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Review Paper On Design And Fabrication Of X-Y Gantry Mechanism For Chemical Handling In Chemical Industries

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Abstract: *The last two decades have witnessed a significant advanced in the field of robots application. A robot is a mechanical device that performs automated tasks and movement according to their set of general guidelines and direct human super vision. The tasks either replace or enhance human work such as in manufacturing or manipulation of heavy and hazardous material handling. The robots have become the solution of future as cost labour wages and customers demand. The rapid development and and very high demand in quality with ISO 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 improving and upgrading quality standards of product. The aim of this paper is to developing a robot for material handling purpose in chemical industries. For the material handing operation the robot will be consisting of rack and pinion arrangement in X and Y direction. 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.*

Keywords: *Gantry mechanism, stepper motor, rack and pinion arrangement*

I. Introduction

In modern industries material handling plays an important role to increase the productivity and decrease the cost of product. The material handling can be defined as an integrated system involving such activities as moving, handling, storing and controlling of materials by means of gravity, manual effort or power activated machinery. Efficient material handling is needed for less congestion, timely delivery and reduced idle time of machines due to non availability or accumulations of materials at workstations. Safe handling of materials is important in a plant as it reduces wastages, breakage, loss and scraps.

The last two decades have witnessed a significant advance in the field of robots application. Many more applications are expected to appear in space exploration, battlefield and in various actives of daily life in the coming years. A robot is a mechanical device that performs automated tasks and movements, according to either pre-defined program or a set of general guidelines and direct human supervision. These tasks either replace or enhance human work, such as in manufacturing, contraction or manipulation of heavy or hazardous material. Robot is an integral part in automating the flexible manufacturing system that one greatly in demand these days. Robots are now more than a machine, as robots have become the solution of the future as cost labor wages and customers demand. Even though the cost of acquiring robotic system is quite expensive but as today's rapid development and a very high demand in quality with IS0 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.

Mrs.R.Dayana, Gunaseelan P, "Microcontroller Based X-Y Plotter",[1] The plotter mechanism is designed for bidirectional movement. The main applications of x-y plotter are engraving machine, laser cutting machine, CNC machine, graph plotting machine. The main advantage of this plotter is we can replace the tool depends on any type of application like engraving machine, laser cutting machine, painting of any surface. From this paper, the low power microcontroller is used in which separate timer circuit is used for modification. This microcontroller is of Texas Instruments manufacturer. The main components of potter design are stepper motor, guiding shaft, limit switch, bearing and microcontroller. From this paper, we can generate several application based on x and y axis movement.

Jaygude S, Kothmire M, Lobhe P, Sagel A, "Low cost x-y positioning system using Arduino",[2] The main aim of this paper is to develop x-y positioning system to translate the motion along x and y axis of the gantry and this information use as the output for a microcontroller that can modify the commanded position of stepper motor as input data provided. The x-y positioning system is micropositioning stage which is driven by two stepper motor and controlled by arduino microcontroller. The implementation of close loop control which generates additional costs but we achieve better positioning resolution with accuracy. In case of pulley and belt

drive based gantry we achieving micro stepping but motor step error, belt slop, and the dynamics of the support structure introduce large errors. From this paper, the x-y positioning system is beneficial in many micropositioning and precision applications. This system provide the cost effective way for system interpretation. In this paper, it was attempted to develop x-y plotter that accurately synchronize with the Arduino software system for better response on the movement of x and y axis.

Biswas Palok, S. Anandan Shanmugam, "Design and Development of a 3 axes Pneumatic Robotic Arm",[3] In this paper an articulated robot arm was developed using pneumatic linear actuators to carry out material handling tasks for industries where the usages of hazardous components. The design of the arm employed crank mechanism in which linear displacement from actuation was converted to angular displacement of the joint. A 5/3 way proportional control valve is very effective in controlling the nonlinear arm compared to normal 5/3 way directional control valve. The closed loop control using a microcontroller and feedback sensors provided precise and improved control of the joint angle with high accuracy. It also found that the force changes with the position of the articulated arm dynamically.

S. Senthilraja, R Gangadevi and M Thirugnanam, "Design and fabrication of three axis robot for material handling in chemical industries",[4] In this paper, the three degrees of freedom robot which has able to handle hazardous materials in chemical industries. This paper consist of the design and fabrication of robot for material handling applications.The material handling system in chemical industries has a huge future scope which includes that the number of axes increased to provide a larger base and to carry heavier load. In this paper, the robot arms are equipped with pneumatic actuators to perform arm movements. This pneumatic actuators are interfaced with a unit that consist of PLC microcontroller to control the actuator.

Wahyudi, Jamaludin Jalani, Riza Muhida and Momoh Jimoh Emiyoka Salami, **"Control Strategy for Automatic Gantry Crane System",[5]**The gantry crane system use in building construction for transporting a payload. It is not easy task to moving payload using crane specially when strict specification on the swing angle. There are various methods are used for controlling gantry crane such as open loop, closed loop. Most of the system based on the modelling and parameter but this a have some problem like time consuming and parameter identification. To avoid this, in this paper intelligent and practical control method for automatic gantry crane is introduce. This system is based on simple open loop experiment. This system is very effective also robust to vibrations parameter. It consist of fuzzy logic controller and nominal characteristics trajectory following (NCTF) controller for control the position of trolly NCTF controller is used and for control the swing vibration fuzzy logic controller is used. This gives better performance while comparing with other control system.

Leszek Sowa, Zbigniew Saternus, Marcin Kubiak, "Numerical modelling of mechanical phenomenon in the gantry crane beam",[6] Gantry cranes are used in many industries for transporting load from one position to another. Eg, shipyards, car factories, heavy industry. According to their major operational specification their design specification are very widely. In this paper numerical simulation and mathematical model of the mechanical phenomenon in gantry crane are presented. In this paper, advanced software are used for analysis of stresses and strain of the gantry crane structure. Finite element method is used to solve the problem, it also help the analyzer optimising the over designed section and design is simplified.

