Study and Design of Cartesian Robot for Handling Purposes

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Abstract

This project concerns the study and design of a small model of Cartesian robot. After reviewing all the information around the field of robots and robotics, from different classifications, types of end-effector, study of kinematics, and types of control and programming used with this type of robots. And applying the information to create a design of a robot that pick and place (handle) objects from one point to the other.

Keyword: Cartesian, Handling, Manufacturing,

Objective

The goal of this project is to create a Cartesian Robot, which meant we needed to: -

- Design the Cartesian Robot.
- Calculate the torque affecting the motors.
- Manufacture the parts of the robot (Machining & 3D printing).
- Program the robot, and write the codes to control it.

Constraints

Our study takes in consideration the following constrains: -

1- Economical
2- Safety
3- Manufacturability
4- Functionality

Description

A Cartesian robot move on the XYZ axis in a linear motion. The main components of our robot are (fig.1 & 2): the outer frame, the X system table, the Z system body, the end-effector carrier, and the end-effector. The type of End-effector we used is a two-figure gripper (fig.3), which is best used for pick & place tasks

Figure.1: Cartesian Robot Main Components

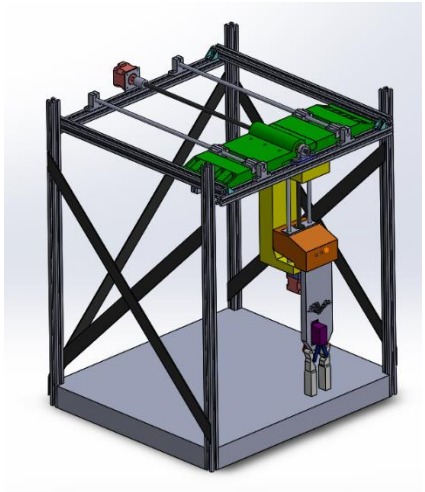

Figure.2: Cartesian Robot Design

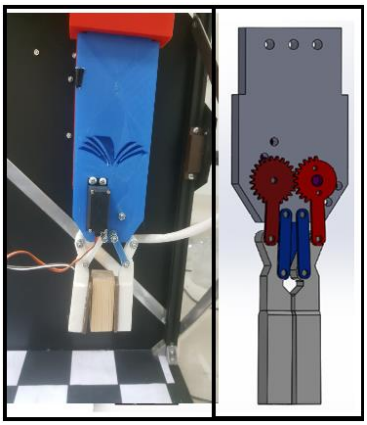

Figure.3: The End-Effector

Control & Programming

The control unit we used for this robot is made up of three main parts:
1- Microcontrolle
2-Stepper Motor Driver A4988
3- Shield of the Arduino.

The programming language used is G-code, which uses command start with single letter and numbers, and the GRBL controller software is used to read & send the codes to the robot.

Conclusion

During this project the Cartesian robot was studied. We discussed the applications, classifications, and advantages of the Cartesian robot. Using many examples as a reference we were able to design a robot that was able to pick and place object in a predefined area, creating the parts using 3D printers or using machining processes (cutting, drilling, or shearing). Then assembling them together before testing the prototype.