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Case Study: Demonstrative Model of Pick & Place Material Handling System for Workstations

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Abstract: ***Semiautomatic Electric Overhead Travelling (EOT) Crane is one of the essential industrial equipment for material handling job. In recent years little attention has been paid to the optimal design of Heavy Electric Overhead Travelling Crane Bridges. Most of the crane manufacturers have standardized the single dimensioned box section for multiple spans and duties of Crane Bridges for manufacturing simplicity. Owing to the recent upward trend in the price of structural materials not to mention the demanding dimensions of heavy-duty crane box girders, utilization of modern design optimization tools is inevitable. This project demonstrates design optimization of EOT crane industrial box subjected to rolling loads. A simple and innovative procedure has been introduced to use for optimization of various parameters of the loading and travelling parameters. In this case study we have tried to develop a model of overhead pick and place semiautomatic mechanism.***
Keywords: Gripper, Automation, Frame, Steeper Motor

I. INTRODUCTION

In manufacturing industries various types of painting machines are used for painting profile of different shape. With increased competition and demand it is become necessary to use advance painting techniques. These techniques help in reduction in painting time and reduce the manufacturing cost. Such techniques adopt NC, CNC machines, but cost of such machine is also high. In these machines manual interference is considerably less. Therefore, chances of mistakes and errors are reduced. Due to elimination of manual activity, unproductive time is minimized. With this point of view an attempt is made to design and develop a machine which reduces the production time and enhance the accuracy of work. The escalating price of structural material and energy is a global problem consequently optimal consumption of the both cannot be considered redundant. Overhead crane, which is a synonym for material handling in the industrial environment, utilizes structural steel for its girder and energy (mostly electrical) for its operation. Light girder for overhead cranes not only save material cost but also trim down energy expenditure because of subsequent employment of low powered drive units. The general procedure for design of EOT crane girders is accomplished through guidance stipulated in the prevailing codes and standards. Thus, optimal design in such case is not the one which just exhibit stress criteria offered in structural design methods but the one which follows the limits restrained by the codes and safety rules.

II. PROBLEM DEFINITION

Nowadays in this country, the most available jacks are manually powered, we found out that these manual hydraulic jacks were very difficult to be used by our labors especially the female ones because of the strength and energy needed to operate it making it to be time consuming; furthermore, in scenarios of these manual hydraulic jack malfunctioning and subsequently the collapse of the machine under maintenance could lead to musculoskeletal disorders, injuries of the neck, back and shoulder. Thus, to overcome this problem of drudgery, musculoskeletal disorders, injuries, increase timeliness and efficiency in the industrial material handling.

III. OBJECTIVES

1) Design a machine which has ability to paint the vertical plane as well as horizontal plane.
2) Construct the model for testing and analysis of software part of the machine.
3) To design a motorized control system for to operate overhead mechanism.
4) To fabricate a mechanism of with pneumatic cylinder mechanism.
5) To develop mechanism simple and easy to operate.
6) Develop system simple and handled by non-technical person.
7) It should be simple and low cost.

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8) Best suitable for small and portable jobs.

IV. METHODOLOGY

So, in the view of above objective methodology of current research objective will be outlined as shown in the flowchart below,

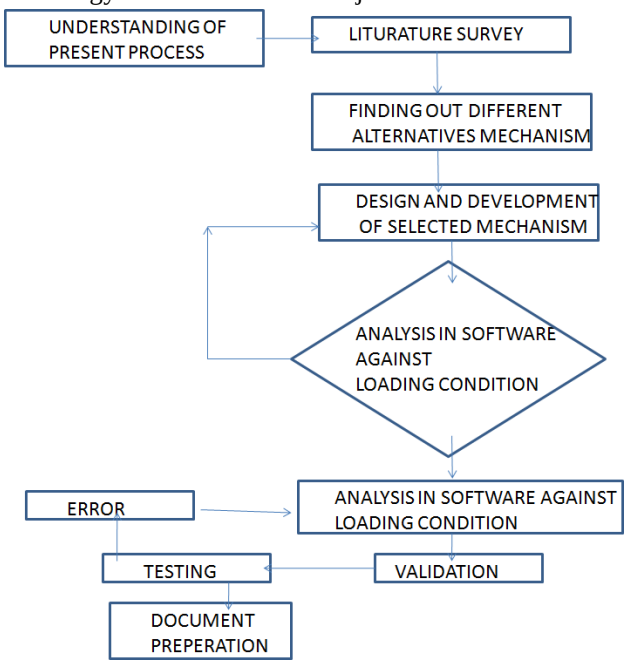


Figure 1: Methodology for Preparing Demonstrative Model

V. DESIGN OF SOLUTION

The system design comprises a development of the mechanism so that the given concepts can perform the desired operation. The mechanism is basically designed by considering.

