Digital Foiling Machine

What is foiling?

- Foiling is used to create different shiny designs and graphics on various materials.
- Traditional foil printing is a specialized process that involves heat, pressure, metallic foil, and a brass die. In this method, the foil and paper are pressed together using a heated die, resulting in a textured, debossed finish as the foil is transferred onto the card or paper stock.
- Digital foil printing, on the other hand, eliminates the need for brass plates. Instead, varnish is printed directly onto the paper stock using a printer, which means there are no setup costs. The varnish-printed paper is then passed through a heated rubber roller along with the foil, depositing the foil only where the varnish has been applied.

Objective:

- The objective was to design a digital foiling machine that is cost-efficient for small foiling orders and operates on a single-phase power supply, allowing small presses to perform fast and economical foiling.

Approach:

- Planned to develop a prototype to validate heating calculations and evaluate the foiling process. This prototype will also allow the PLC programming team to test their code, ensuring effective integration and performance.
- Conceptualized a timing belt–driven foil tensioner, conveyor, and heating roller system powered by a single motor. To lower motor torque and manufacturing cost decided to use a hollow Hard chrome-plated aluminum roller.
- After conducting thorough testing of the initial proof of concept, the final prototype with automatic paper feeding and collection will be developed.

Solution:

- I developed a robust digital foiling machine that can foil paper up to 2 feet wide and operate on a single-phase power supply.
- Developed a timing belt–driven foil tensioner, conveyor, and heating roller system powered by a single motor, using a hollow Hard chrome-plated aluminum roller that lowered motor torque by 30%, and manufacturing cost by ~15%.
- It features automatic paper feeding and collection, making it suitable for both small and large order quantities. The addition of a pick-and-place system ensures smooth operation and enhances efficiency in the foiling process.

My Role:

- Conceptualized and developed CAD, production drawings with GD&T for precise manufacturing.
- Performed Structural and Heater calculations.
- Performed DFMA to streamline production and reduce assembly time.
- Oversaw prototype manufacturing and procurement of off-the-shelf parts.
- Planned, managed, and participated in testing for validation.

- **Final Product -**

- **Prototype -**