Development and Construction of a Low-Cost Six-Axis Robot Arm

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Is it possible to develop and build a six-axis robot arm as a high school student and just with knowledge acquired from the internet? This paper covers my research on a low-cost robot arm that shares many technological features with comparable commercial products. During the course of this project, I acquired a broad spectrum of knowledge. Problems in the fields of mechanical engineering, electrical engineering, computer science, mathematics, and physics were to be solved. One such challenge, for instance, was the development of a light and, at the same time, powerful actuator. Another one was implementing a closed-loop control system, which was required to execute high precision movements. Over the course of two months, I developed a complete concept, which I then proceeded to translate into action. My finished robot arm has a wingspan of one meter and can manipulate more than two kilograms. I successfully implemented my robot into the robotics framework ROS. Additionally to the robot, I also developed a stereo camera system, with which I am able to locate certain objects in the room at an accuracy of plus-minus five millimeters. Once my camera system has localized an object, my robot arm autonomously calculates and executes the necessary movements to grab and manipulate the object. The total cost of the project amounts to just 4,300 Swiss francs.

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