Stereolithographic 3D Printer

Overview
The Pennsylvania State University’s MACS Lab (Magneto-Active Composites and Structures) has a need for a 3D printer that is capable of creating magnetic 3D objects. The previous design team made a printer capable of printing two-dimensional shapes out of UV-light sensitive resin. This year, a capable of printing in 3D must be constructed to begin the initial three-dimensional tests.

Objectives
The main focus of this project was creating a printer capable of creating a column with multiple cross-sections with a height of at least 5 millimeters. The printer must be designed to leave room for future modifications to incorporate the features required for printing magnetic objects.

Approach
- Old prototype design studied for reference
- Various commercial 3D printers researched and studied
- Multiple concepts generated and weighed, with the highest-scoring concept chosen
- Alpha prototype rendered in SolidWorks
- Parts researched and purchased
- Alpha prototype modified into current design
- Acrylic pieces cut to form UV-proof casing
- Mechanical components installed to allow adjusting of focusing mirror
- Threaded rod installed for vertical movement of the lifting arm
- Initial resin tests performed to analyse behaviour of resin during curing
- Arduino Mega code written to control motor speed based on resin test results
- Electrical components constructed and inserted into printer

Outcomes
- Constructed at roughly 20% the cost of a commercially available printer ($800 vs $4000)
- Nearly-instantly forms solid 2D objects with greater precision than most injection 3D printers
- Printer experiences issues with 3D objects falling off the arm or sticking to the resin dish despite multiple non-stick sprays being tested
- Maximum part thickness of 3 millimeters achieved