

Plastic Extruder

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Motivation

The motivation behind this project came from the love of 3D printing and its capabilities, especially in the world of engineering where prototyping is an essential element to draft ideas into reality. The plastic extruder extrudes 3D printing filaments. It has a deeper purpose as well which is to create composite filaments which would be suited for 3D printing structures of various properties

Background

Plastic extruders are machines that utilizes a process that melts and compounds various raw plastic materials into a continuous, differential cross-sectional shape depending on desired die. The proposed design includes an assembly of the mechanical system components: Screw, Barrel, Die, Motor, Band Heaters and control system components: Thermal Sensor, Stepper Motor Driver, Pressure Transducer, LabVIEW, DAQ, and Arduino.

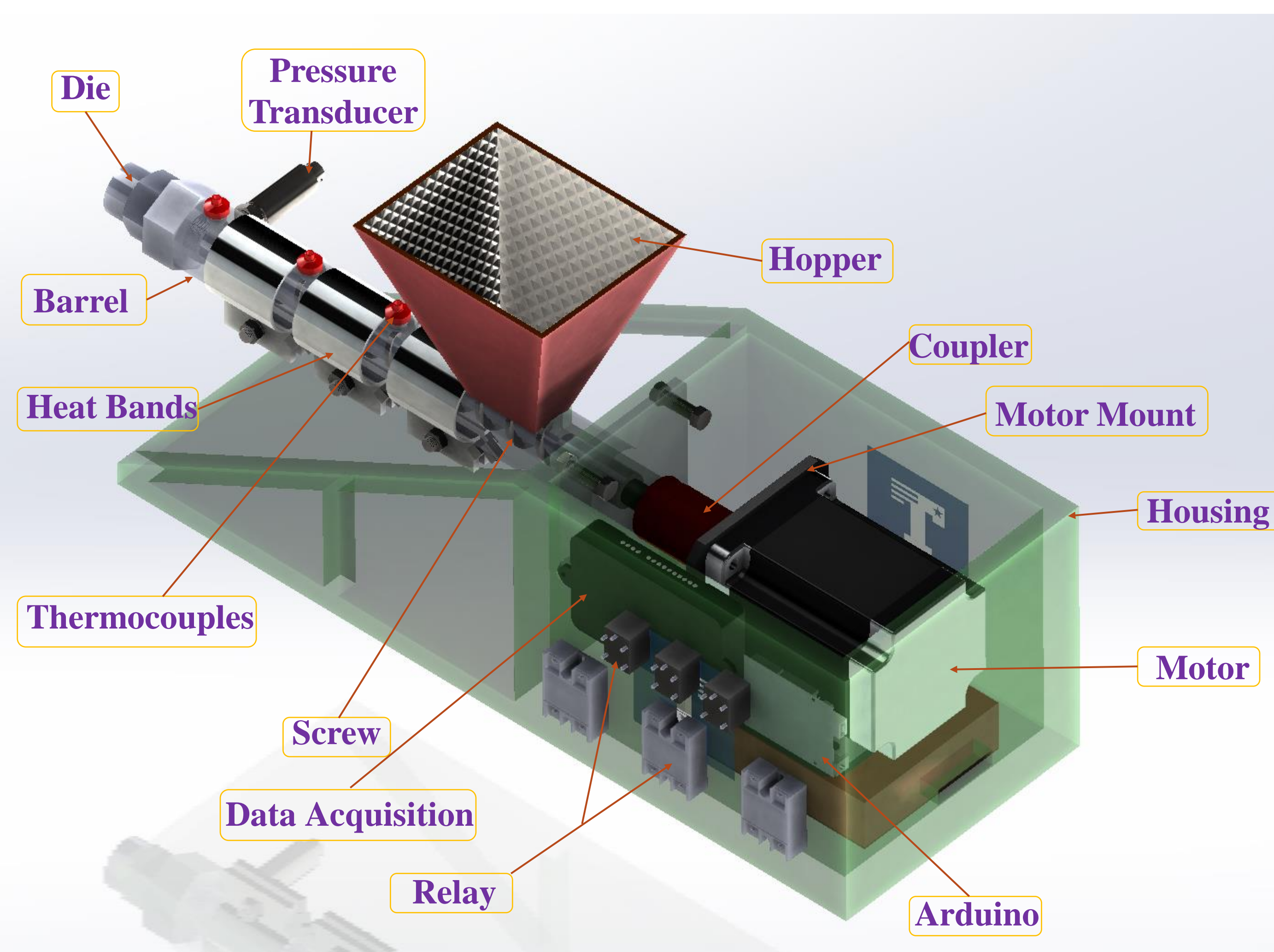


Fig 1: Labeled Components Tabletop Plastic Extruder

Abstract

