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Design and Fabrication of X-Y Gantry Mechanism using Python: A Review

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Abstract: ***A crane is a machine that is primarily used to handle big weights in a variety of jobs. For instance, building work, shipbuilding, cargo transportation, and the cement industry may all benefit from this technology since it allows them to monitor and control their video processing systems using a PC. Cranes are frequently utilized in the industrial sector around the world to boost productivity and minimize personnel.***

Cranes are used to transport loads from one location to another. During this movement, there are typically unwanted vibrations and variations in the hoisted weight that must be managed. This paper gives a review of a new way for operating an overhead crane that uses a PC (Portable Computer), RF (Radio Frequency), and video processing approach to operate the crane from a certain distance.

The crane movement is now controlled directly by the crane operator; nevertheless, due to the human inability to handle the crane efficiently, the crane speed is severely limited. This procedure allows a single employee to handle the crane from a greater distance by watching the location of each and every movement towards and away from the crane using a video processing technology and a radio frequency controlling system. The technology use computer vision to identify load location, which is then used to optimize crane operation.

The intimation of the PC monitors reveals that the accident levels to become decline for handling the overhead crane even by operator, according to the technology for sustaining job.

Keywords: Overhead Crane, PC, Arduino, Relay Controller Unit, Automation Control, Block cipher, Sensor.

I. INTRODUCTION

Because of the delayed reaction of the massive structures and the lightly-damped payload oscillation, controlling a crane is sometimes difficult for human operators. When the interaction between both the human and the crane is intuitive, manipulation tasks become even more difficult. Despite recent significant developments in transportable electronic devices, crane control applications have yet to benefit from this valuable technology. Crane-assisted human handling of hanging payloads can be difficult. This touch screen allows an operator to walk around the workplace freely while controlling the crane using a simple graphical user interface. Through a series of human operator performances, the touch screen's operational effect was compared to that of a regular pendant interface.

The touch screen allows the operator to move around more freely while yet getting equivalent manipulation results. A controller is necessary in order to accelerate in a suitable way. This controller should make the operator's job easier by restricting crane acceleration while maintaining control. Calculating the greatest permitted acceleration from prior control signals can be used to build such a controller.

However, because the system requires perfect knowledge of the load weight, this is a solution with limited use. A formed into sensor is required to identify load position. The use of accelerometers was considered; however, it was ruled out due to the difficulties of preventing drift. The second option is to utilize a standard digital and computer vision to locate the load. The concept is to take photos with a single digital camera and then have a PC analyses them in real time to determine the load. The cargo coordinates would then be sent to the controller, who might subsequently set a speed restriction. The operator should be able to move the load from one point to another as quickly as possible and with the least degree of sway as feasible if computer vision is used to adjust the process of moving trolley. The location of the load is the foundation for fixing the problem. A computer must be built that can recognize and track the trolley in real time. This is a process that can be made better by employing control theory. Cranes are categorized into two types based on their construction: overhead cranes and gantry cranes. Overhead and gantry cranes are commonly used to transport containers, store materials, and load trucks. This crane usually has three distinct operations for material transfer. The main action is the hoist, which lifts and lowers the material. The second option is the trolley (cross travel), which allows the hoist to be put directly on top of the material for placement. The third form of motion is gantry or bridge motion (long trip), which allows the crane to move around in its entirety.

II. LITERATURE REVIEW

Mrs. R. Dayana, Gunaseelan P, "Microcontroller Based X-Y Plotter,[1] The plotter mechanism is intended to move in both directions. Engraving machines, laser cutting machines, CNC machines, and graph plotting machines are some of the most common uses for x-y plotters. The fundamental benefit of this plotter is that it can be used to replace tools for any sort of application, such as engraving machines, laser cutting machines, and painting on any surface. The low-power microcontroller is utilized in this study, with a separate timer circuit for tweaking. This microcontroller is made by Texas Instruments. The stepper motor, guiding shaft, limit switch, bearing, and microcontroller are the primary components of the Potter design. We may develop numerous applications based on x and y axis movement using this article.".

Jaygude S, Kothmire M, Lobhe P, Sagel A, "Low cost x-y positioning system using Arduino, [2] The major goal of this work is to create an x-y positioning system that can translate motion along the gantry's x and y axes and utilize that information as an output for a microcontroller that can change the commanded position of a stepper motor based on the input data. The x-y positioning system is a tiny positioning stage that is controlled by an Arduino microcontroller and operated by two stepper motors. Close loop control is used, which incurs greater expenses but results in higher positioning resolution and precision. We achieve micro stepping using a pulley and belt drive-based gantry, but motor step error, belt slop, and the dynamics of the support structure cause substantial inaccuracies. From this paper, the x-y positioning system is beneficial in many micro positioning and precision applications. This system provides 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] This study describes the development of an articulated robot arm that uses pneumatic linear actuators to perform material handling jobs in industries that use hazardous components. The arm was designed with a crank mechanism that transformed linear actuation displacement into angular joint displacement. In comparison to a standard 5/3-way directional control valve, a 5/3-way proportional control valve is particularly effective in regulating the nonlinear arm. A microprocessor and feedback sensors were used to create a closed loop control system that offered accurate and enhanced joint angle control with great precision. It was also discovered that the force varies dynamically with the location of the articulated arm.".

