Modeling (Mechanical) and Analysis of Robo-Arm for Pick and Place Operation in Ceramic Industry

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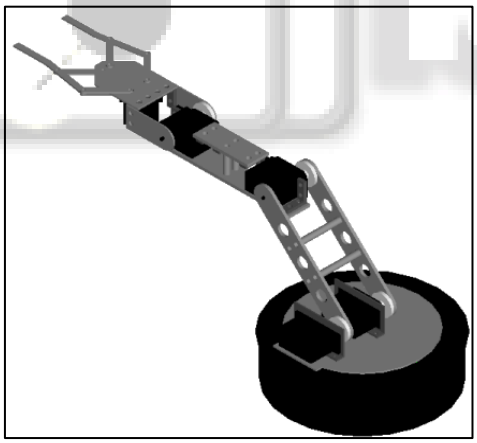
Abstract— Robo- arm is assembly of number of joints which can work in 180 degree direction that allows the object to 'move' in its require direction, and is commonly used in mechanical industry where pick and place operation are carried out .It consists of a pair of hinges located close together, oriented at maximum 90° to each other, connected by a pin joint .Now, this project is based from ceramic industry in which the robo-arm perform its operation for pick and place activity very quickly. Here, I design the mechanical structure of robo-arm. Robo-arm can work at which places where, human can't work continuously in ceramic industry. For example at Furnace division .Robo-arm has its own end effectors. with the help of it, rob-arm can pick the object easily and safely. Basic design concept is taken from ceramic industry at the furnace division where, the working temperature is more than ambient temperature .With the help robo -arm we can save the time and cost, as compare to crane operated loading system and manual belt conveyor system, because robo-arm can place the component at particular place of the part storage area.

Key words: Robot technology, Solid works, ANSYS, Stress Analysis

I. INTRODUCTION



A robotic arm for Ceramic industry is a type of mechanical arm, usually programmable, with similar functions to a human arm; the arm may be the sum total of the mechanism or may be part of a more complex robot. The links of such a manipulator are connected by joints allowing either rotational motion (such as in an articulated robot) or translational (linear) displacement. The links of the manipulator can be considered to form a kinematic chain. The terminus of the kinematic chain of the manipulator is called the end effector and it is analogous to the human hand.

II. PROBLEM DEFINITION

When parts are at different places in the production line of the ceramic industry, there is a requirement of pick and place operating devices. So, robo-arm is the best option of ceramic industry picks and place operation.

Here, I am designing the robo-arm for ceramic industry for pick and place operation of ceramic parts, ie. Sink, tiles, etc.

The end effectors are changed as per requirement of operations.

III. LITERATURE REVIEW

GOPU G.[1] Till date automation in small and medium scale industries has not enjoyed the same rate of growth as in other information technology sectors, lagging significantly behind automation in large batch production. The use of Lab VIEW interfaced with micro-controller in controlling a robotic arm is a latest technique which is being implemented in this project. In medium scale industries packaging of rotors is done manually. This Process is time consuming and also requires manpower. Through this project our efforts are to increase the efficiency by building an automated system which would employ and also reduces manpower. It involves the use of a robotic arm which would identify the rotors positioning, pick it and then place it in the desired location. With the use of this system the process of packaging can be done effectively without any manpower and also does not require constant monitoring and guidance. The DC gear motors are used in actuating the robotic arm. Electromagnetic gripper is employed at the end of the arm which picks and desired position for packaging and this mechanism is automated and controlled using Lab VIEW. The complete set up is compact and versatile.

VISHNU R. KALE [2] the paper presents a smart approach for a real time inspection and selection of objects in continuous flow. Image processing in today's world grabs massive attentions as it leads to possibilities of broaden application in many fields of high technology. The real challenge is how to improve existing sorting system in the modular processing system which consists of four integrated stations of identification, processing, selection and sorting with a new image processing feature. Existing sorting method uses a set of inductive, capacitive and optical sensors do differentiate object color. This paper presents a mechatronics color sorting system solution with the application of image processing. Image processing procedure senses the objects in an image captured in real-time by a webcam and then identifies color and information out of it. This information is processed by image processing for pick-and-place mechanism. The Project deals with an automated material handling system. It aims in classifying the colored objects by colour, size, which are coming on the conveyor by picking and placing the objects in its respective pre-programmed place. Thereby eliminating the monotonous work done by human, achieving accuracy and speed in the work. The project involves sensors that senses the object's colour, size and sends the signal to the

microcontroller. The microcontroller sends signal to circuit which drives the various motors of the robotic arm to grip the object and place it in the specified location. Based upon the detection, the robotic arm moves to the specified location, releases the object and comes back to the original position.

