A Self-Replicating 3D Printer

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The self-replicating machine will revolutionize human industry. Not only will self-replicating factories raise the standard of living across the globe, but it is also a vital step toward a self-replicating spacecraft that will dramatically increase our access to space. This project aims to create the first fully 3D printed 3D printer, a type of self-replicating machine. Previous attempts to do this have only printed 73% of the machine and required laborious assembly, reducing its ability to self-replicate. In this project, 100% of components have been printed by solving the four critical problems outlined below. A novel method was created to print low resistivity electronic parts (problem 1). This material is 98.3% less resistive than the best commercial conductive 3D printing filament and 99.7% to 50% less resistive than high-performance experimental materials while being easier to produce allowing a functional brushed DC motor to be printed for the first time. To control the 3D printed motors without non-3D-printable microprocessors, a 3D printed motor controller was designed and built (problem 2). The device, whose function was optimized by a custom genetic algorithm, can control the speed and direction of each motor by reading a data strip (problem 3), generated by a custom Python program, which encodes a digital model in a language unique to the printer. The kinematic components of the printer have been designed and built (problem 4). A second version that can be printed in place and requires no assembly has been designed and is being built. The fully 3D printed hotend, printed from the polymer PEEK, can be annealed after printing which may allow it to print itself. All components have been integrated into a functional proof of concept.

Awards Won:

First Award of $5,000

IEEE Foundation: Second Place Award of $600