TEAM INERTIA
Custom 3D Printer

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BACKGROUND

Affordable 3D printers today compromise too much on speed, quality, and user-friendliness. They require downloading software to interface with, and the software contains hundreds of options to change the print. Most printers utilize off-the-shelf components to lower the engineering barrier to entry. Team Inertia set out to design a new, compromise-free 3D printer by designing the mechanical, electrical, and software systems from scratch.

The team also integrated a web interface and a touch screen interface to make controlling the printer as easy as possible. This printer is designed to produce dimensionally accurate parts reliably and repeatedly without compromising on speed or price. They set out to make making things affordable, easy, and fun.

MEET THE TEAM

The team consists of one Mechanical Engineer (Colton) and three Electrical Engineers (Alex, Michael, and Sam). Colton designed and created the mechanical sub-system, featuring over 800 parts selected, out-sourced, and machined. Sam designed the electrical system, featuring a custom printed circuit board. Michael designed the printer's onboard software and aided in the electrical system design. Alex designed the touch screen user interface and the web integration.

The team from left to right: Alex, Michael, Colton, and Sam

OUR SOLUTION

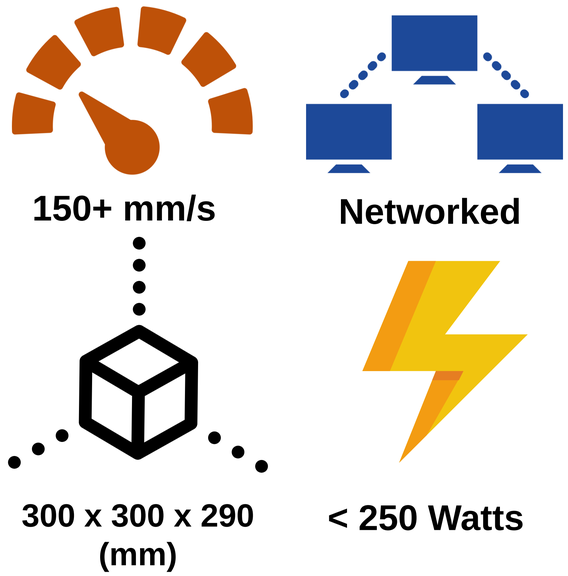
Team Inertia has designed a revolutionary 3D printer from the ground up. Designing custom electronics allows for cost savings that can be put into higher quality mechanical components. Those off-the-shelf mechanical components combined with simple sheet metal parts and consistent mounting brackets allow for a highly-precise yet affordable machine. The X-Y gantry runs on Misumi linear rails to yield an accuracy higher than our target goal of ±0.003" (0.08 mm). The team also chose the industry leading Mosquito® hotend, which was recently developed by Slice Engineering.

The electrical design focused on simplicity as well as scalability. Designing a circuit board to handle all functionality of the printer as well as the network connectivity. This involved combining two microcontrollers, one to drive the display and the network, the other to quickly drive the four axis. The team also chose high precision Trinamic stepper drivers to minimize noise and maximize power to the motors.

Lastly, the software was written from scratch. Traditionally printers use off-the-shelf firmware, but the team wanted to tightly integrate the faster-than-usual hardware in order to yield the fastest possible speeds. The software was designed for user-friendliness and speed of printing.

The printer, before walls and door are placed.

ACHIEVEMENTS



NEXT STEPS

Up next for Team Inertia is the continued development of their system-level software. Implementing full PID control for both temperature control and motor control will allow for smoother operation.

Also, the mechanical design has various improvements, the biggest of which will be reducing the overall mechanical footprint. The electrical design will also begin using active filters for temperature control to increase the accuracy and reduce noise in the system.

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