1) Space requirement

2) Constraint motion

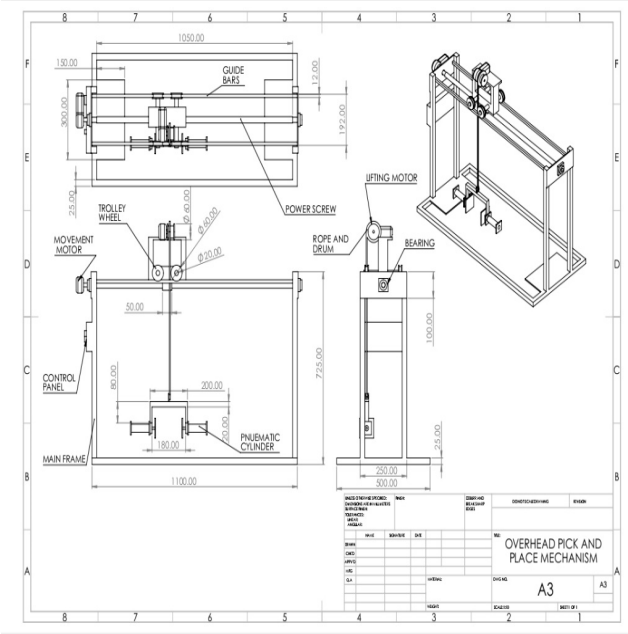


Figure 2: Design of System on Solidworks

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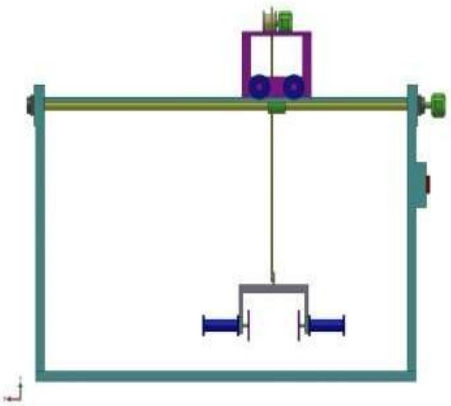


Figure 2: Model of Workstation for Material Handling System

VI. WORKING

The working of a pick and place material handling system involves the following steps:

1) *Step I. Initialization:* The system is initialized by the operator, who inputs the necessary information, such as the position of the material or object to be picked up, the position of the workstation, and the path of the robot arm.
2) *Step II. Detection:* The system uses sensors to detect the location of the material or object to be picked up. The sensors can be optical sensors, proximity sensors, or pressure sensors, depending on the type of material or object.
3) *Step III. Gripping:* Once the location of the material or object is detected, the gripper is activated to pick up the material or object. The type of gripper used depends on the shape, size, and weight of the material or object.
4) *Step IV. Transport:* The robot arm moves the material or object to the designated location, such as a workstation. The path of the robot arm is programmed in the control system, which ensures that the robot arm moves in a smooth and efficient manner.
5) *Step V. Release:* Once the material or object reaches the designated location, the gripper is activated to release the material or object. The gripper can be programmed to release the material or object in a specific manner, such as gently placing it on a surface or dropping it into a container.
6) *Step VI. Repeat:* The system repeats the above steps for each material or object that needs to be handled. The system can be programmed to handle multiple materials or objects simultaneously, depending on the capacity of the robot arm and the gripper.

VII. ADVANTAGES & APPLICATION

A. *Advantages*

Pick and place material handling systems offer several advantages for workstations, including:

1) Increased efficiency: Pick and place systems automate the material handling process, reducing the need for manual labor and increasing productivity.
2) Improved accuracy: These systems are designed to precisely position and place materials, reducing the risk of errors and improving overall accuracy.
3) Reduced labour costs: By automating the material handling process, pick and place systems can help reduce labor costs and improve the bottom line.
4) Increased safety: These systems can reduce the risk of injury associated with manual material handling, improving workplace safety and reducing workers' compensation costs.
5) Greater flexibility: Pick and place systems can be customized to handle a wide range of materials, allowing for greater flexibility and versatility in the workplace.
6) Enhanced quality control: By reducing the risk of errors and improving accuracy, pick and place systems can help ensure consistent quality and reduce waste.
7) Improved throughput: Pick and place systems can handle materials quickly and efficiently, improving throughput and reducing bottlenecks in the production process.
8) Scalability: These systems can be designed to handle a range of volumes, from small-scale operations to high-volume manufacturing, allowing for scalability and growth.

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B. Applications

1) A pick and place material handling system is a type of automation system that is commonly used in manufacturing and production processes. It involves the use of robotic arms or other mechanical devices to pick up materials or components from one location and place them in another location, typically on a production line or workstation. Here are some potential applications of a pick and place system for a workstation:
2) Assembly line: A pick and place system can be used to pick up components and place them in position on an assembly line, allowing for faster and more accurate assembly of products.
3) Packaging: Pick and place systems can be used to pick up products or components and place them in packaging, such as boxes or bags, for shipment.
4) Material transfer: A pick and place system can be used to transfer materials from one location to another, such as moving raw materials to a processing area or finished products to a storage area.
5) Quality control: Pick and place systems can be used to pick up products or components and move them to a quality control area for inspection and testing.
6) Material sorting: A pick and place system can be used to sort materials, such as separating different types of materials or components based on size, shape, or other criteria.

