**Gabriel Yeager**

**SYSE 5110**

**Conceptual Design Breifing**

Develop approximate requirements allocation from  
functional decomposition  
• Develop system synthesis to examine feasibility for each  
alternative solution  
• Specifically identify how each feasible solution satisfies  
the stated need  
• Identify major subsystem interfaces  
• Identify major Operations and Maintenance considerations  
• Identify major system or subsystem trade studies required  
to select preferred design alternative  
• Identify major cost elements impacting feasible  
alternatives  
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Cost: $1000

Build volume: 250mm x 250mm x 250mm

Print speed: 150mm/s

Uses common 1.75mm filament

Prints PLA, PETG, ABS, Nylon, PVA, PC, and composites

Wifi connectivity

Bed level sensing

Cold nozzle change

MLH/OH: 0.02

A0 = 0.9989

**Requirements allocation**

**Power Supply Subsystem**

Convert standard 120v AC power to necessary type for control board and kinematics

Power Minimum: 240W

Utilize circuit breaker

Cost: $30

**Toolhead Subsystem**

Cost: $150

Hotend Component

Cold Nozzle Swap

Power Maximum: 120W

Weight Maximum: 40g

Cost: $40

Nozzle

Nozzle Temperature Minimum: 290C

Cold Side Temperature Maximum: 100C

Part Cooling Component

Airflow Minimum: 2.5CFM

Power Maximum: 3W

Cost: $30

Direct Drive Extruder Component

Cost: $50

Weight: 100g

Stepper Motor

Torque minimum: 40Ncm

Power Maximum: 28.8W

Bed Level Sensor

Accuracy: 0.005mm

Precision: 0.005mm

Power Maximum:0.5W

Cost: $20

**Bed Subsystem**

Cost: $50

Bed heater Component

Bed Temperature Minimum: 120C

Bed Surface

Bed Size: 250mm x 250mm

**Control Board Subsystem**

Cost: $200

Micro Controller Unit

Wifi Connectivity 2.4Ghz

Cost: $100

Stepper Drivers

Cost: $20

**Kinematics Subsystem**

Cost: $120

Stepper Motors

Torque: 40Ncm

Power Maximum: 28.8W

Cost: $70

**Frame Subsystem**

Cost: $50

Develop Synthesis

Core XY system – Moves toolhead in xy directions with belts and stationary motors.

Z axis movement by raising toolhead platform above fixed bed with motor(s) and lead screw(s).

Z axis movement by lowering bed with z screws below fixed toolhead

Produces fused deposition models from 1.75mm filament

Cartesian Bed Slinger

Moves toolhead along X axis on gantry with motor.

Moves bed along the Y axis with motor.

Moves Z axis by raising X gantry with motor and lead screw(s).

Motor drives belts and pullys attached to carriage.

Can be v wheels carriage or linear rail carriage.

Delta Printer

Moves toolhead along X, Y, and Z axes with 3 motors on vertical rails.

Toolhead attached to motors with movable arms.

Position of toolhead determind by position of the motors on the vertical rails.

Subsystem Interfaces

Operations and maintenance

System and Subsystem Trade Studies

Cost Impact on Alternatives Feasibility