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Axis Delta Robot Using HMI & Mapp Robotics for Pickand Place

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Abstract: *In this project, this project going to make a machine centric robot which will be controlled for a certain process using MappRobotics and HMI screen will be developed for the robot. This 4-axis robot is controlled for the desired application. It has 3 drives connected to 6 motors, by controlling the drives and motors, a synchronized motion of the manipulator is performed which results in a robotic application, for example the manipulator of the robotic arm will trace 'B&R'. Operator can control the robot automatically and manually by giving commands through HMI as well. This robot will perform tasks on the basic of structure text (type of CNC programming) written on the program.*

Keywords: Robotic Arm, Mapp Robotics, HMI, Structure Text Programming, Scene Viewer, Automation Studio, Communication, 4-Axis, VNC Viewer, PLC, etc.

I. INTRODUCTION

The aim of this project is to offer unprecedented levels of machine flexibility and precision by merging robotics with machine control enabling remote access, increased efficiency and also save floor space. Robots are an integral part of automation industry. Traditionally, robots used in machines are self-contained, with their independent controller and its control cabinet. The configuration, diagnostics and maintenance of robot are all performed using a dedicated system, with a specific robotic language. These robots have to be coordinated with the machines so that they can give the required output.

This system requires dedicated controller for each machine and robot. Therefore, machine centric robot is required which has only one controller. As this robot will no longerrequire a dedicated controller, all interfaces between the machine and the robot are eliminated, while the fact that all axes and sensors will now communicate on a common network increases precision and speed of response. Thisalso helps to increase the productivity of the machine and the output of the process.

II. OBJECTIVES OF THE WORK

- To perform Pick and Place operation in Industry.
- Will helps to increase the productivity of the machine and the output of the process

III. LITERATURE SURVEY

The concept design of Delta robot from many literatures have started from free body diagram creation [1], then find solutions of forward and inverse kinematics [2]. Finally, designing mechanism of delta robot has been implemented. Although the process of design in each related works are the same, the output results are different. Especially, the basicof mechanical design have the same idea [3], but the length of arms and some mechanism details have difference from purpose of usage such as food production, small workpieces, and cycle time. Thus, many researches have focused on improvement of Delta robot. Not only speed and accuracy, but also controller and programming have been improved [4].

[5] Authors introduce a new concept for designing and manufacturing an industrial robot by using modern productiontechniques and 3D modelling software. The most important requirements of this project were to build a customized light weight and low-cost robot. A firmware design and its implementation on a real time embedded system for driving a 4 DOF parallel robot arm is presented in [6].

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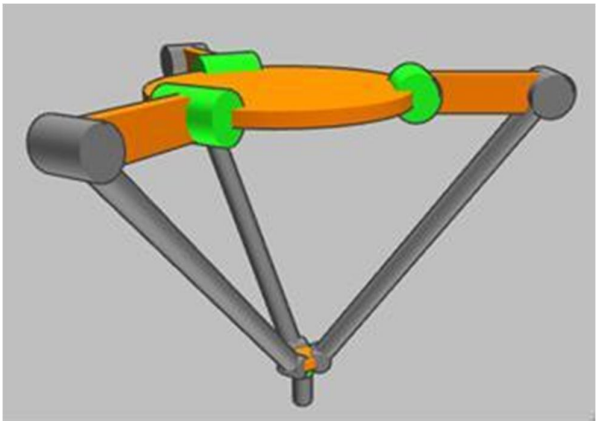
The firmware primarily comprised of two components to produce motion of the robot arm: A) Generation of continuous position coordinates. B) Generation of actuating signals. These two components were processed in two different microcontrollers with common communication bus.

III. SYSTEM MODULE



For robotics systems, the focus is on path movements through space rather than on the movement of the individual motors required to achieve this. The main factor here is a mechanical axes group that enables movements along a path via transformation. For individual axes, the focus is on controlling the motor with regard to position, distance or constant velocity. Dynamic couplings based on the master/slave principle, as well as torque movements, offer significant advantages for a wide range of applications.