Andreas Bjornsson, Marie Jonsson, Kerstin Johansen, "Automated material handling in composite manufacturing using pick and place system",[7] The main purpose of this paper is to highlight the challenges associated with automated handling of these materials and analyze the main design principles that have been employed for pick and place system in terms of handling strategy, gripping technology and distribution of grouping point etc. There are systems used in manufacturing. With this few cases of industrial application in full scale manufacturing could be identified. Gripping technology- The type of technology is used to order achieve the grip force required to pick up and handle the material. The gripper cat-gory include several different types of vacuum systems such as ordinary vacuum systems where high pressure difference and low air flow generate the lift. It also includes high flow systems where the pressure difference is smaller and the airflow is much higher. In the high high-flow systems the air flow can example- Be generated co and ejectors fans. Sources that present systems using more than one gripping technology or that describe several systems using different technologies appear in multiple categories. With the above information this paper was helpful for us with lot of ways...

Shorya Awtar, Gaurav Parmar, " Design of large range XY nano positioning system [8] This paper is about to achieve nanomatric motion quality (<10nm) and challenges associated with bearing, actuators, sensors and their integrations. Particularly multi-axis system having restricting range upto to 100 micrometer.The paper gives the new physical system that consist of bearing, actuators and sensors that enables large range nano positioning. The mechanism used is parallel kinematic x-y flexure mechanism. It is a mechatronics system having nano metric motion quality in terms of precision, accuracy and resolution. The system consist of aerostatic bearings which avoids friction and backlash to provide sub nano metric precision,

zero maintenance and infinite life. The objective of this paper is to overcome design challenges and present a new system concept for large range x-y nano positioning which overcomes all the challenges related to the existing system. The new system gives a resolution up to 1nm compared to 5nm by existing system.

Fan Yu. Chen "Gripping mechanism for industrial robots",[8] This paper provides information about variety of grippers and mechanisms for industrial robots. It also gives description about convectional gripping devices and classification according to kinematic pairs, gripping mechanisms using linkages, gears, cams, screws, etc. Also some versatile grippers like mouldable grippers inflatable grippers, soft finger grippers and three finger grippers. The robot arm is of no use without tool or gripper attach to it. The grippers are attached to the arm for grasping and releasing variety of materials. It is a specialised device used in industrial robots for material handling in various industries. It performs an important task of handling hazardous materials in industries like atomic power plants, chemical industries and steel making industries. It also conforms safety during the operations and also reduces labour cost and increases accuracy and efficiency. It also gives information about various types of grippers like two finger grippers, three figure gripper, linkage type, cam type, rack type, screw type, pulley type, etc. It also contents some versatile types like vacuum and magnetic type, universal grippers, inflatable grippers etc.

Kensuke Harada[1], TokuoTssuji[2],Kazuuyuki Nagata[3],Natsuki Yamanobe[4] "Validating an object planner for robotic pick and place tasks"[9] This paper propose an $^{object"t}$ placement planner for a grasped object during pick and place tasks. The proposed planner automatically determines the pose of an object that is stable placed near assigned point on environment surface. Picking and placing is one of the most common tasks that a robot is required to achieve. However it is often difficult for a robot to automatically plan its pick and place motion. The paper proposes an object placement planner for use in robotic pick and place planning. In this method, we first cluster the polygon models of the object and environment. Then candidate for the pose of an object.

Vallari S. Ansingkar[1], Vrushali G. Raut[2] "automation of pick and place Mechanism in Industry[10]This concept deals with consumed time and reduced productivity. All hardwiring now reduced due to PLC programmable logic controller. Biggest advantage is that logic of machine can be changed without much alteration on the electrical side. Program in PLC will move the object to location, pick the object and bring it to predefined location using robotic arm. Automation involves electronic, electrical and mechanical component. Accuracy, repeatability and productivity of manufacturing process was the main driving force behind the development of automation product.PLC along machine with machine interface, servo motor and sensors will automate entire mechanism of picking and placing. It reduces manual efforts in all risky areas of machine in industry. The system also reduce errors and increase precision. From this review paper conclude that it reduces errors and increase precision.

D.T.Pham,S.H.Yeo, "A knowledge based system for robot gripper selection: criteria for choosing grippers and surfaces for gripping"[11] Gripper is the very important element in material handling system. It is interface between arm of robot and work piece. It is device by which robot performs the programmed work, so it is very important to select the correct and appropriate gripper for an application. This paper gives information about selection of grippers. The factors affecting the selection of gripper are work to be performed, work environment, how to grip component. The three types of gripper are also discussed. This are jaw type, vacuum and magnetic gripper. The characteristic of components and grippers like geometry, area, shape, size, distance, material used, load acting are also discussed. It involves gripping features of component and gripping characteristics of gripper and gives idea about their appropriate combination.

II. Summary Of Review

Today because of developments in technology various industries use robots in material handling to avoid accidents in hazardous chemical industries and also for increasing efficiency, accuracy and safety of workers. It also leads to decrease the cost of workers.

Shorya Awtar ea al., Developed a physical system that provides nano metric motion quality upto 1nm. Compared to 100 micro meter in existing system. In 2007 Jamaludin Jaloni ea al., used Nominal Characteristic Trajectory Following (NCTF) controller and Fuzzy Logic controller for controlling gantry crane and robust to parameter vibration. Andreas Bjornsson ea al., gives information about challenges faced while handling robotic components with proper solution.

So from this review we are developing XY gantry mechanism for material handling in powder coating.

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