

Design of X-Y- Gantry Mechanism

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Abstract—In industries the material handling is carried out workers, but it is more dangerous for chemical handling. So automation is very necessary in industries. We used rack & pinion mechanism to move materials in industries. For lifting we used lead screw. It consists of designing of lead screw, shaft, rack & pinion, gripper assembly. Different types of X-Y control Positioning System is used in industries for many application. Now-a-days in industry this mechanism is operated by using PLC and Microcontroller. But the cost of PLC is high. So PLC is replaced by arduino controller. Arduino controller operates on IDE programme. The purpose of our project is to develop a XY gantry mechanism to translate the motion along the X and Y axes of the gantry and to use this information as the output for a microcontroller that can modify the commanded position of the stepper motor as the input data provided.

Keywords: rack & pinion, lead screw; PLC, Arduino controller, etc.

I. INTRODUCTION

Many applications are expected to appear in space exploration, battlefield and in various activities of daily life in the coming years. A robot is a device that performs automated tasks and movements, with respect to either pre-defined program or a set of general guidelines under direct human supervision. These tasks replace or enhance human work, such as in manufacturing, contraction or manipulation of heavy or hazardous material. Robot is an important part in automating the flexible manufacturing system. Now a day's FMS greatly in demand these days. Robots are now more than machine, as robots are become the solution of the future as cost labor wages and customer demands. Even though the cost of acquiring robotic system is expensive but as today's rapid development and a very high demand in quality with international standards, human are no longer capable of such demands. Research and development of future robots is moving at a very rapid pace due to the constantly improving and upgrading of the quality standards of products

II. PROBLEM STATEMENT

In the chemical processing industries, the handling of chemicals is now very harmful as it done manually. As safety concern it is required to find the alternative to handling of chemicals. So we are designing a system that can handle by the robotic arm which is automated system.

Design and develop the 'Design and Manufacturing of material handling robot using X-Y gantry mechanism.' which will do pick and place operation for material handling concern.

III. OBJECTIVE

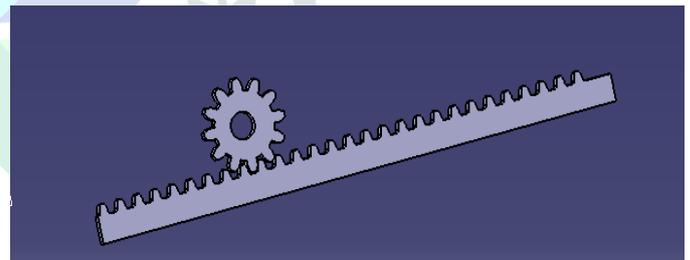
- 1 To design the mechanism which moves in two directions.
- 2 To perform operation which picks product's & place to another place.
- 3 To organize manpower in efficient manner.
- 4 To make trustworthy workforce.

IV. COMPONENTS OF THE SYSTEM

- 1) *Rack & pinion*
- 2) *Motor*
- 3) *Bed*
- 4) *Lead screw*
- 5) *Gripper*
- 6) *Guided rod*
- 7) *Arduino controller*

A. Rack & pinion

It is used to move the arm in the horizontal direction. The main work of the Rack & pinion is to convert the rotary motion to the reciprocating motion. We are converting the rotary motion of the motor to the linear movement of the arm.



