforced. It's the admixture of the wrist with the control algorithm which makes this design feasible.[1]

2. Design of new elastic structure of Industrial robot wrist, Which exhibits a six degree of freedom for low-cost construction by Stefan Havlik.

In this paper propos enew elastic structure design of wrist. Functional characteristics of wrist are analysed and mathematically formulated. The new elastic structure is examined with a example of placing of a peg into a hole. Force and compliance analyses of the elastic structure are analysed and fundamental mathematical relations are derived. The designed structure use is to permit the assembly of close tolerance parts with industrial robots having relatively low positional accuracy. Some recommendation are given for application and for future work. It can also be applied to other manual or automatic matching operations.[2]

3. A novel arrangement of a wrist mechanism has been proposed for a robot by James P. Trevelyan .

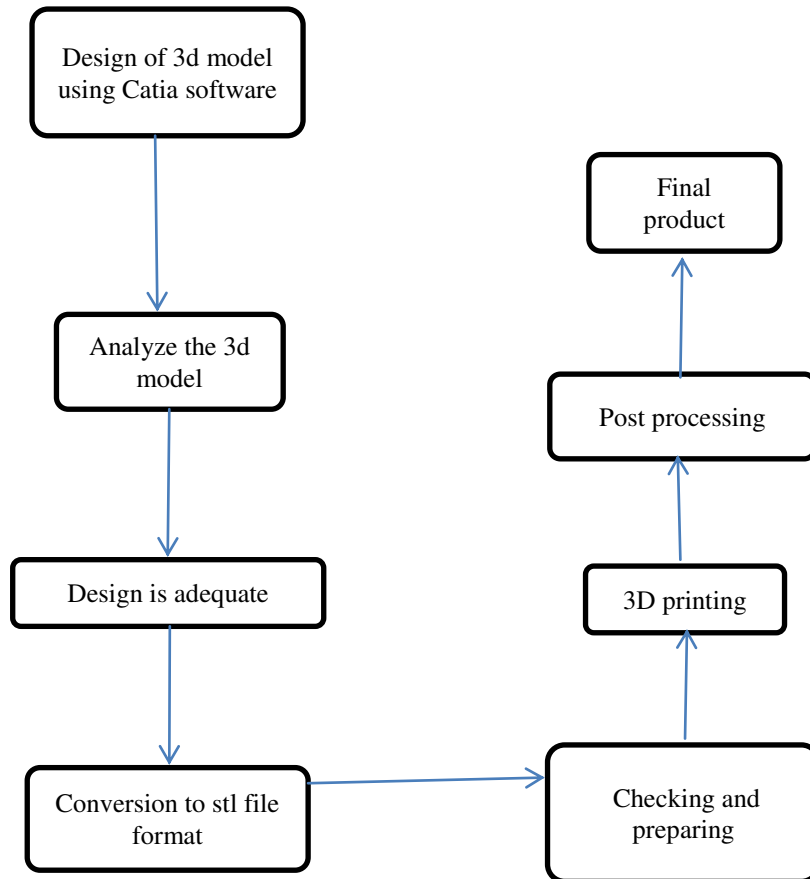
In this paer propose It is designed for robots which respond to sensed changes in the environment. Designed with well conditioned kinematic and dynamic performance and to avoid practical difficulties with flexible cables. It shows that it is possible to design a wrist mechanism with large angular work space. we designate three three actuated motion of each wrist. The mechanism is considered as an equivalent three axis arrangement. Dynamic analysis was used to calculate actuator forces when geometrical configuration and performance specifications were defined. The mechanical arrangement of the components was obtained by considering the central member containing the gears to be fixed and the two yokes to rotate about it.[3]

4. Jamshed Iqbal, Raza ul Islam, and Hamza Khan (2012) has performed aanalysis. they studied kinematic problem by using two generally used styles are grounded on DenavitHartenberg (DH) dad screw deportations. Both styles are methodical in nature and further suitable for modeling periodical manipulators. A extensively used 6 DOF robotic arm manipulator, ED7220C has been kinematically modeled followed by the analysis of its workspace. A kinematic model has been validated using MATLAB. The results from the deduced kinematic model match exactly with that of MATLAB.. Results attained from the model have been compared with the factual performance of the robot in negotiating a taski pick and place. It has been plant that with the common angles reckoned by IK model, the robot achieves position perfection within ± 0.5 cm. They suggested the strategy used in this kinematic model and analysis may also be used to model and dissect other 6 DOF robotic arms.[4]

5. Gregory L. Long(1989)-To perform arbitrary rotations about its instantaneous center a novel inverse kinematic algorithm is designed for a four-revolute-joint wrist which provides complete spatial orientation. The joint screws belong to third order screw system. In the process of presenting our algorithm, they have developed the fundamentals of differential motion with n revolute-joint spherical wrists. The algorithm is a rate controlled method which depends on the required Cartesian rate. They applied the method for 4-R regional structure and developed an 8-R manipulator which is free for internal.[5]



III. METHODOLOGY



Flow chart of Methodology

A . Design : In the Catia software the model of physical prototype to be fabricated is designed. Solid model is automatically generated as the enclosed volume . therefore prototyping the cross sections inn direction must be closed curves for generating a solid object.