The purpose of this project is to design, build, and test a plastic extruder that is capable of extruding composite extrudate. The design can handle a variety of thermoplastics with melting temperatures less than 350°C. The primary working variables of the extruder, are the zone temperatures and throughput, which are controlled using LabVIEW by manipulating on/off cycles of the heating bands and by manipulating the rotating speed by adjusting the pulse rate of the stepper motor.



Fig 2 : Tabletop Plastic Extruder

Screw Design

The building process of the extruder revolved around the heart of this project, which was the screw. The screw design was chosen based on

- Compression Ratio
- Length to Diameter Ratio
- Compatibility to different dies
- Extrudate throughput

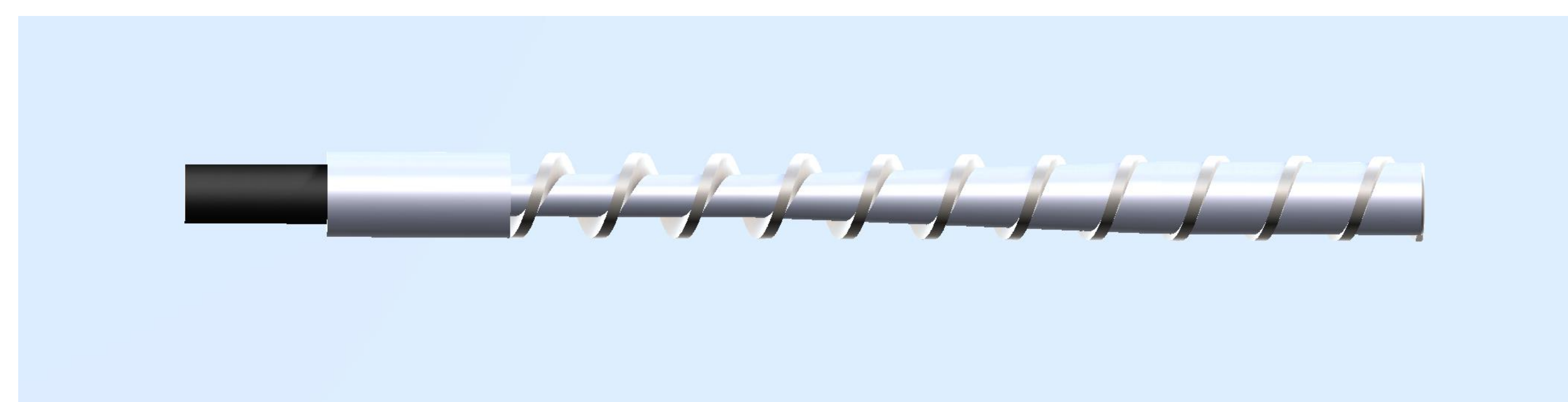


Fig 3 : Extruder Screw

DATA Acquisition

Motor and thermocouples are integrated to be controlled via LabVIEW through a DAQ module. The system receives feedback through sensors to maintain the desired motor speed and heating.

