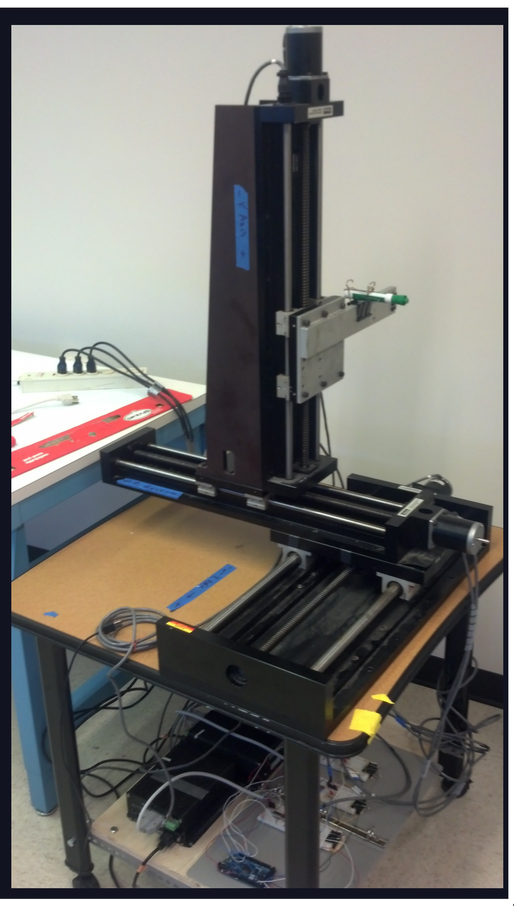
3D Printer: Hardware
MAY14-06

Advisor:
Dr. Tom Daniels
Client:
Iowa State University
(Dr. Tom Daniels)

Team Members:
Kyle Lichtenberg
Ross Friedmann
Andrew Speer
Jake Meyer
Cheng Song

Introduction

Problem Statement:
Our client, Dr. Tom Daniels, wants to repurpose an old 3-axis positioning system into a 3D printer. While building a DIY printer is a challenging task in itself, molding this positioning system into a 3D printer is a great undertaking. The large size of the positioning system allows for a large printing area, a positive in terms of printing, but a headache in terms of design.



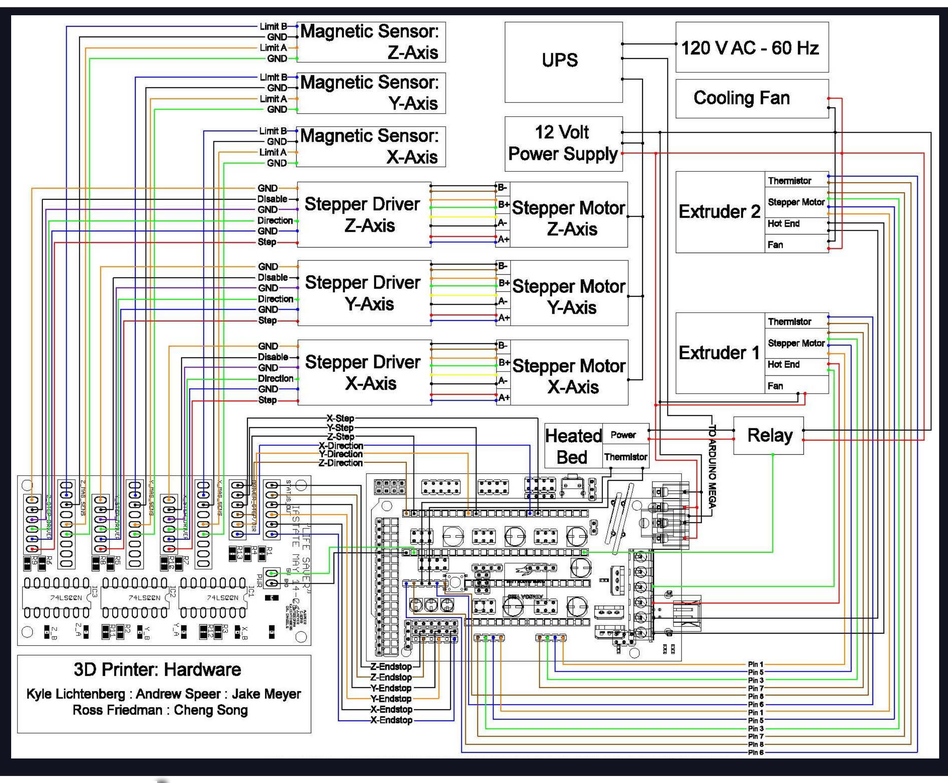
Solution:
To reach the final product, our team must apply our knowledge of electrical engineering , along with practical engineering skills and hardware implementation. The final product is defined by the following: a 3D printer capable of loading a file and successfully printing the object, while remaining user friendly and easy to operate.