B. Analyze the model : In this step the model is analyzed by using different softwares by applying different load conditions and temperatures on the model if the design model is adequate it is processed to next step if the design is not adequate some changes are made in the design.

C. Conversion to stl file : After creating the model it is required to convert the model into a file format compatible with the 3D printing. Small triangular sections are used to approximate more curved surface in stl file format.

D. Checking and preparing : This stage involves or examining the design model stl file format followed by model preparation of physical model fabrication in next stage. Different softwires are available to check and repair the files. Idea maker is one of the software . its main objective is to obtain optimization and guiding of work flow in 2d printing by enabling editing of stl file and data preparation. The stl file is imported to the slicer software. After importing files into software initially files are viewed to check errors which may lead to undesirable cracks, gaps, holes in physical model. Then error are repaired using tools available for repair in the software. After ensuring that stl files free from errors, data preparation is carried out . data preparation involves model slice data calculation and determine other build parameters the model is sliced into cross sections .thickness of each slice and other build parameters such as build orientation ,assortments of special movement are evaluated using ,analysis data.



E. 3D printing : In this stage fabrication of physical model is carried out in 3d printing machine. Once the 3D digital data is ready, printing machine is loaded with required material and machine is started for printing of the model. This stage is completely automated. Based on the size of the part and number of parts to be fabricated, building process may extend up to hours. After completion of part printing ,operator alert system gets activated. Thereby operator can stop the machine and the part for post processing .

F. Post processing : post processing is the final stage of 3d printing process. In this stage prototype obtained in printing is allowed to undergo different post processing operations such as cleaning, finishing, and post curing, based on the requirements. Mostly post processing are carried out manually, therefore operator has to deal carefully, without causing damage to the part. It may not be necessary to perform all post processing operations on parts built.

