Incredible Fused Filament Fabricator

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Background

- Specially designed metal waveguides are used to move high frequency signals with low loss and very high power handling.
- Waveguides are expensive with both difficult large lead times and high costs (> $200 per component).

Objectives

Build a waveguide fabrication pipeline, using a custom 3D printer to allow prototyping of RF waveguide components that is:

- Fast
  ○ Additive manufacturing should take hours as opposed to weeks
- Cheap
  ○ Daily usage costs will only include PLA and paints
- Accurate
  ○ Resolution ±0.5mm

Software/Firmware Design

3D Printed Waveguide Process

Waveguide Components are printed in pieces
Inside of waveguide painted with metallic paints
Create complex components for RF design

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Operational of the IFFF printer is governed by five RTOS tasks controlling the motors, heaters, memory, user interface and error handling respectively. The above flowchart depicts ways in which these tasks interact with each other.

System Overview

The IFFF printer is composed of five subsystems which control two heaters, four motors, flash memory and a touch screen UI.

Hardware Design

Hardware functionally is split between two PCBs, one for the MCU and flash processes and one to manage motor and heater controls as as well as generating our 24V, 5V, and 3.3V power.

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Results/Website

- Each subcomponent has been tested and essential integration has been done. However, due to COVID19, we were unable to have a complete, final product.
- We created a website to act as documentation so another student could successfully complete this project.

https://noamargalit8.wixsite.com/ifff