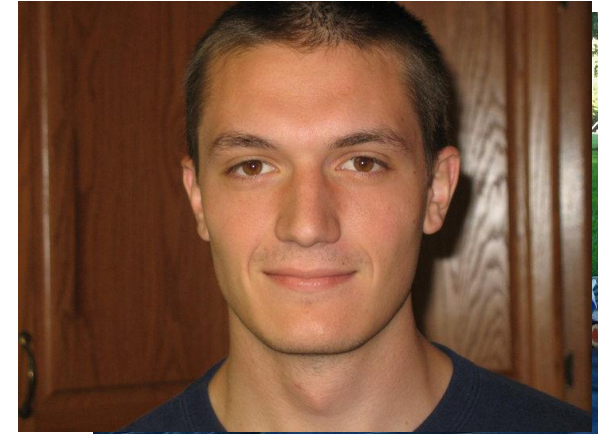


WonkaBot

3D Chocolate Printer



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Project Concept & Motivation

- Concept:
 - 3 Axis (XYZ) CNC Machine w/ Chocolate Extruder
 - Design chocolate treats on your computer
 - Print edible chocolate treats quickly
- Motivation
 - 3D printing is becoming more affordable
 - The next step is to print edible treats
 - Chocolate anyone?

Competitive Analysis

Product	3-axis motion (XYZ)	In Production	Solid Chocolate	Open Source
<p>Cornucopia (MIT)</p> 	No	No	No	Yes
<p>Imagine (Essential Dynamics)</p> 	Yes	Yes	No	No
<p>WonkaBot</p>	Yes!	Yes!	Yes!	Yes!

