6-Axis Robot Manipulator for an Educational Process and for Automation of Small-Scale Enterprises

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The aim of this project is designing and production of a 6-axis robot manipulator with swivel joints for schools or universities educational process and for automation of small-scale enterprises that require multifunction robots of a low payload namely up to 1 kilogramme. The parts of the robot are produced on a 3D printer, and this fact makes its production and modification really convenient. The robot controller and tool controller were designed and the software was coded, in addition to the robot development. The given equipment was made truly manufacturable for anybody who wants to can produce it. The following objectives were set throughout this project: • Development, designing and producing an electronic robot control that is a board based on STM32F205 microcontroller. It controls 6 bipolar stepper motors, processes signals from 12 limit stop switches, has 2 UART and 1 USART interfaces with voltage-level translation circuits for connecting with other microcontrollers of the control block. Designing and producing the end-of-arm tool controller, based on ATmega328P microcontroller. The printed circuit boards development and designing were performed in CAD-system Altium Designer. • Development, designing and producing of a 6-axis robot manipulator. All the development and computing robots units were performed in CAD-system Autodesk Inventor and its CAE module Autodesk Simulation Mechanical. • Creating a robot’s mathematical model included the development of a new method of solving inverse kinematic problems using basic concepts of the geometrical approach. The entire mathematical model was tested using Matlab. Achieved engineering goals: • 6-axis robot manipulator was developed and constructed. • Robot's electronic control system was made and coded.

Awards Won:

Third Award of $1,000