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# DESIGN AND MANUFACTURING OF AUTOMATIZED CHEMICAL MATERIAL HANDLING SYSTEM

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**Abstract** - *In powder coating industry, heavy and large quantity of components are processed. For powder coating process, the components need to be taken to three stages. Components are taken to these three stages by lifting them. This lifting is time consuming and difficult. We need labor for this, and thus it can lead to accident. Thus, for this purpose we are creating a mechanism that would save our time. For horizontal and vertical movement, we have used lead screw. The feed is supplied to the lead screw with DC motor and for holding the component we use grippers.*

***Key Words***: Material Handling, X-Y Mechanism, Rack & Pinion, Powder Coating, Lead Screw Mechanism.

## 1. INTRODUCTION

The last two decades have witnessed a significant advancement in the field of robot application. Many more applications are expected to appear in space exploration, battlefield and in various day to day activities in the coming years. A robot is a mechanical device that performs automated tasks and movements according to a pre-defined program or set of general guidelines and under direct human supervision. These tasks replace or enrich human labor, for example in production, shrinking or handling heavy materials o The robot is an integral part of the automation of the flexible manufacturing system, which is in great demand today are as labor costs, wages and customer demand increase. The initial cost of a robotic system is pretty high, but so fast improvement and a completely excessive call for in fine with IS0 requirements, human is not able to enjoyable such demands. Research and improvement of destiny robots is transferring at a completely speedy tempo because of the continuously enhancing and upgrading of the fine requirements of products. So, the improvement of such automatic structures is needed in each subject of the engineering that is much less expensive than robots.

## 2. PROBLEM DEFINITION

### 2.1 Problem Statement

In the powder coating process, product handling is now very difficult as it is done manually. When the component size is larger than the normal size, it is difficult to lift and handle these components. As it is required to find the alternative to handling of products.

### 2.2 Solution

So, we are designing an automated system that can lift the material. Design and develop the 'Design and Manufacturing of Automatized chemical material handling system', which will do pick and place operation for the system.

### 2.3 Project Objectives

- To design and developed the X- Y mechanism for the application.
- Perform pick-and-place operations.
- Reduce labor and increase human safety.
- To save time and money in material handling.
- To improve work efficiency.

## 3. LITERATURE SURVEY

**Biswas Palok, S. Anandan Shanmugam, "Design and Development of a 3 axes Pneumatic Robotic Arm", [1]** In this work, an articulated robotic arm with a pneumatic linear actuator was developed for material handling in the construction industry task. The lever uses a crank mechanism in which the linear displacement of the drive has been effectively converted into the angular displacement of the joint. The 5/3-way proportional control valve has proven to be very effective in lever control. Compared with the normal component, it is largely non-linear. 5/3-way valve. The closed-loop control with the help of microcontrollers and feedback sensors can achieve precise and improved steering angle control, the level of which was previously unattainable by PLCs. It was also found that the force

changes dynamically according to the position of the articulated arm.

**S Senthilraja, R Gangadevi and M Thirugnanam, "Design and fabrication of three axis robot for material handling in chemical industries", [2]** Three-degree-of-freedom robots that can handle materials are designed and manufactured for the following purposes: harmful substance. In the chemical industry. The robot is designed and manufactured by stainless steel, and a pneumatic linear actuator is used to drive the connecting rod. The material flow system has great potential in the future. In addition, the number of shafts can be further increased to achieve a larger footprint and heavier load, and the system can be improved by applying functions to multiple fixtures at the same time. The robot can then be calibrated with a vise, taking the completed work out of the vise and putting it down if necessary.

**S. Premkumar, K. Surya Varman, B. R. Balamurugan, "Design and Implementation of multi handling Pick and Place Robotic Arm", [3]** This article describes the design and effective implementation of a multifunctional pick and place robot. The robotic arm has been thoroughly tested and necessary corrective measures have been taken. Therefore, the goal of developing and manufacturing grasping and setting robots at low cost has been successful, and it has been found that the operating costs of the robot have also been significantly reduced. Help reduce labor costs and increase profits with a very low initial investment. The proposed model is demonstrated using a real application example. Taking
into account the above advantages and various advantages, this project can be used in the assembly industry.

**Ravikumar Mourya. Amit Shelke, Sourabh Satpute, Sushant kakade, Manoj Botre, "Design and implementation of pick and place robotic arm", [4]** this article describes how the robot works in four degrees of freedom. The boom can be rated based on torque, payload, speed, range, repeatability, and cost. Compared to many commercially available mobile platforms and arms, this article considers the user-friendly design of the arms and computers. Use design software such as Creo1.0 and Auto CAD to simulate the required manipulator.

**Aman B. kotwal, Mangesh N. Gavhane, "Design and Analysis of Lead Screw for Fixture", [5]** A robot is a machine designed to perform specific tasks repeatedly and efficiently with speed and accuracy. Many different types of robots are used for various tasks in industrial and other applications. Usually in industry, robots are used to move cutting tools. The purpose of this work is to reduce the amount of work required by the robot by implementing the sliding device concept. On machines used to convert rotary motion to linear motion. Therefore, in this research work, the design and analysis of the lead screw is carried out under consideration of gradual loading and considering different loading conditions.