Design Requirements

Functional Requirements:
- Microcontroller
- Computer
- Extruder
- Heated Bed
- Analog Circuitry
- Digital Circuitry
- Software

Non-Functional Requirements:
- Testability
- Reliability
- Accessibility
- Accuracy
- Safety
- Documentation
- Robustness

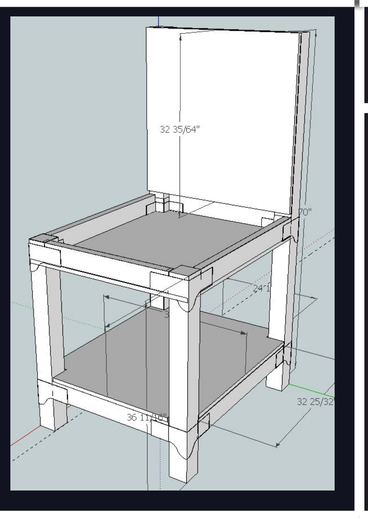
Wiring Diagram



Bench Design

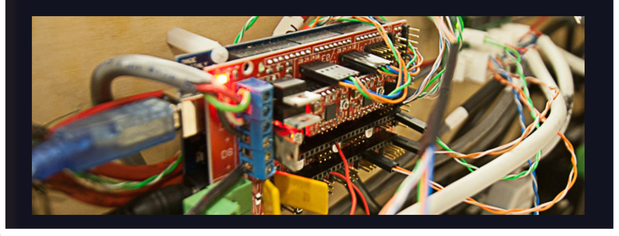
Approach
- Wood
- Upright mounting
- Robust

Construction
- Dr. Daniel's workshop
- Ensured stability
- Weight distribution



RAMPS

- Works with Arduino Mega
- Hardware-to-hardware interface
- Cut down cost and resources



Safety Circuit

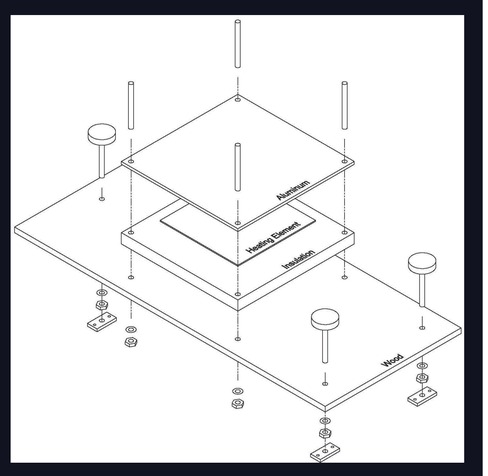
Design:
- Tests axis limits
- Tripped by magnetic sensors
- NAND gate logic
- Designed using Eagle software

Fabrication:
- PCB was fabricated elsewhere
- Components were then added

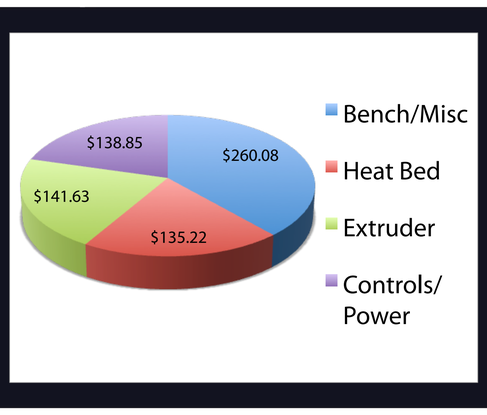
Heated Bed

Function:
- Prevents warping
- Operates at 100° Celsius
- Allows for expansion

Design:
- Silicon heating element
- Aluminum surface
- Insulation layer
- Leveling screws



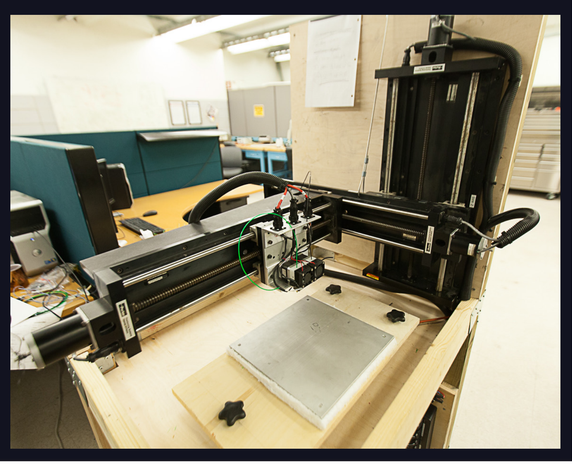
Cost



Testing

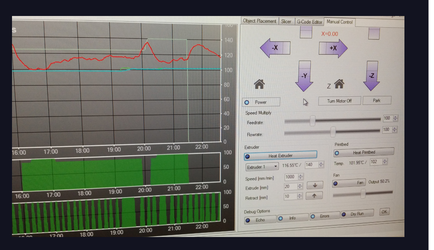
All components and systems were tested independently, followed by printing tests after the system was complete.

Tests:
- Calibration
- Alignment
- Heat systems
- Power systems
- Extrusion
- Safety



Firmware

- Repetier firmware
- Configuration
  - Calibrating Axis
- Capability
  - Momentum



Extruders

- Printer head
- QU-BD MBE extruder v9
- Dual extruder
- Assembled by us
- Had to be modified
  - Jamming issue