S. Senthilraja, R Gangadevi and M Thirugnanam, "Design and fabrication of three axis robot for material handling in chemical industries, [4] The three degrees of freedom robot that can handle hazardous chemicals in chemical industries is discussed in this research. The design and manufacturing of a robot for material handling applications is the subject of this study. The chemical industry's material handling system has a big future potential, which includes increasing the number of axes to give a larger base and transport heavier loads. In this research, pneumatic actuators are used to produce arm movements on robot arms. To control the actuator, this pneumatic actuator is connected to a unit that includes a PLC microcontroller.".

Wahyudi, Jamaludin Jalani, Riza Muhida and Momoh Jimoh Emiyoka Salami, "Control Strategy for Automatic Gantry Crane System", [5] The gantry crane system is used in the construction of buildings to transfer payloads. Moving a cargo with a crane is a difficult undertaking, especially when there are precise requirements for the swing angle. Controlling a gantry crane may be done in a variety of ways, including open loop and closed loop. The majority of systems are built on modelling and parameters, however this has significant drawbacks, such as time consumption and parameter identification. In order to avoid this, this work introduces an intelligent and practical control approach for an automated gantry crane. The foundation of this system is a basic open loop experiment. This method is not only efficient, but it is also resistant to vibrations. For controlling the location of the trolley, it comprises of a fuzzy logic controller and a nominal characteristics trajectory following (NCTF) controller.".

Leszek Sowa, Zbigniew Saternus, Marcin Kubiak, "Numerical modelling of mechanical phenomenon in the gantry crane beam, [6] Gantry cranes are used to carry loads from one location to another in a variety of industries. Shipyards, automobile manufacturing, and heavy industries, for example. Their design specification is fairly broad, according to their key operational requirements. The mechanical phenomena in a gantry crane is numerically simulated and mathematically modelled in this article. Advanced software is utilized to analyses the stresses and strains of the gantry crane structure in this article. The problem is solved using the finite element approach, which also aids the analyzer in optimizing the overdesigned part and simplifying the design.".

Andreas Bjornsson, Marie Jonsson, Kerstin Johansen, "Automated material handling in composite manufacturing using pick and place system, [7] The major goal of this study is to emphasize the difficulties of automated handling of these materials and to examine the fundamental design ideas used in pick and place systems in terms of handling strategy, gripping technology, and grouping point distribution, among other things. In the manufacturing industry, there are several systems. There were just a few examples of industrial applicability in full-scale production that could be found using this method. Gripping technology is a form of technology that is used to create the grip force needed to pick up and handle materials. The gripper category encompasses a variety

of vacuum systems, including standard vacuum systems that provide lift through a high-pressure difference and low air flow. 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] paper is about to achieve nanometric motion quality and challenges associated with bearing, actuators, sensors and their integrations. Specifically, a multi-axis system with a limiting range of up to 100 micrometers. The research describes a novel physical system that includes bearings, actuators, and sensors that allows for long-range Nano placement. The x-y flexure mechanism is a parallel kinematic x-y flexure mechanism that is used. It is a nanosized motion quality mechatronics system in terms of precision, accuracy, and resolution. Aerostatic bearings are used in the system, which eliminate friction and backlash for sub-nanometer accuracy, zero maintenance, and unlimited life. The goal of this study is to address design issues and provide a new system idea for long-range x-y Nano positioning that addresses all of the problems with the current system. The new system gives a resolution up to 1nm compared to 5nm by existing system".

Kensuke Harada1 , TokuoTssuji2 ,Kazuuyuki Nagata3 ,Natsuki Yamanobe4 "Validating an object planner for robotic pick and place tasks [9] This paper propose an object's 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. Ansingkar1 , Vrushali G. Raut2 "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 reduces 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] In a material handling system, the gripper is a critical component. It serves as a link between the robot's arm and the workpiece. It is the device via which the robot carries out the programmed task, therefore choosing the right gripper for the job is crucial. The purpose of this study is to provide information about gripper selection. Work to be done, work environment, and how to grip component are all aspects that influence gripper selection. There's also a discussion of the three different sorts of grippers. Jaw, vacuum, and magnetic grippers are the three types. Geometry, area, form, size, distance, material employed, and load acting are all covered in detail for components and grippers. It discusses the gripping qualities of the component and the gripping characteristics of the gripper, as well as the best way to combine them.".