## 4. COMPONENTS OF THE MODEL

1) Rack & pinion
2) DC motor
3) Structure
4) Lead screw
5) Gripper
6) Guided rod

## 5. CAD MODELLING

The CAD model was prepared by using CATIA V5 software.

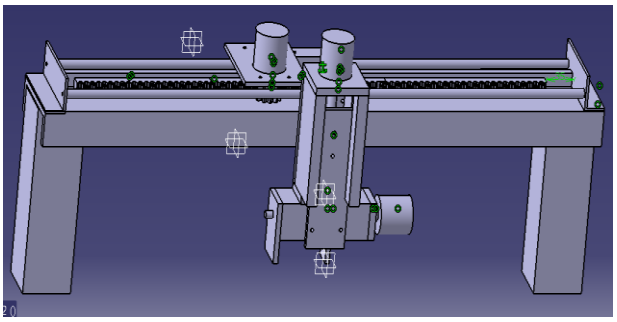

Fig. 1. 3D CAD Model

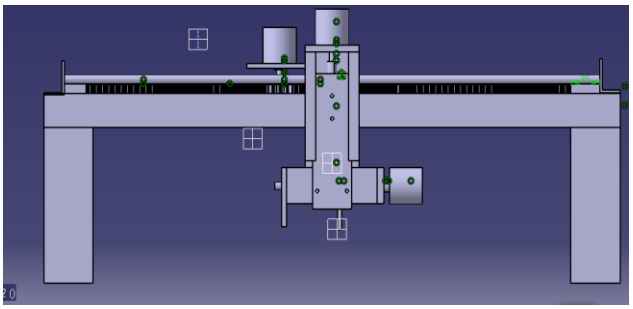

Fig. 2. Front View

## 6. WORKING MECHANISM

For the material handling operation, the robot will be consisting of rack and pinion arrangement in X and Y directions. While working in X direction rack will be fixed and pinion will be moving and for Y direction rack will be moving and pinion will be stationary. For pick and place operation there will be a gripper. The pick and place operation and all motion will be guided by DC motor.

## 7. ANALYSIS

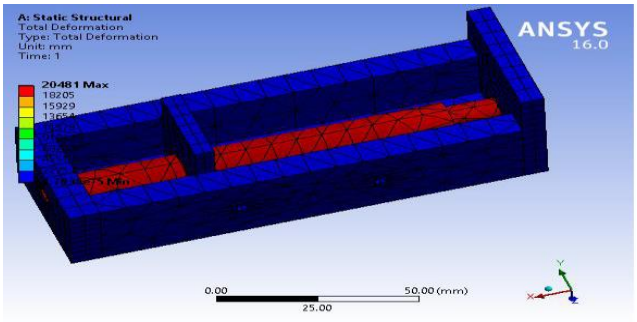


Fig. 3. Deformation

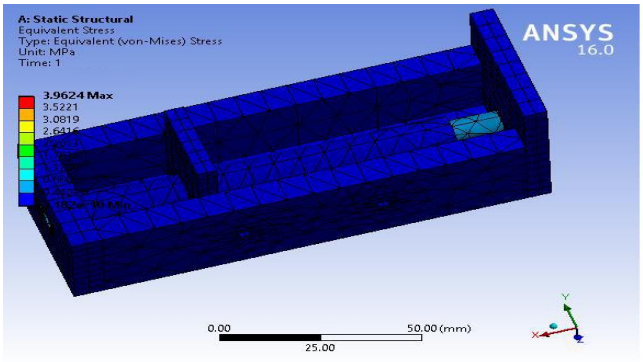


Fig. 4. Equivalent Stress

## 8. ACTUAL MODEL

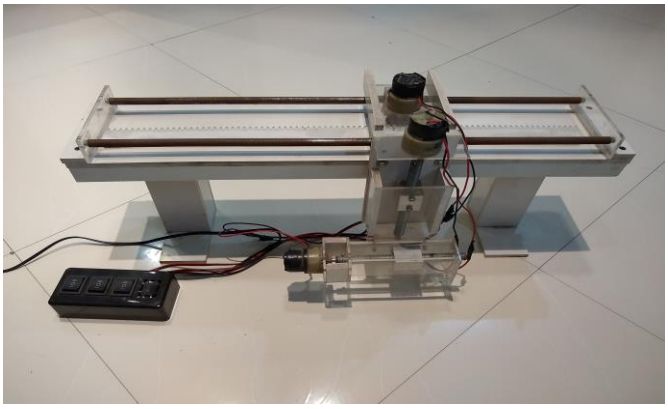

Fig. 5. Actual Model

## 9. ADVANTAGES

a. It is easy to use at certain distances.

b. It carries all kinds of goods.

c. It is easier to maintain and does not require any major lubrication systems such as chain conveyors.

d. Its reliability has been proven for a long time in industrial applications.

## 10. DISADVANTAGES

a. Maintenance is required.

b. Initial cost is high.

## 11. APPLICATIONS

a. Gantry cranes.

b. Rubber tyred Gantry Crane.

## 12. RESULT

Design and analysis of mechanism is done and from deformation and stress analysis our design is safe.

## 13. CONCLUSION

In this project, we have successfully designed and manufactured the material handling system. It will help to reduce the material handling time and cost. This system is very useful in medium-scale and small-scale industries. 3D Model is prepared with the help of CATIA V5 software. Analysis of stresses and deformation is done with the help of ANSYS 16.0 software.

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