The following are just some of the wide ranges of applications possible:

- Pick-and-place tasks • Palletization
- Sorting

This robot will be divided into 4-axis. Top base will be fitted to the upper part of the conveyor. Axis1- This axis, located at the robot base, allows the robot to rotate from left to right. This sweeping motion extends the work area to include the area on either side and behind the arm. Axis 2- This axisallows the lower arm of the robot to extend forward and backward. It is the axis powering the movement of the entire lower arm. Axis 3 -The axis extends the robot's vertical reach. It allows the upper arm to raise and lower. This axis gives the upper arm the better part access. Axis 3 Working in conjunction with the axis 4, this axis aids in the positioning of the end effector and manipulation of the part. Known as the wrist roll, it rotates the upper arm in a circular motion moving parts between horizontal to vertical orientations. Axis 4 - This axis allows the wrist of the robot arm to tilt up and down. This axis is responsible for the pitch and yaw motion. It is responsible for a twisting motion, allowing it to rotate freely in a circular motion, both to position end effectors and to manipulate parts.It is usually capable of more than a 360degree rotation.

IV. HARDWARE ARCHITECTURE

Based on Intel ATOM processor technology, X20 CPUs cover a wide spectrum of requirements. They can be implemented in solutions ranging from standard applications to those requiring the high levels of performance. The series starts with Intel ATOM processor 333 MHz compatible models – X20CP1583 and X20CP3583. With an optimum price/performance ratio, it has the same basic features as all of the larger CPUs. The basic model includes USB, Ethernet, POWERLINK V1/V2 and replaceable CompactFlash card. The standard Ethernet interface is capable of handling communication in the gigabit range. For even more real-time network performance, the onboard POWERLINK interface supports poll response chaining mode (PRC).

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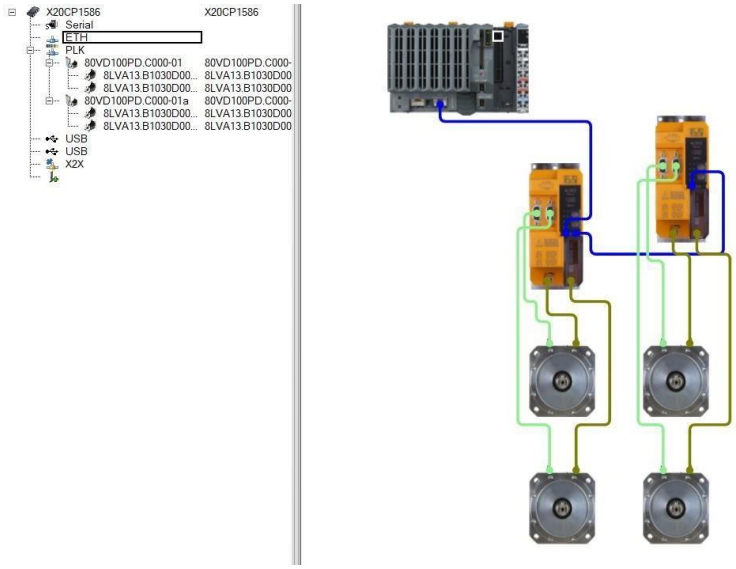
Up to 3 more slots are available for additional interface modules to increase flexibility. By default, the POWERLINK interface is operated as a managing node (MN). In the managing node, the node number is set to a fixed value of 0. If the POWERLINK node is operated as a controlled node (CN), a node number from 1 to 253 canbe set in the POWERLINK configuration in Automation Studio.



System Designer provides a visual overview of the hardware configuration being used. It illustrates how modules are physically arranged in relation to each other as well as how they are connected to each other. To make it easier to identify different types of modules, photorealistic images are used in place of icons. Interfaces on individual modules and cable connections are shownin different colors depending on the network type they are being used with.

