THERMO-GEN

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Sponsor: Steve Miller at HeetShield

Problem Statement

HeetShield

- Our client: HeetShield
  - What they do and how they do it…
    - Create and test advanced protective materials
- What do they need us for?
  - The problem…
    - The testing process they use lacks precision and timeliness

Image from HeetShield.com

- This is an example of the paper making process

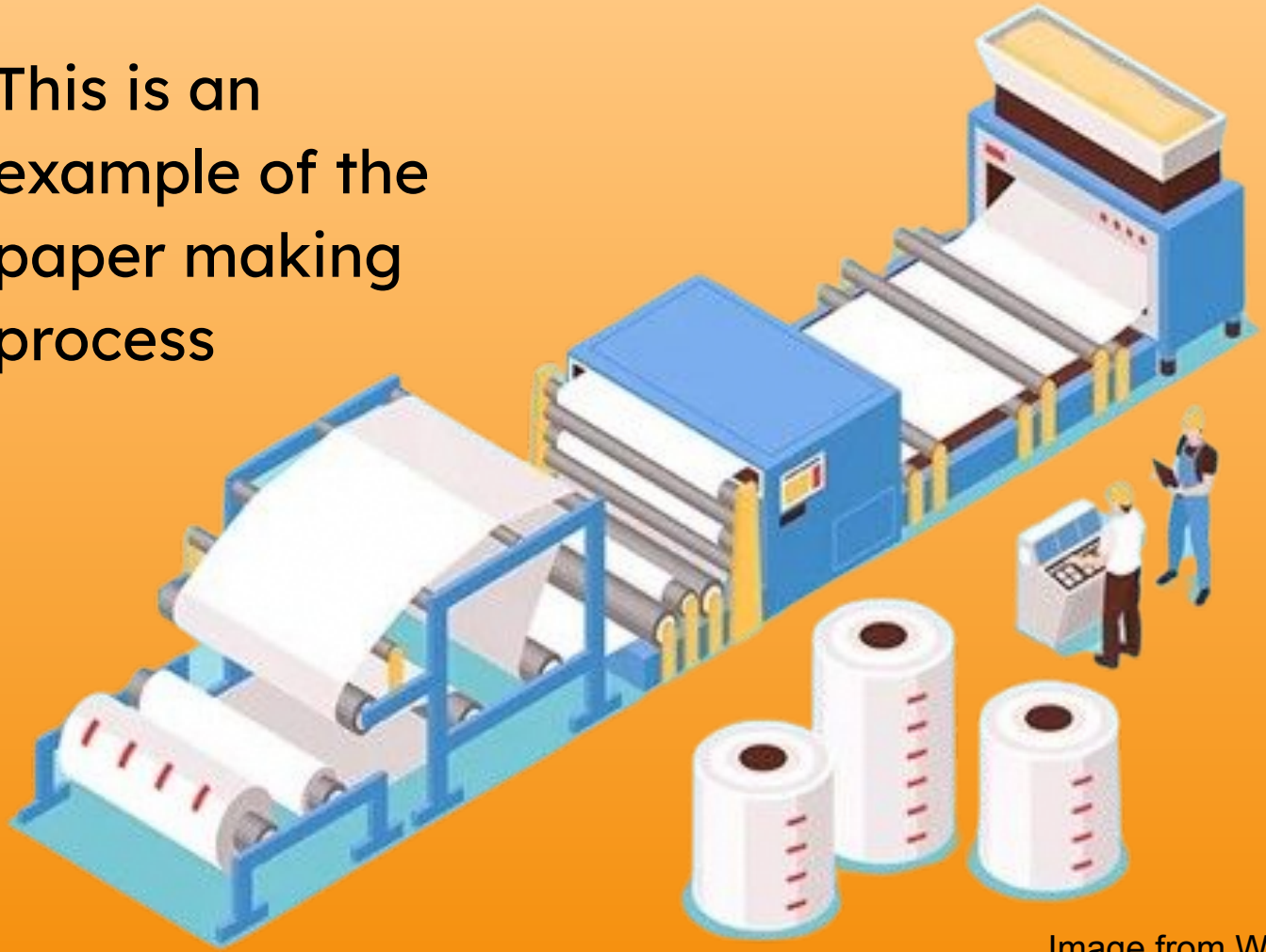


Image from World Paper Mill

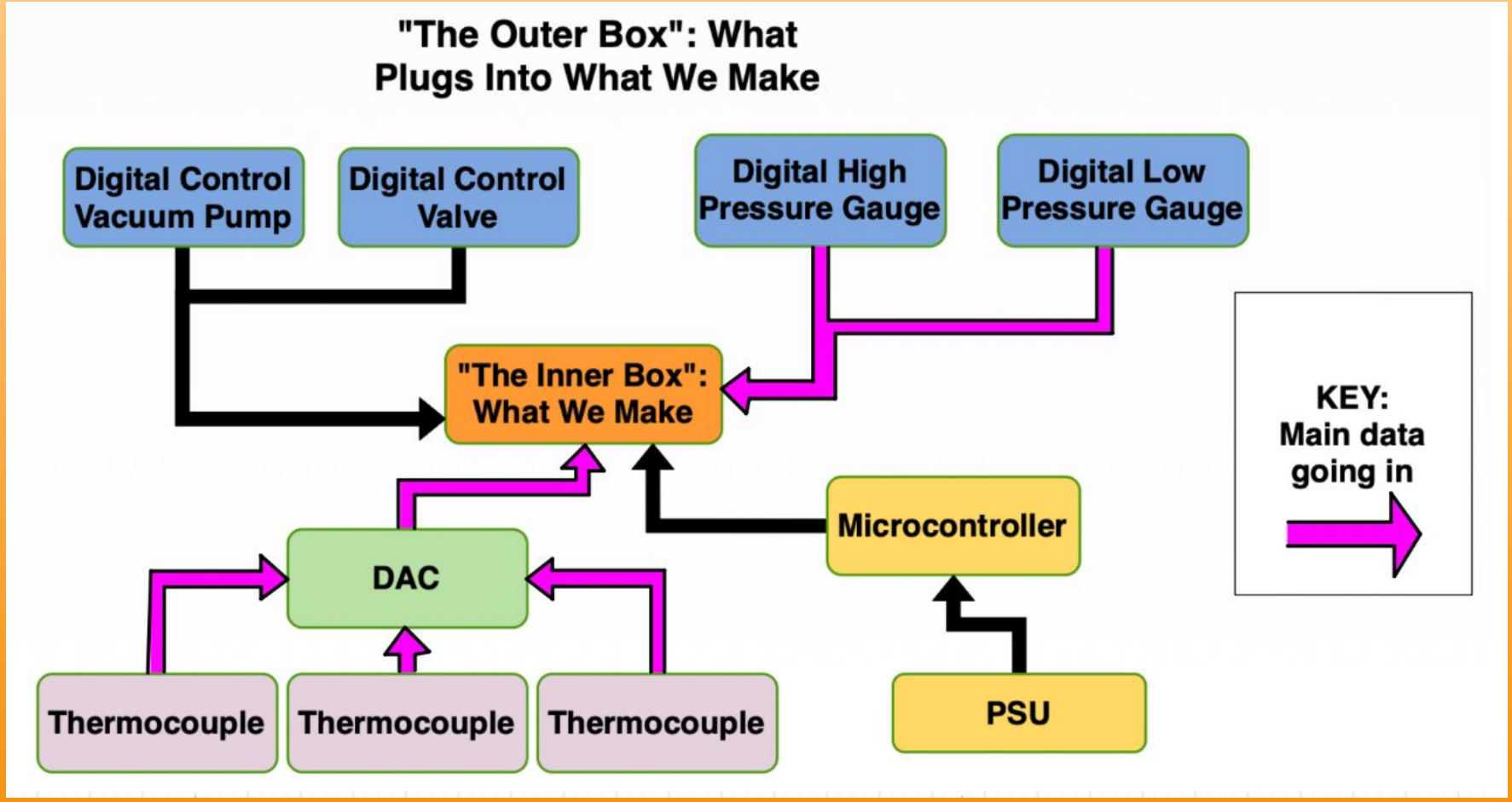
- This is an image of their process