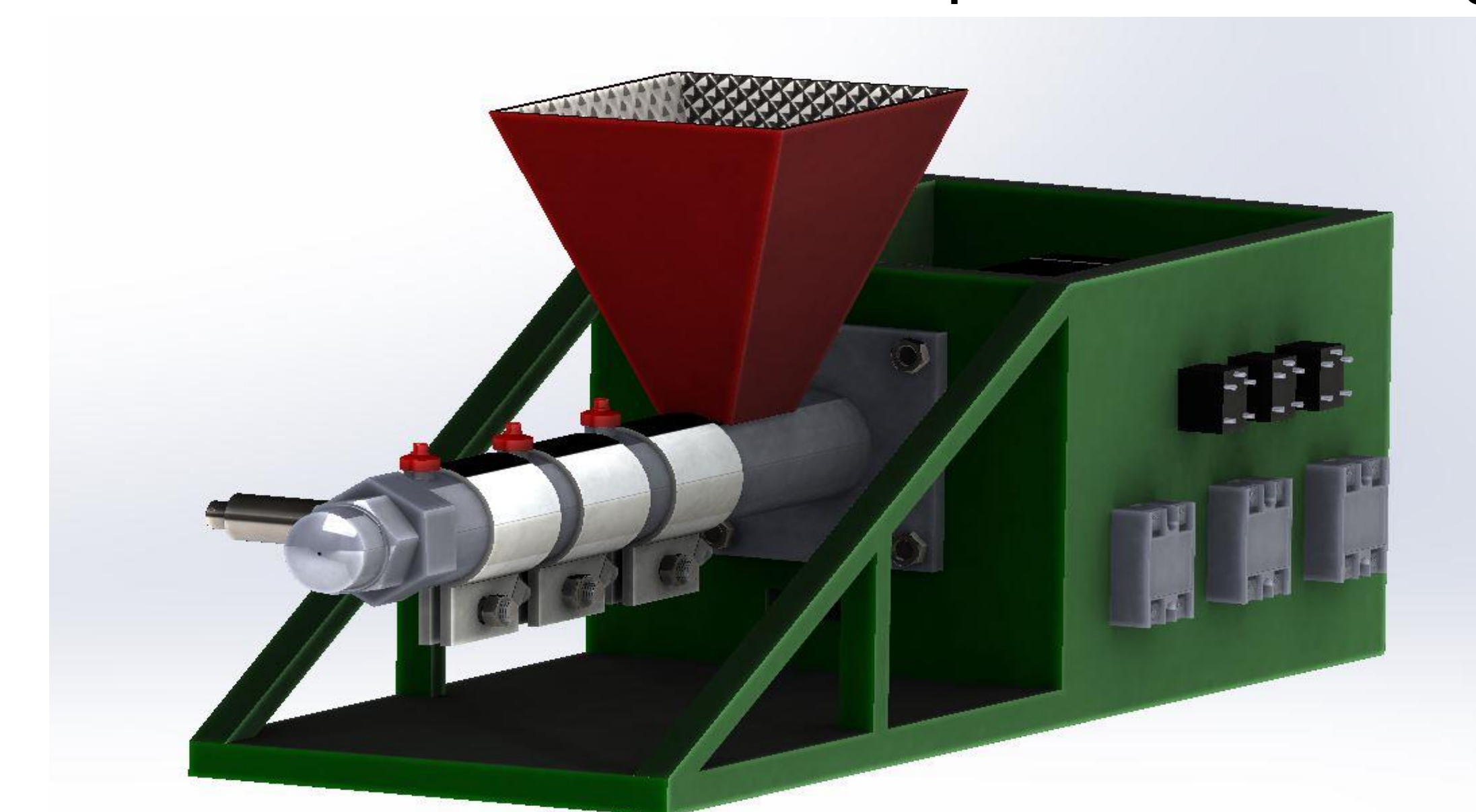


Fig 4: Control Components

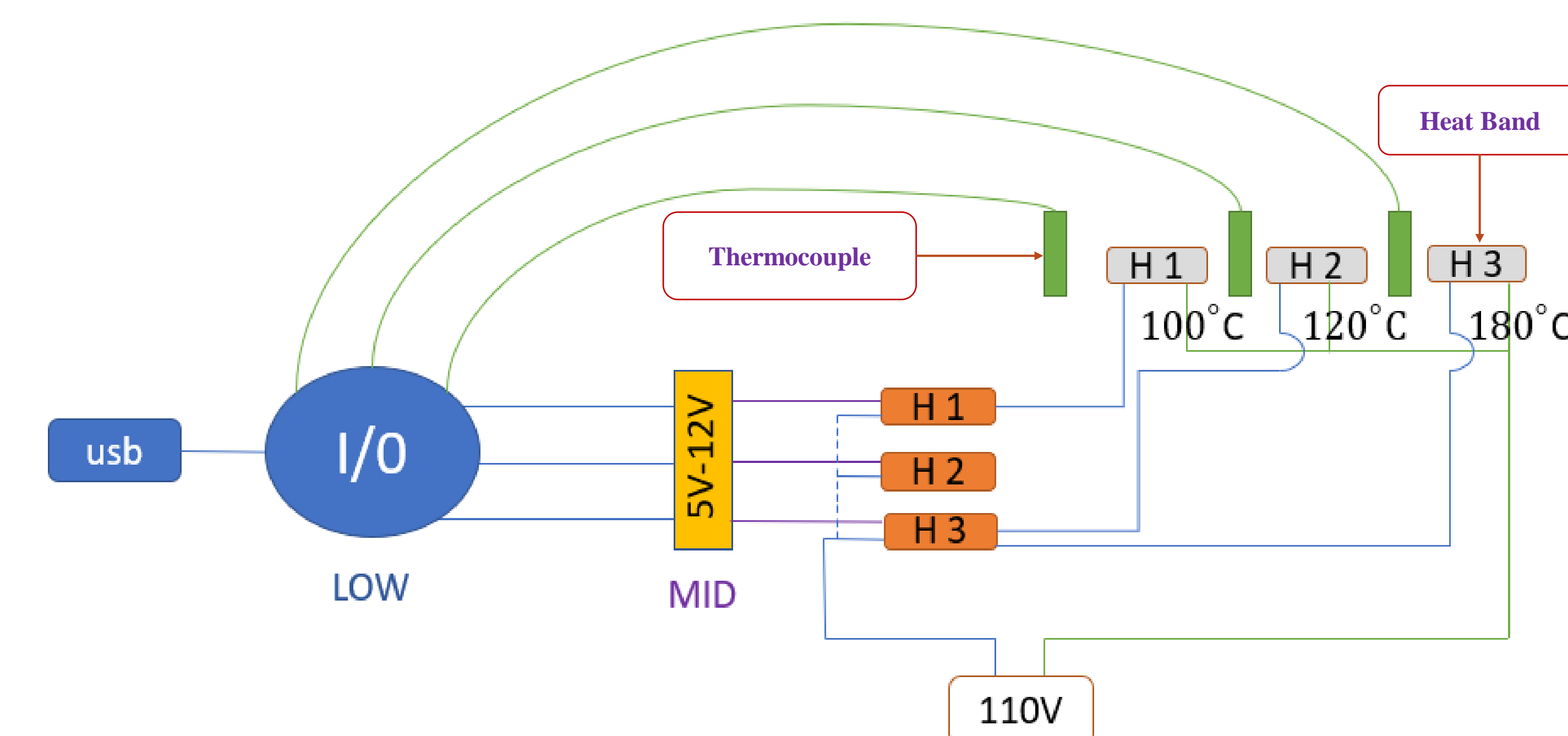


Fig 5: Heating Element Schematic

Acknowledgements

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