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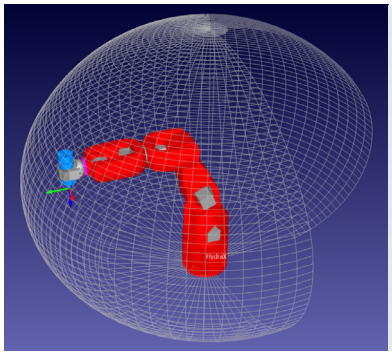
Category: **Crossmodality** Country: **Greece**

Research Area 3: **Automation and Robotisation** Idea Number: **18**

HydraX robot: a hybrid 3D printing and milling 3D printed robotic arm

This study aims at enabling the combination of Additive and Subtractive Manufacturing processes carried out by a low cost 3D Printed Robotic Arm through proper control and efficient programming. The 6-axis robotic arm was custom designed and its components were manufactured by a domestic 3D printer with PETG material, so as to serve both functional properties and aesthetics. 3D printing parameters were carefully chosen for optimal robot part stiffness and integrity. Construction was complemented with appropriate off-the-shelf parts and motors for smooth operation. G-Code was selected as the programming language, which facilitates both CNC beginners and experts in its use. The robotic arm has the ability to automatically change its end-effector, whether it is a milling spindle, a 3D printing hot end, a laser engraver, or a gripper via its specially designed Automatic Tool Change system, thus providing the ability of multiple manufacturing processes and part handling on a single platform. The CAM software Post-Processor for G-code extraction was developed in the philosophy of a Finite-State Machine (FSM), which means that the NC output file is automatically adjusted, when input variable values are changed in the CAM software. Custom macros (M-Codes) have also been developed for specialized functions, such as filament extrusion and tool change. Furthermore, as the robotic arm does not require specialized training or working conditions, it can safely and efficiently be utilized in either domestic or industrial environments for low-cost quality production of even high complexity parts.



Key Characteristics

3D Printed Robotic Arm • Manufacturing