Muhammad Ikhwan Jambak[3] The system development of virtual robotics simulation will be the alternative for the robotics learning process. This project wills effort the virtual robotics simulation that will combine all the information about the robot arm. This system can also hopefully be the training place for students to simulate the robot' s movement virtually and remotely for learning purposes.

Ayokunle A. Awelewa[4] In the industry today, continuous attempts to realize optimal efficiency and increased productivity have spawned much progress in the use of intelligent automated devices and machines to perform various operations and tasks. The thrust of this work is to present the development of a three-degree-of-freedom revolute robot manipulator amenable to pick-and-place operations in the industry. Appropriate kinematic equations of the manipulator are obtained, and then used to develop algorithms for locating predetermined positions of a small object in a customized workspace. An Arduino-based controller circuit is built to implement the algorithms, and servomotors are used to carry out independent joint control of the manipulator. The positions of the object are identified with the aid of light-dependent resistors (LDR). Besides, in order to aid easy fabrication of links and overall system assembly, a 3D model of the manipulator is designed. The results of the work, showing effective and satisfactory operation of the manipulator, are presented.

Cheryl Ann Perich[5] The quest to move small objects quickly, efficiently, safely, and effectively has been a goal of robotics and manufacturing since the beginning of mass production and the decreasing size of components of technological interest (i.e. electronic components and other similar materials). While there is a lot of diversity in the mechanism of transport, such as the number of degrees of freedom in a robotic arm as well as the type and number of end efforts handling the object, there is still a lack of consistency, accuracy, and delicacy in moving millimeter, micro- and nano-scale objects. This paper explores the use of electroosmosis to transport mm-sized spheres which are used to assembly large scale objects. In contrast to previous works, [1, 2], which focused on using arrays of bridges to grab a single substrate, we demonstrate individually controlling each element in the array to pick up objects from positions of our choosing. The advantage of this water droplet method is that it allows for delicacy in transport due to the lack of mechanical grabbing mechanisms. What makes this device particularly unique is the ability to individually address each droplet channel to control the droplet growth. The droplet size can be predicted, and the emerging droplets and surface tension to pick up objects can be controlled prior to any motion. Furthermore, this device has the capability to be expanded for massively parallel (on the scale of millions) assembly.

.Alex m. Felker[6]This project, in partial completion of degree requirements for a Bachelors of Science in Industrial Engineering, has been performed at Johanson Technology in Camarillo, CA. Johanson Technology was facing an increasing customer demand of Ceramic Single Layer Capacitors and needed to increase the throughput of their packaging station to meet this demand. Currently one person is designated to picking and placing capacitors into Waffle packs, plastic pocketed trays, while another person places capacitors onto Gel Packs or Ring Packs. Johanson had the choice of several solutions to increase throughput: hire additional packers, design a custom automated system, or purchase an existing automated robotic arm. This paper looks at the cost analysis and research that led to Johanson Technology's decision to purchase an existing robotic arm known as the RS20, manufactured by Stäubli, and the steps taken to integrate this robot into full production.

Samson Khoo Hock Chye[7] The project of Design and Analysis of Robot Gripper for 10 kg payload is divided into two parts. The first part of the project is about the project's proposal and the second part is about project implementation. This report fully describes about the combination of both parts, which contains five chapters starting from introduction, literature review, methodology, results, discussion and conclusion respectively. The first chapter describes about scopes and objectives of the project and expected results. The main objective of the project is to design and analysis of Robot Gripper for 10 kg Payload. Meanwhile, the second chapter discusses about literature review on designing and analysis of grippers. The next chapter is methodology. This chapter describes about steps or procedures that is used to complete this project. In this project, design and analysis will rely heavily on design software, namely SolidWorks for the analysis, simulation and animation of the gripper's design. The following chapter discusses on the result and discussion about the gripper's design, material selection, and the working architecture of the gripper. Finally, the overall project and its achievements are concluded in chapter five.

IV. CONCLUSION

The construction of a robot arm for simple pick-and-place operations has been considered in this paper. The system hardware and software have been highlighted and discussed, and tests carried out on the complete assembly shows that the implementation is satisfactory. In order, however, to obtain an optimum grip pressure on the target object, it is recommended that a pressure sensor be incorporated and installed on one of the end-effector's fingers. Besides, a video camera and a computer with image processing capability can be used to give arbitrary locations of the object (instead of the pre-programmed positions employed in this work). Also, this work uses the independent joint control method for the pick-and-place operations. Thus, to make the manipulator more accurate and precise, future work, which the authors are currently looking at, will involve the use of computed torque control method.

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