Specifications

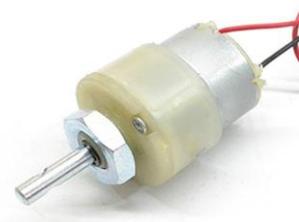
Rack

Module=1mm No. teeth=42 L=127mm

Pinion

Module=1mm No. teeth=18 id=6mm

B. Motor

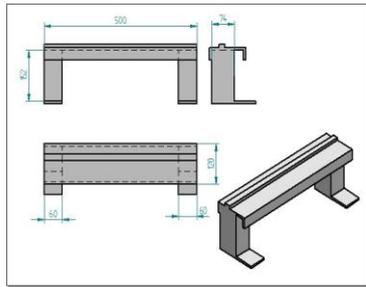


Specifications

Voltage=12v,

Amp=2, T=3kg, Rpm=30

C. Bed

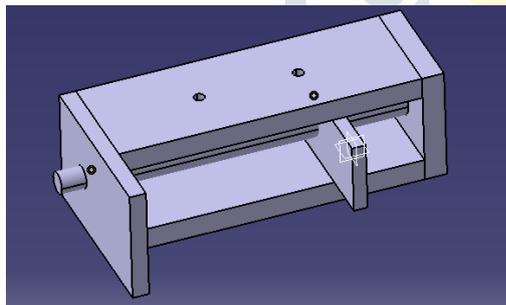


D. Lead screw

- Lead screw is very smooth, anticorrosive, cheap and also self lubrication property.
- They are favored in situations that require higher levels of customization. Because of vibration-free operation they're often used in insulin pumps for medical field and also for personal desktop PCs.
- Lead screws are self-locking; there is typically no need to apply additional brakes, even in situations where you're lifting a vertical load during an electricity outage. As the lead screw has higher friction on its sliding face it requires higher power to drive it forward or backward.
- Material: Mild Steel



E. Gripper -

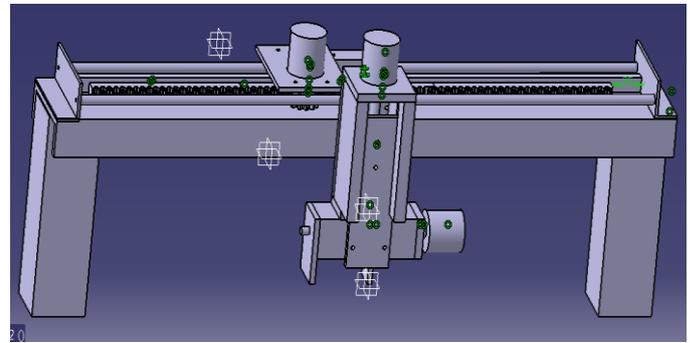


V. WORKING MECHANISM

A Gantry mechanism

A gantry mechanism is usually a mechanism in which a structure is supported by two end support. In our concept we use three mechanisms namely gripper assembly, vertical assembly, rack and pinion mechanism. we use the gripper system for gripping the part to be handled. Lead screw is used for holding the gripper against vertical loading. For vertical movement again we use motor driving lead screw mechanism for lifting the load. For vertical movement we specially use lead screw because of its self locking property. In third part of mechanism, rack & pinion arrangement is used for horizontal sliding motion.

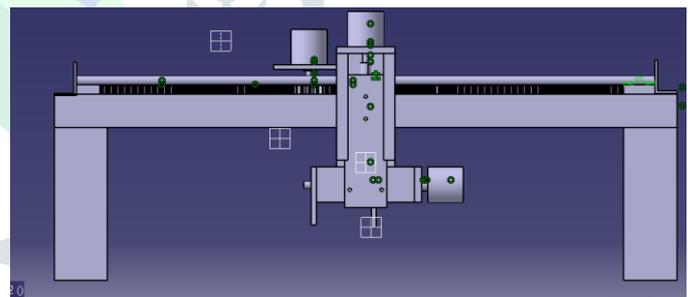
VI. CAD MODELING



3D model

VII. LITERATURE SURVEY

S Senthilraja, R Gangadevi and M Thirugnanam, "Design and fabrication of three axis robot for material handling in chemical industries", Department of Mechatronics engineering, SRM University, Chennai, 2016, pp 2700-2702, [2] A three degrees of freedom robot which has the talent to handle hazardous materials in chemical industries was designed and fabricated. The robot was designed and manufactured using stainless steel materials and the pneumatic linear actuators were used to actuate the links to perform arm movements. The material handling system has a huge future scope which includes that the number of axes can be further increased to provide a larger base and to carry heavier loads, the efficiency of the system can be increased by applying functions simultaneously to multiple grippers, the robot can be made calibrated to the vice further to pick completed jobs from the vices and dropping them to required places



Front view

VIII. APPLICATION OF GANTRY MECHANISM

- Gantry cranes
- Transtrainer

IX. ADVANTAGES

- Reliability of mechanism has been proved over a long period by using it in industries.
- Carry all kinds of loads.
- Lower maintenance is required as comparative to chain drives.
- Life span of the system with higher reliability.

X.CONCLUSION

We successfully designed the XY coordinate mechanism for the material handling in chemical industries for material handling. It reduces the time required to perform the application.

In this project we are designing and fabricating of a 4-DOF manipulator has been successfully completed. The reference of available manipulators, a practical design has been studied and computer aided designing tools Creo 1.0 and AutoCAD are used to model the desired manipulator. FE Analysis is done by using ansys software.

XI.REFERENCES

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