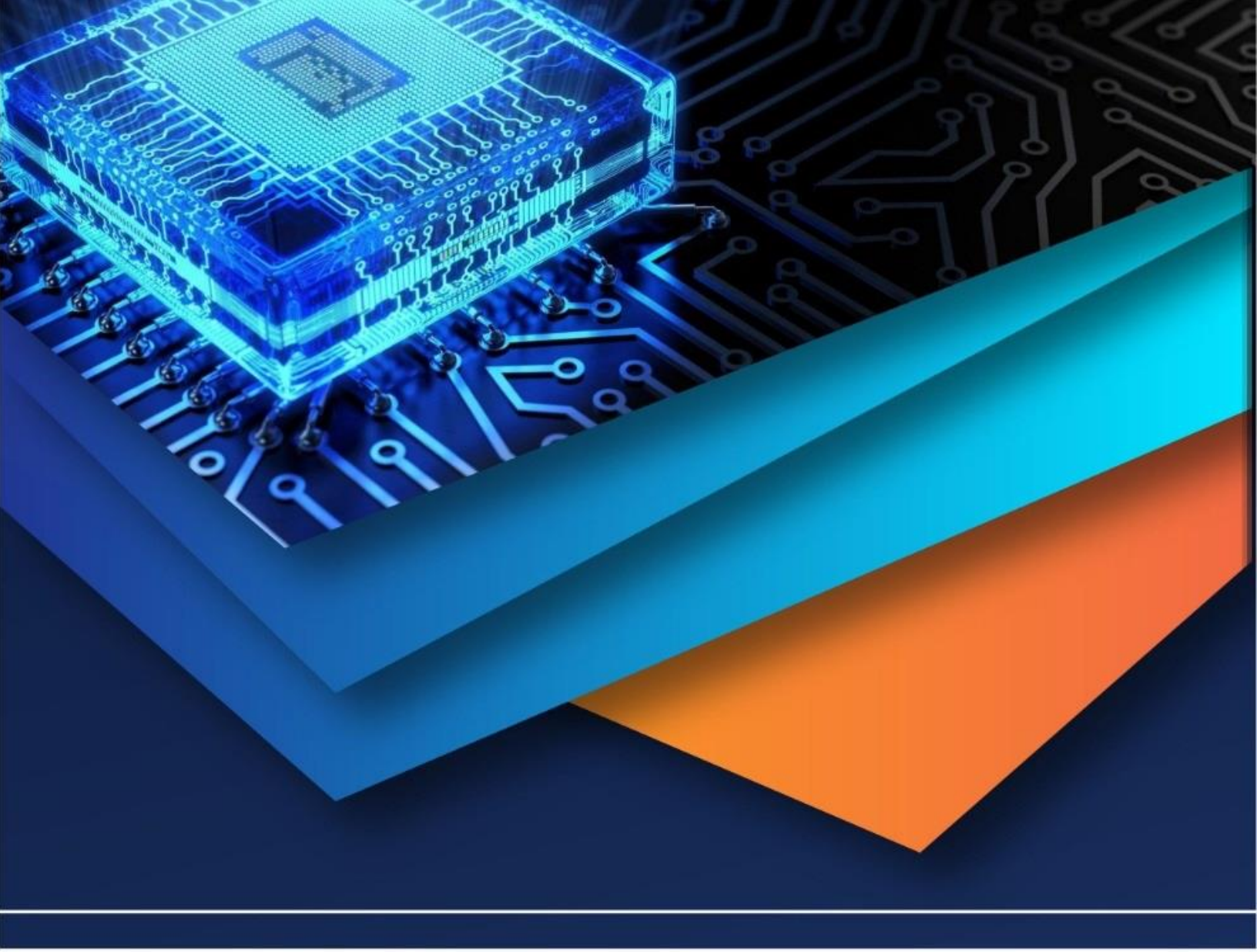
VIII. CONCLUSION

1) A pick and place material handling system is a critical component in any workstation that involves the movement of materials from one place to another. The system automates the process of picking up items and placing them at a designated location, thereby saving time and increasing efficiency.
2) In conclusion, the pick and place material handling system is an excellent addition to any workstation that requires frequent handling of materials. The system offers several benefits, including increased efficiency, reduced labor costs, and improved safety.
3) One of the key advantages of the pick and place material handling system is its ability to handle a wide range of materials, including fragile and heavy items. The system can be customized to handle specific materials, ensuring that they are moved safely and efficiently.
4) Another advantage of the pick and place material handling system is that it reduces the risk of workplace injuries. The system can perform tasks that would otherwise be hazardous to human operators, such as lifting heavy objects or working in high-risk areas. This reduces the risk of accidents and injuries, leading to a safer workplace environment.
5) Furthermore, the pick and place material handling system is highly accurate and reliable, ensuring that materials are moved to the correct location every time. This reduces the risk of errors, leading to increased productivity and efficiency in the workplace.
6) In conclusion, the pick and place material handling system is a critical component in any workstation that involves the movement of materials. It offers several benefits, including increased efficiency, reduced labor costs, improved safety, and high accuracy and reliability. Therefore, implementing a pick and place material handling system is an investment that can improve the overall performance of a workstation, leading to increased productivity and profitability.

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