An Accessible, Adaptable, 6-Axis, Low-Cost 3D Printed Robotic Arm Solution

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Robotic arms are useful in a variety of applications: manufacturing, de-palletization, artificial intelligence research, etc. However, on average, a typical robotic arm with 6-axis capabilities can cost many thousands to millions of dollars depending upon the payload, accuracy, repeatability, and workspace size. Additionally, if an arm needs to be utilized for a task requiring different constraints than originally intended, expensive modifications are needed to meet requirements. High initial costs and expensive modifications deter many independent researchers, small scholastic institutions, hobbyists, and others with limited budgets from having access to the possibilities that robotic arms offer. To address this issue, an adaptable, 6-axis, low-cost 3D printable robotic arm that is compatible with Robotic Operating System (ROS) was designed, built, and tested for those who can't afford industrial arms but who still need a comparable utility. The robotic arm was designed to have a maximum reach of 800mm at a standard length that it could be easily extended and modified for specialized tasks. Additionally, the robot was designed to have a repeatability of under 2mm, a payload of 1kg at the standard maximum length, an accuracy below 1cm, and a cost under $800. When refined and tested at the maximum length, the average repeatability was 1.13mm. The accuracy ranged from 0.07cm to 3.58cm with an average of 1.38cm. The maximum maneuverable payload was 0.644kg and the max holding load was 1.45kg for lifting at 800mm. Finally, the price, adaptability, and compatibility with ROS were successfully implemented.

Awards Won:
Fourth Award of $500