IV. RESULT

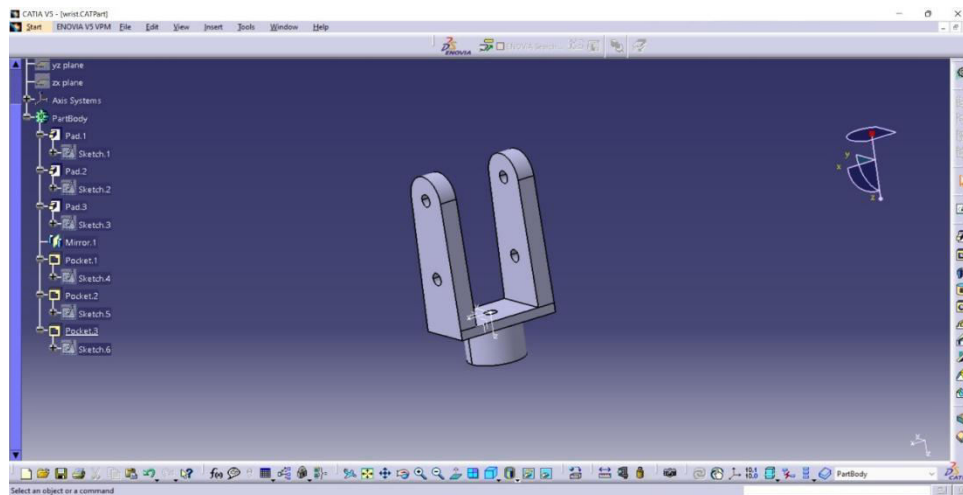


Fig.1: Wrist part connected to the elbow

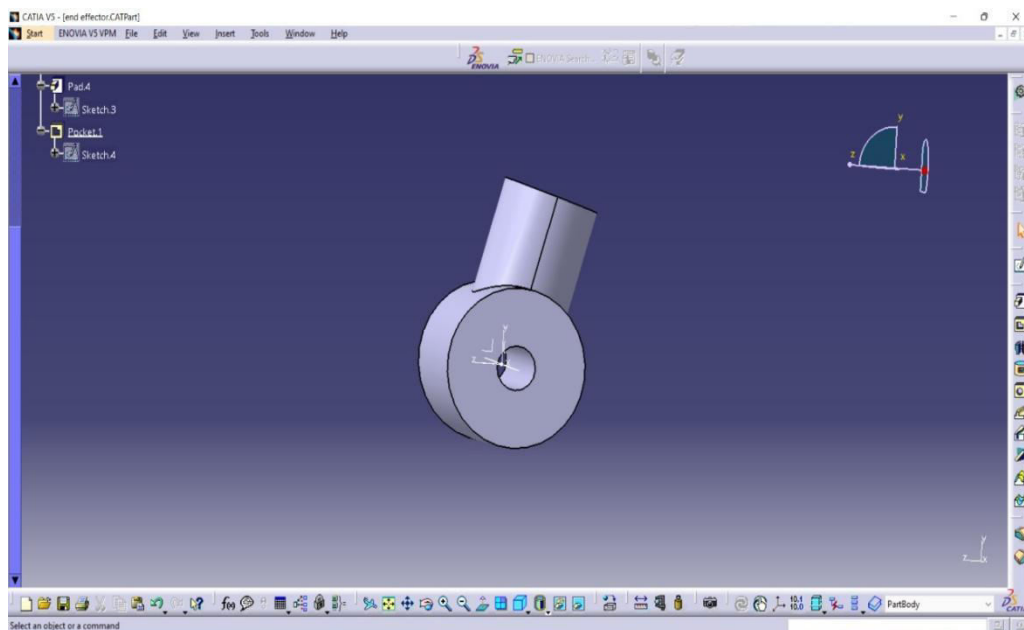


Fig.2 End effector

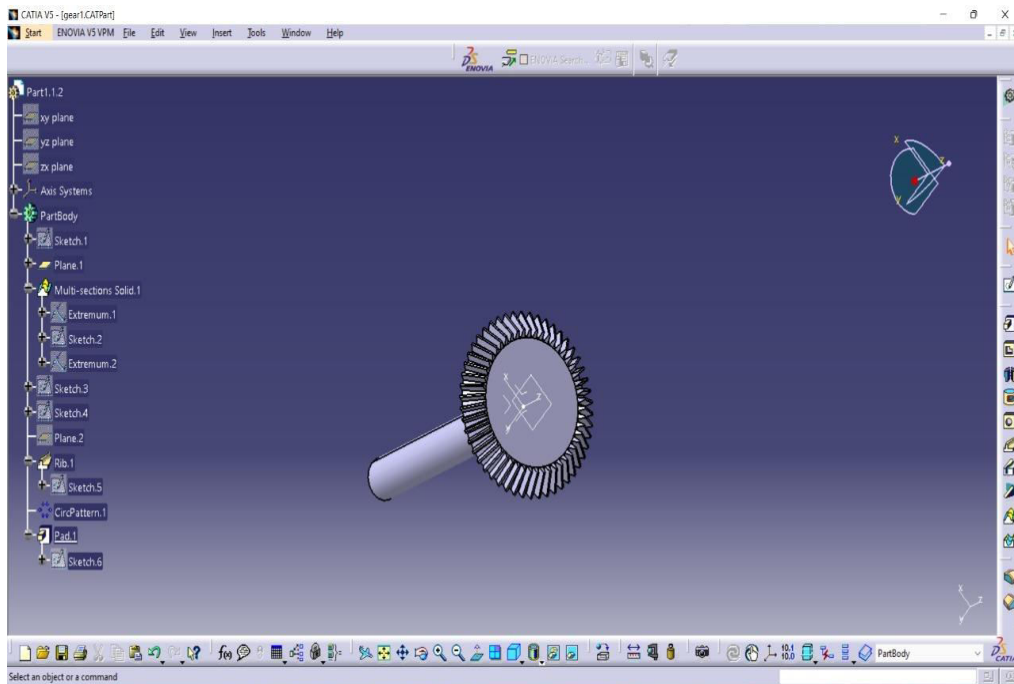


Fig.3: Gear

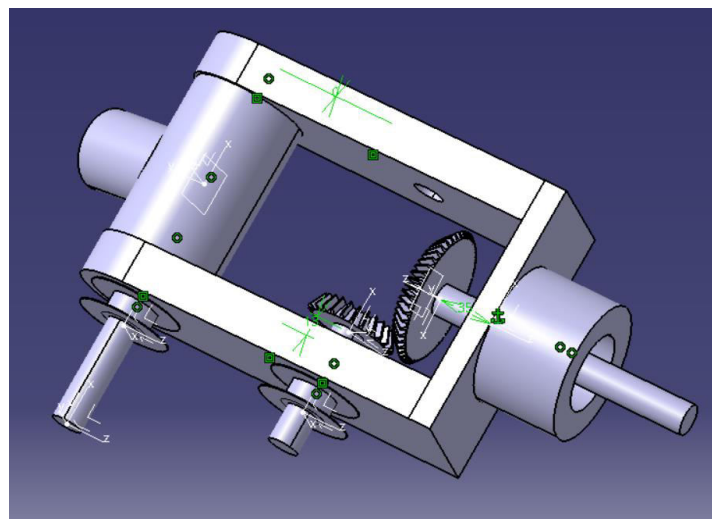


Fig.4: 3D Model of Robotic Arm Wrist

The above figure is the design of robot arm wrist. The design is created using Catia software and the different components of the design is saved in STL file format. These STL files are sliced using Ideamaker software and G- code files are extracted and transferred to 3D printer and the prototype is printed.

V. CONCLUSION

The robot arm wrist is an important aspect to the use of robotic arms and manipulator for different robotization tasks. It features different configurations that need to be considered before the robot is put to work. this help ensures that you're working with stylish configurations designed to move the end effector in the right direction. when you getting your robotic arms, consider having your robotic arm manufacture configure it to your relish. By using 3D published model veritably light weight model can be created by using light weight accoutrements.



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