Image from HeetShield

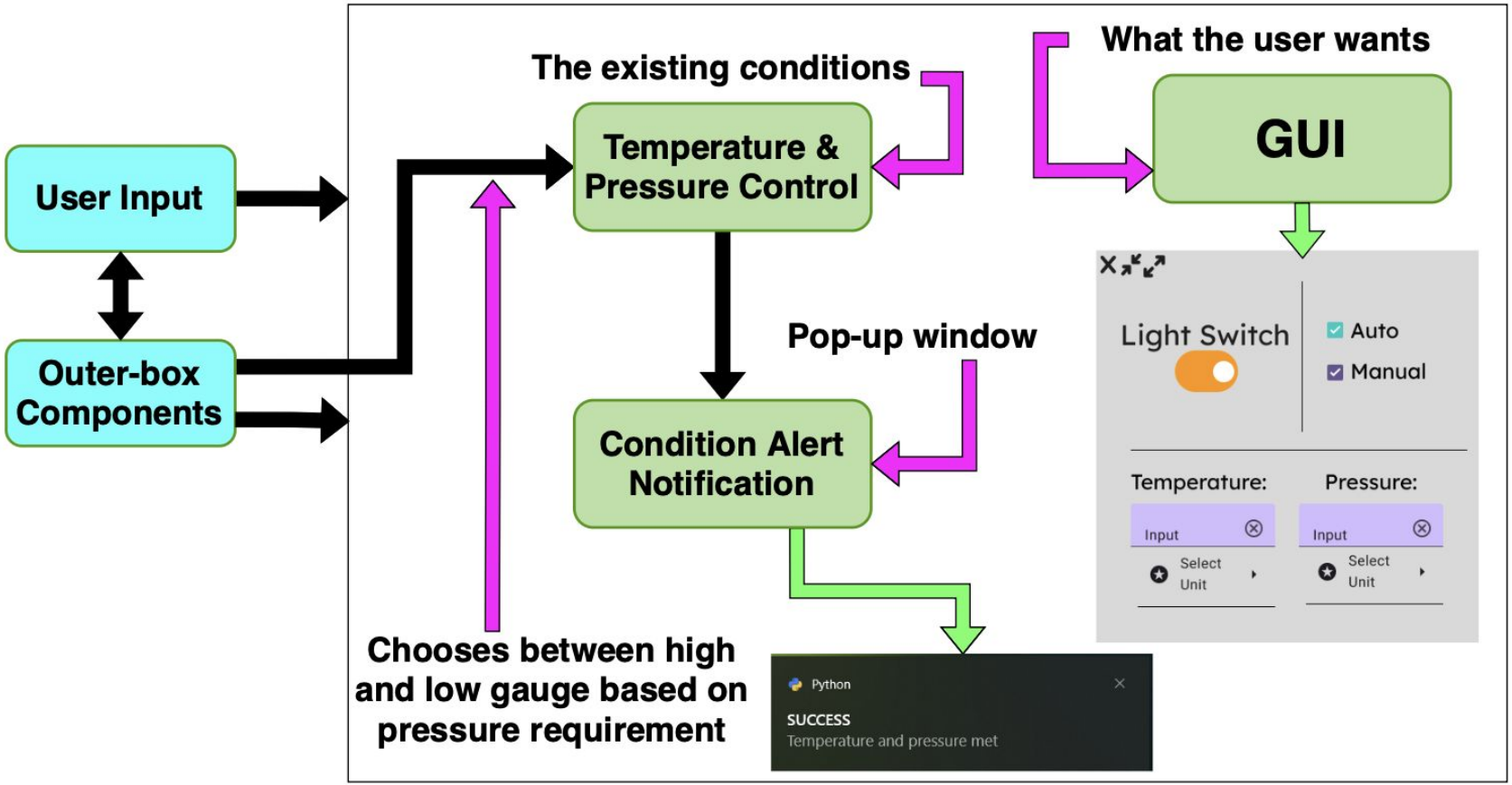
- This is the testing apparatus

Solution Overview

To address the client needs that outlined we have developed a solution: an integrated system to independently monitor and control testing parameters with user inputs and notifications