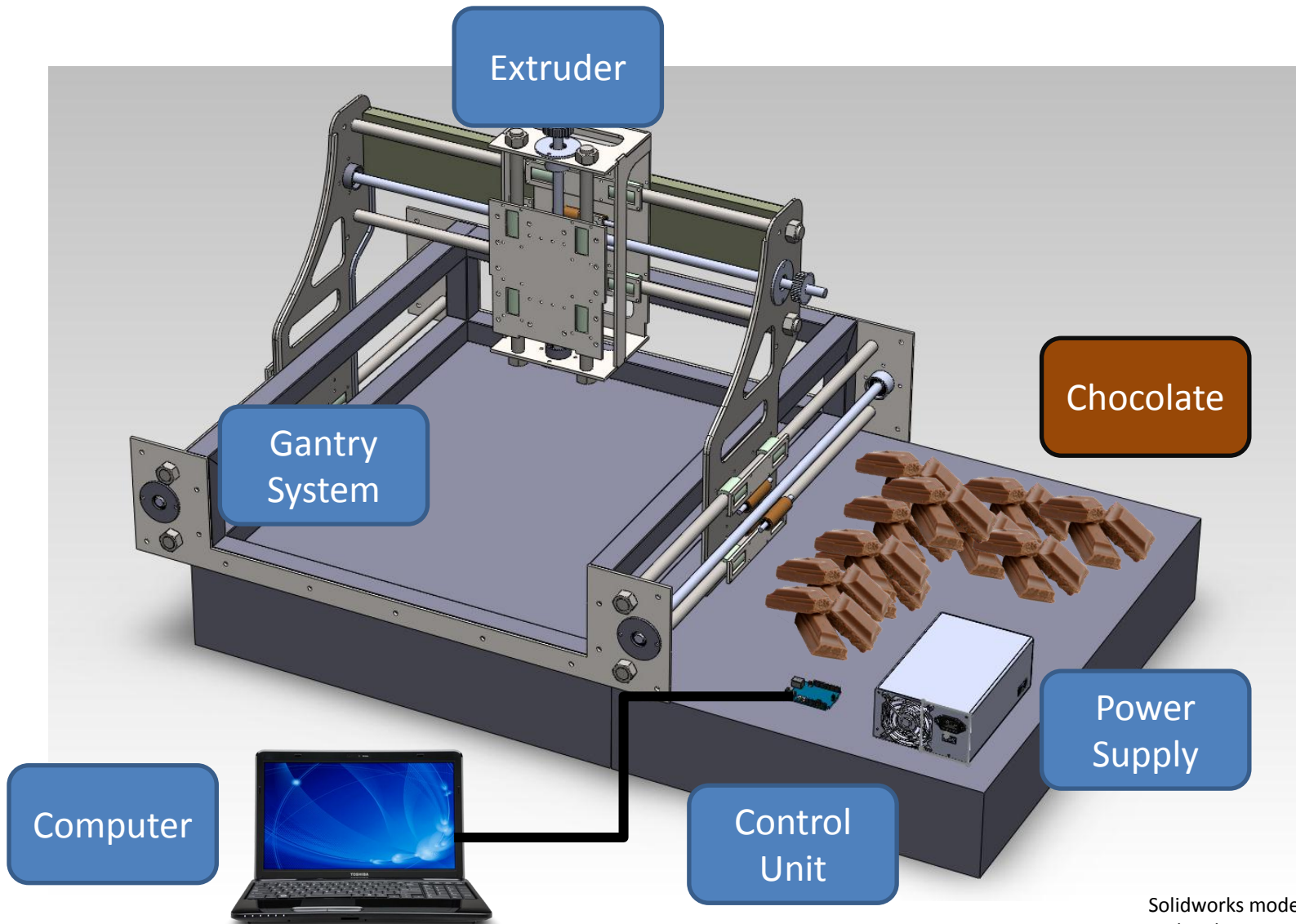
Requirements

Extruder	Software	Gantry (XYZ)
<ul style="list-style-type: none">• Accurately control temperature of chocolate• Create thin (<2mm) chocolate extrusion• Accurately control extruder flow rate• Hold and melt enough chocolate for at least one print	<ul style="list-style-type: none">• Interface with both extruder and gantry subsystems• Convert 3D models to stepper motor commands• PID control all temperature-related tasks• Prevent unnecessary waste of chocolate	<ul style="list-style-type: none">• Accurately position extruder over build area• Cool and harden chocolate as it exits the extruder• Utilize limit switches to prevent destruction or run-off outside of build area• Contain all subsystems and electronics for easy transportation

Technical Specifications

- Design and build heated chocolate extruder
 - Nichrome hot wire
 - Archimedes screw to extrude chocolate filament
- Cooled platform (Peltier unit) to harden chocolate
- CAD to GCODE conversion software
 - May use off-the-shelf solution (ReplicatorG/Skeinforge)
- 3-axis (XYZ) gantry system
 - Stepper motors for precise control

Architecture



Anticipated Risks and Mitigations Strategies

<ul style="list-style-type: none"> Chocolate may burn in extruder 	<ul style="list-style-type: none"> Keep chocolate barely above melting temperature keep chocolate moving
<ul style="list-style-type: none"> Chocolate doesn't come out in small extrusion 	<ul style="list-style-type: none"> Reduce nozzle size Rework nozzle shape
<ul style="list-style-type: none"> Chocolate flows too quickly out of extruder 	<ul style="list-style-type: none"> Slow down or back-drive Archimedes screw Reduce nozzle size
<ul style="list-style-type: none"> Chocolate flows out too slowly 	<ul style="list-style-type: none"> Increase nozzle size Increase torque of drive motor
<ul style="list-style-type: none"> Basin doesn't hold enough chocolate 	<ul style="list-style-type: none"> Use larger basin Supplement basin during build
<ul style="list-style-type: none"> 3D objects are difficult to model 	<ul style="list-style-type: none"> Support multiple modeling programs (SolidWorks, SketchUp, etc.)
<ul style="list-style-type: none"> 3D file to GCODE conversion is non-trivial 	<ul style="list-style-type: none"> Use off the shelf conversion program (Skeinforge)
<ul style="list-style-type: none"> GCODE to stepper motor command conversion is non-trivial 	<ul style="list-style-type: none"> Use off the shelf conversion program (ReplicatorG)
<ul style="list-style-type: none"> Stepper motors are difficult to control 	<ul style="list-style-type: none"> Use pre-built stepper motor drivers (EasyDriver)
<ul style="list-style-type: none"> Gantry system is hard to implement 	<ul style="list-style-type: none"> Look at open-source CNC implementations for inspiration (or get one donated)