DIGITAL PROTOTYPING PROJECT

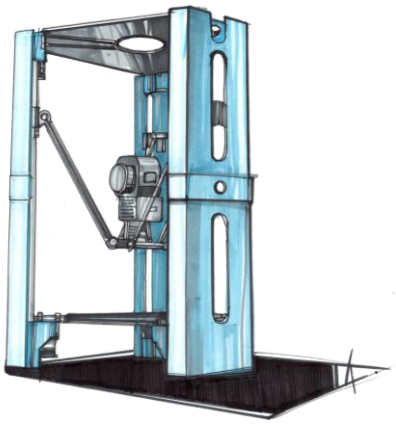
Chocolate Hydro 3D printer

This project will feature all forms of digital prototyping including CAD, hardware (laser cutting, CNC machining and 3D printing), software, and electronics.

One of the main challenges in 3D printing chocolate is in being able to very quickly solidify the melted chocolate. There are a number of commercially available chocolate 3D printers today. These printers all use cold air, or a cold build plate to try an solidify the chocolate as it is extruded, which is relatively slow, so these printers cannot print fast. They also cannot print designs with overhangs, as these need to be supported, which is not possible with chocolate.


In 2017, a team of students (Felix Lundblad, Gustav Östgren, Hugo Barsne, Jonathan Ahlse, Patrik Östlund, and Viktor Regefalk) came up with the idea of printing the chocolate onto the surface of cold water, which almost instantly solidified the chocolate, and then raising the level of the water by a specific amount for the next layer. They proved that the concept worked by manually using a syringe to deposit melted chocolate on to the surface of water and then manually raising the water level as they were printing.


Your job is to take this idea of printing on the surface of water into a complete working chocolate hydro 3D printer product. Your team will be given a 101 Hero delta 3D printer that you will need to convert into a working chocolate 3D printer that prints on the surface of water.



Your goal is to develop a working prototype of 3d chocolate printer that prints on the surface of water. The printer should print the first layer of chocolate on the build-plate, and then raise the level of the water by whatever layer thickness is chosen. The printer should then print the next layer on top of the previous layer, making sure that it adheres to the previous layer, and any overhanging features should float on top of the water and begin to solidify as soon as they make contact with the water.

Minimum requirements for the printer include:

MUST HAVE:

- Must use laser cutting
- Must use CNC machining
- Must use 3D printing (125cm^3 of SLS printing will be provided free of charge)
- Must have an electronic control system for controlling the water level
- Must have electronic control system for controlling the flow of chocolate

NICE TO HAVE

- A way of controlling the temperature of the chocolate to keep it molten until it is extruded
- An easy way to remove the chocolate part once the print is finished
- An easy way of replacing and/or refilling the chocolate supply

You will be supplied with a 101 Hero 3D printer, Arduino micro-controllers, sensors and other common electronic components, peristaltic pumps, syringes, servo motors, etc. and you will have a budget of SEK200 to purchase additional components.

Project Assessment

The project assessment will be as follows:

Assessment	When	Mark
System design: How complete is you system design of how the 3D printer will work? A basic idea, but no details worked out = 3 A good idea of the system with some details worked out in CAD = 4 A complete idea of the system in CAD and how each sub-system will work = 5	Week 3	30%
Water raising and chocolate extrusion sub-systems: How confident are we that you will be able to make a working water raising system and chocolate extrusion system within the next 3 weeks? Not very confident = 3 Somewhat confident = 4 Very confident = 5	Week 4	20%
Digital prototypes: Do you have at least 1 laser cut part, 1 CNC machined part, and 1 3D printed part? Is your 3D printed part properly designed for additive manufacturing? Not well designed for AM (could have easily been done in another way) = 3 OK design for AM = 4 Well designed for AM = 5	Week 6	20%
3D Printer demonstration: How well does you 3D printer work? Works but not reliably = 3 Works OK but chocolate parts produced are of average quality = 4 Works very well and produces nice chocolate parts (and includes some of the 'nice to have' features above= 5	Week 7	30%