V. FUTURE SCOPE AND CONCLUSION

In this research, we have shown a new method to manufacture an industrial robot. Using the additive Technology and modern software tools for designing and controlling industrial Robot wewere able to shorten the development periods. The first step after creating the main concept was a Structure Text design of Links and Joints of Robot, which would be stiff enough to pick and placeindustrial applications. The simulation software is endowed to simulate the mechanical behavior of the material during the motion study of the robot and consequently the robot axis was optimized. The next step was developing a user interface for the operator to program robot motions.

The developed robot is suited for pick and place applications and for learning purposes. It wasproven that additive manufacturing is ineffective production processes for manufacturing high quality robot parts in short time. Also, this method helped to save valuable engineering time and the design engineer can focus his work directly on the product functionality. Our efforts to developa low-cost integrated system for development of pick and place robot have thus far resulted in theiterative development of a tested, proven hardware platform. The software stack has been developed for localization, navigation, and radioactive element detection. Future work can be done on the robustness of court localization and further code optimizations, which are two necessary steps for the integration of these components. The eventual goal for this project is fully automatedsorting and then pick and place robot with maximum accuracy. Considerably larger bandwidth system should be on board because video streaming service is desired. The future work can makethe system robust to environmental variations; it can also aim to develop the decision-making functionality of the platform to create a truly autonomous system.

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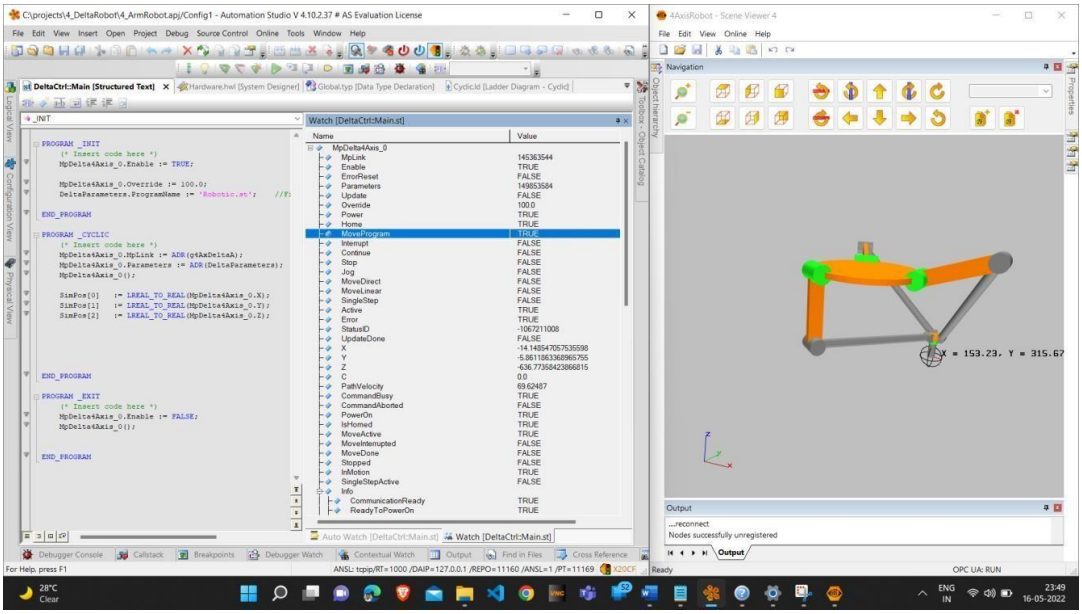
VI. FINAL RESULT

Below image shows the final result of the work. This is the software in ON and Homing condition, right side screen shows the animated 4-axis delta robot. Scene viewer display the animated movementof the delta robot. On the left side of the snapshot is automation studio 4.10 in monitoring mode.



VII. ACKNOWLEDGMENT

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