III. CONCLUSION

A system for overhead crane automation will be created using PC programming and distance computation. Notes can be used to give operation. watching the location of the key board when pressing the keys, the camera processing approach for the overhead crane The According to technology, the advantages of this procedure are as follows: The hint of the reality might be useful for ongoing activity. The accident has been minimized in the PC monitor. Controlling the overhead crane requires lower levels. by use of the operator According to the standard of safety, the fact that all of the safety nodes are machines demonstrates that the rate of accidents may be slow. Cranes are essential components in the industrial sector and are utilized in a variety of applications. Be known for ease of learning, predictability, and simplicity. The topic of intuitive crane control was broken down into two components in this paper: interface planning and controller design.

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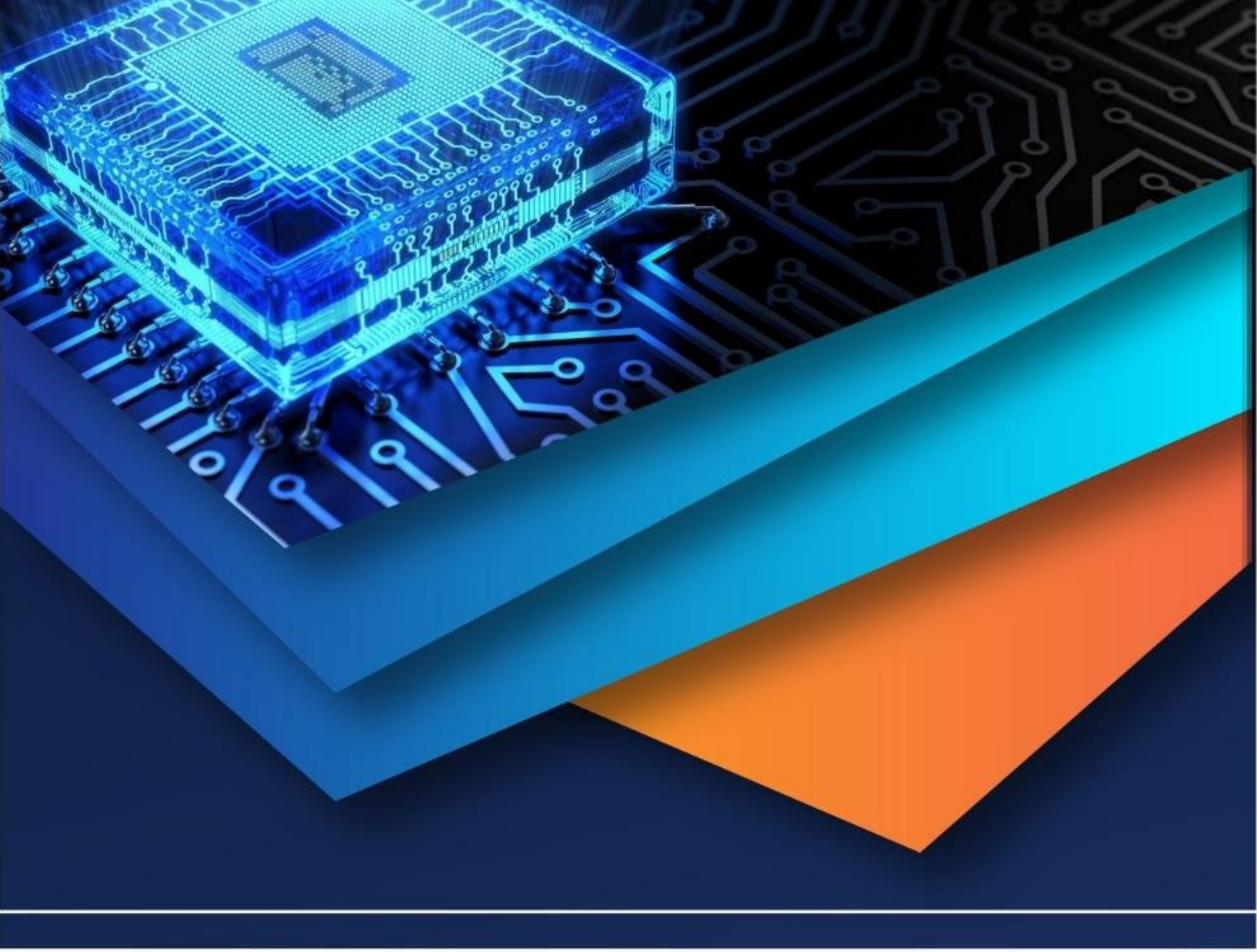

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