"The Outer Box": What Plugs Into What We Make
Digital Control Vacuum Pump
Digital Control Valve
Digital High Pressure Gauge
Digital Low Pressure Gauge
"The Inner Box": What We Make
KEY: Main data going in
Microcontroller
DAC
Thermocouple
Thermocouple
Thermocouple
PSU

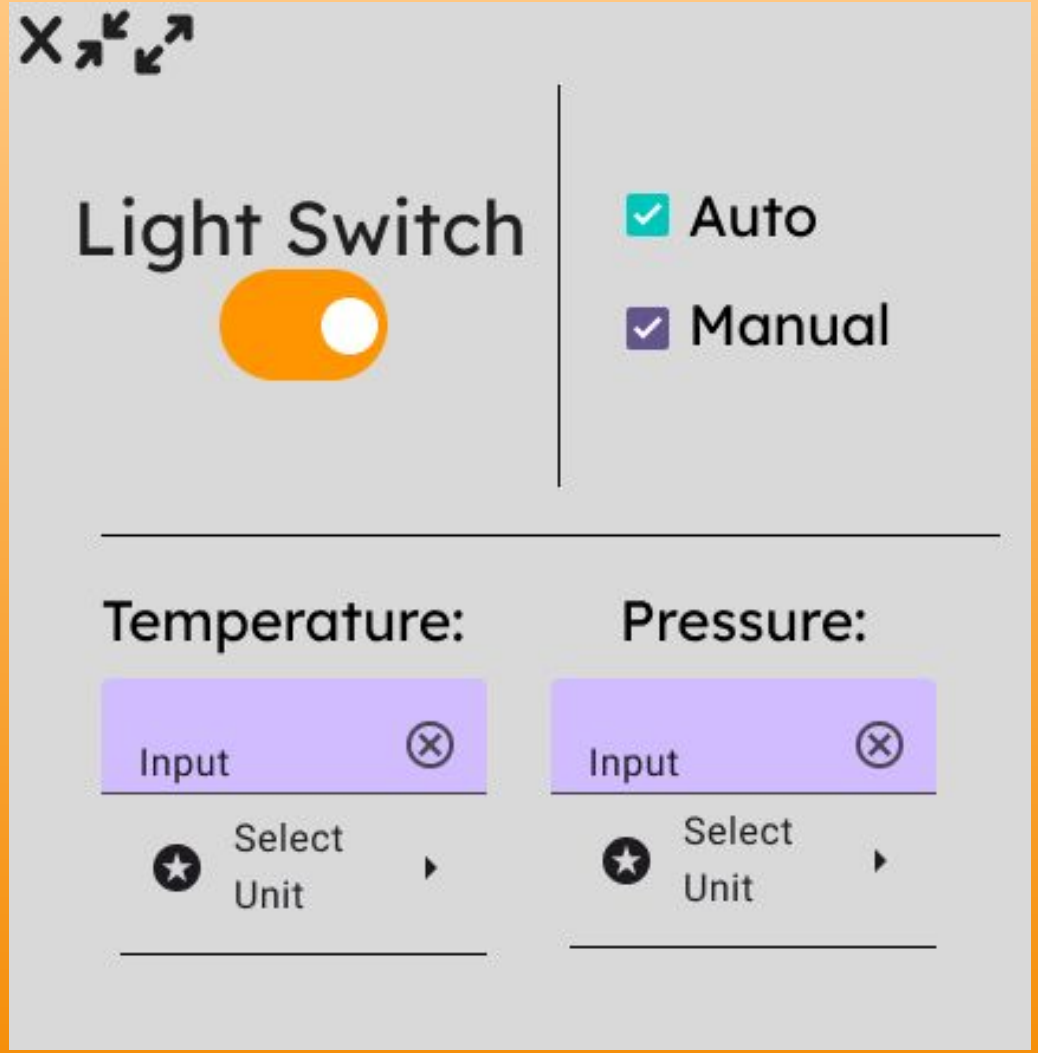
"The Inner Box": What We Make



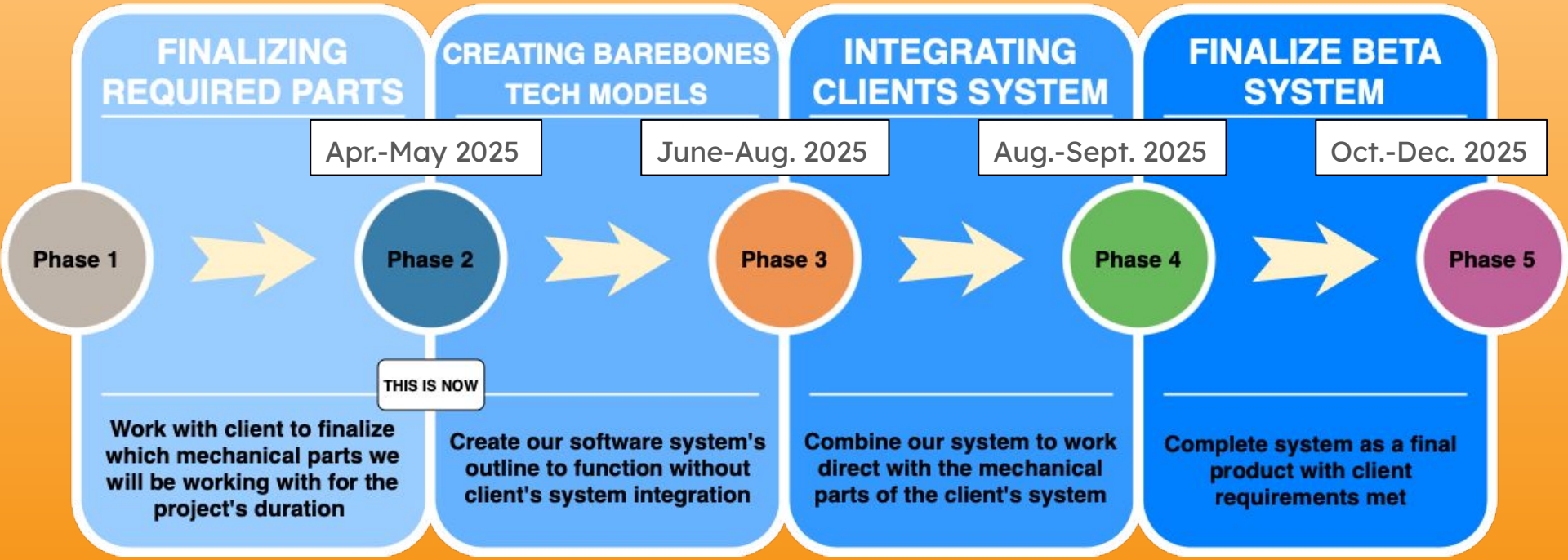
Solution Overview

The user-interface has a way for users to enter their desired parameters, displays current parameters, and provides notification when the system has reached the desired, new parameters.

This frees up engineers from having to constantly monitor the system and allows for more precise settings.



Project Schedule



Key Requirements

- How did we got our requirements?
  - We interviewed our client, did research and reached out to other professors
- Key Domain Requirements
  - Precise temperature and pressure control
  - Real time data monitoring
  - Minimize manual input
  - Clear notification system

Key Requirements

- Performance Requirements
  - Temperature and Pressure accuracy
  - Data Rate
  - Notification Response Time
- Environment Constraints
  - Lab Environment
  - Physical Space
- Temperature Control Automation
  - Read temperature data from thermocouples
  - Compare current temperature to target temperature
  - Adjust power supply
  - Stabilize and maintain desired temperature

Risks and Feasibility

- Sensor Failures
  - Likelihood: Medium
  - Severity: High
- Over-pressure/Over-temperature Conditions
  - Likelihood: Medium
  - Severity: High
- Communication Failures
  - Likelihood: Medium
  - Severity: High
- User error
  - Likelihood: Low
  - Severity: Medium
- Software Bugs
  - Likelihood: Medium
  - Severity: Medium
- Power failure
  - Likelihood: Low
  - Severity: High

Conclusion

- HeetShield creates protective materials for extreme environments so extreme precision is critical
- Current testing process is manual and time consuming
- Solution: an automated system with precise temperature and pressure control
- Key Topics:
  - High level solution
  - User requirements and system functions
  - Functional, performance and environmental requirements
  - Risk assessment and feasibility
- Next Steps: Finalize needed parts, Continue prototyping, LabView Integration