Dwight Look College of
ENGINEERING
TEXAS A&M UNIVERSITY

**ECEN 403 Final Presentation
Team URS-1_Enjeti_Matrix_Converter
Jack Alagood, Kyle Bedrich, Ian Farrar**

Problem Overview

- The rise of energy-intensive computing (AI model training, cloud computing, data centers, etc.) creates a need to optimize power delivery to these loads

- Matrix converters offer bi-directional power flow, adjustable input power factor, and greater power density relative to traditional rectifiers
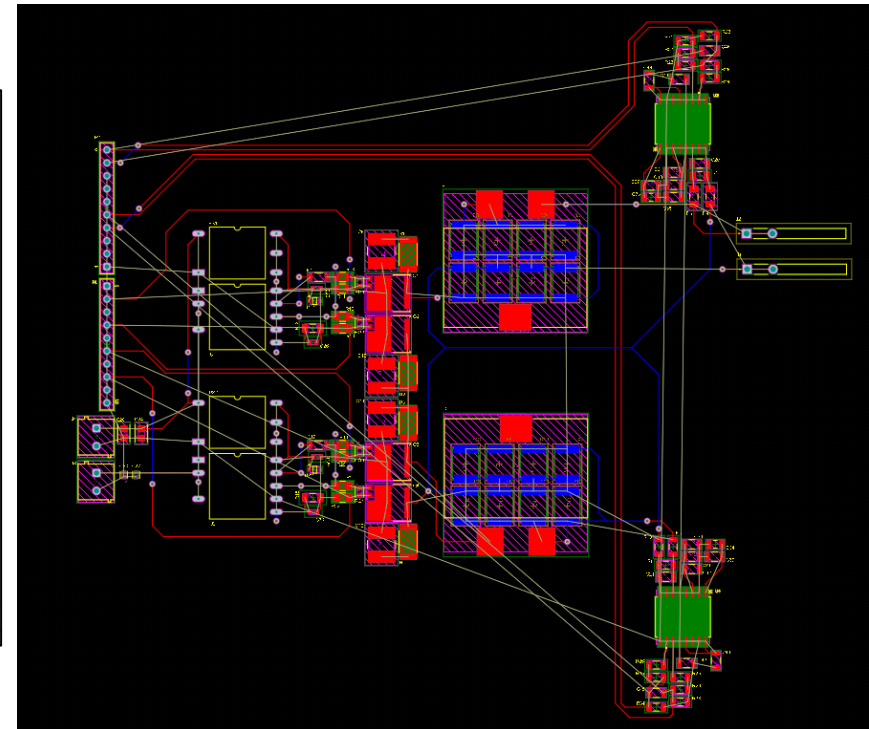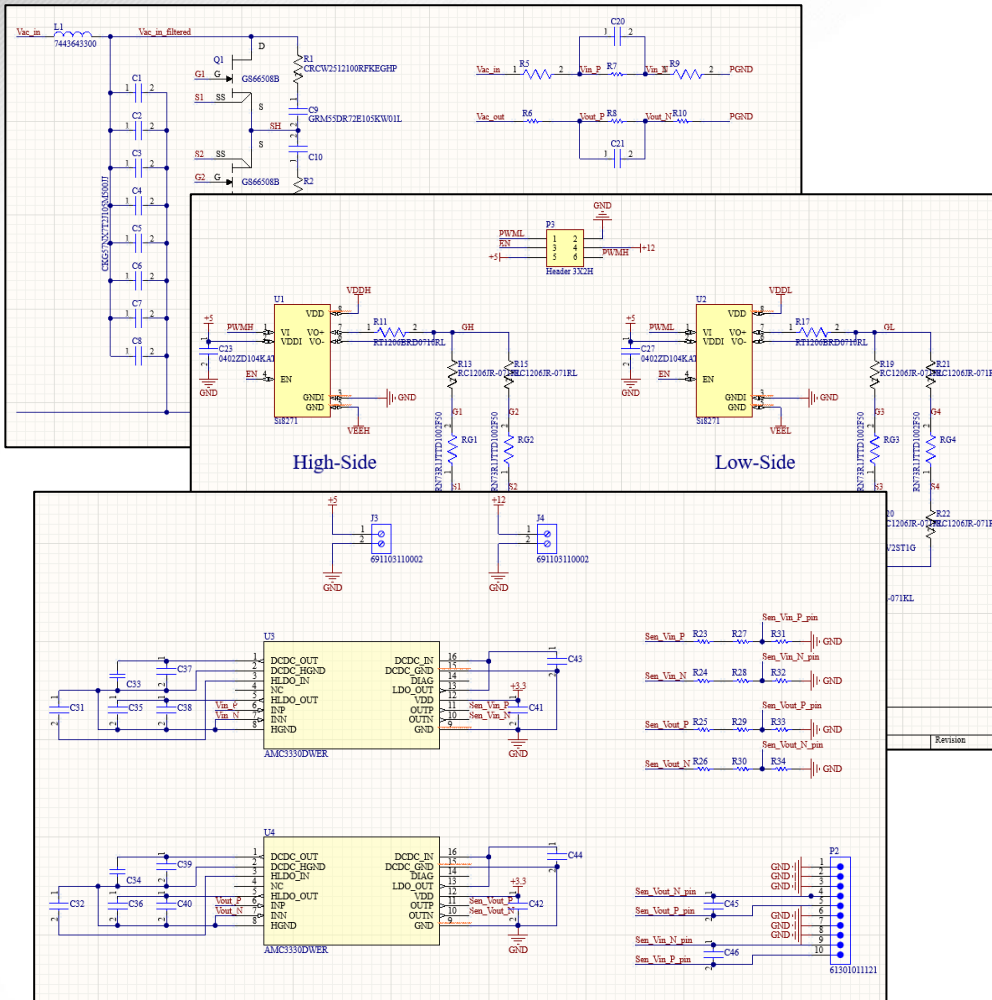
Problem Overview
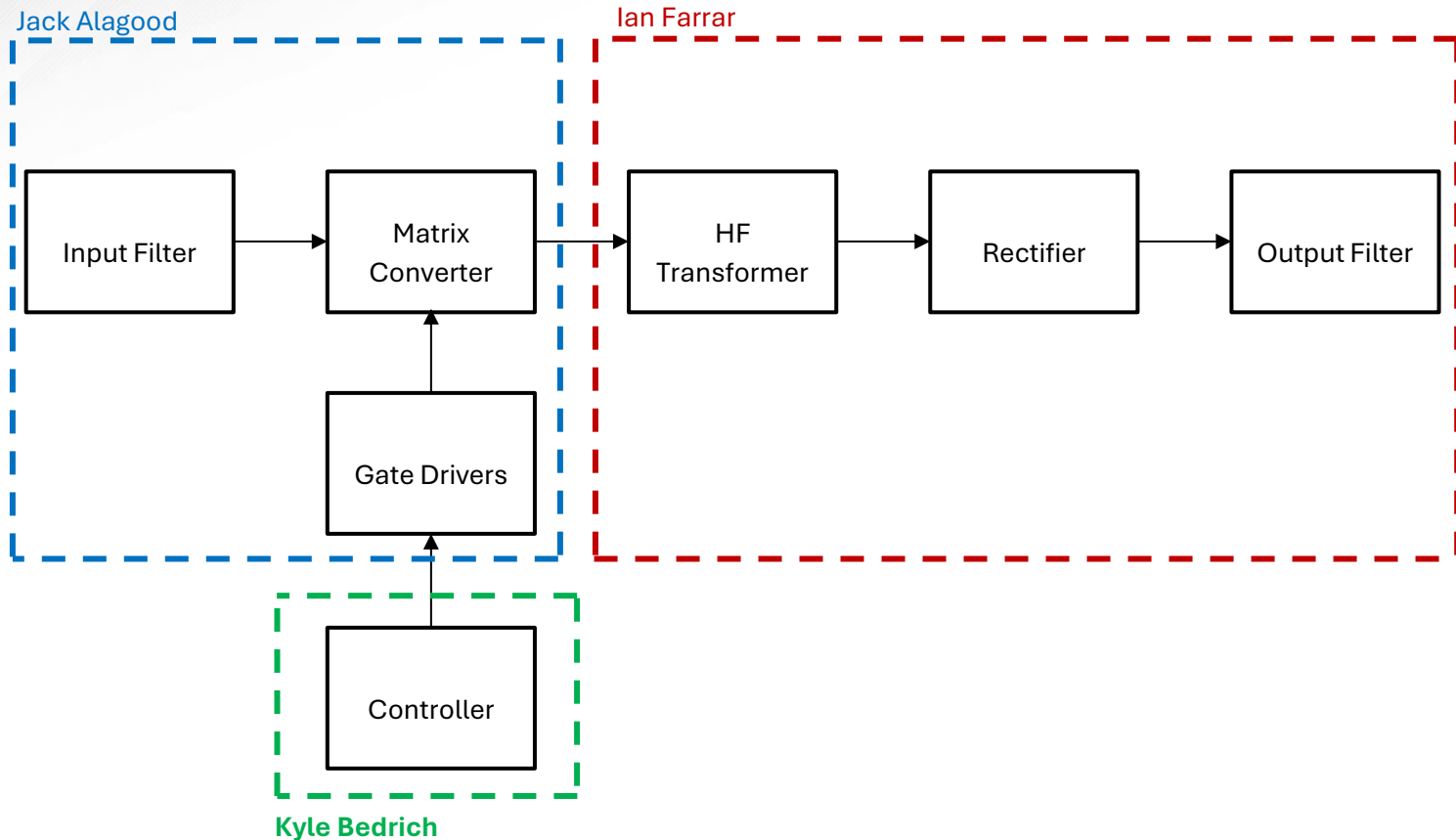
Engineering Design Accomplishments

- Schematics done for gate driver, voltage sensor, and primary side for single-phase converter (will expand to 3-phase after verifying current design)
- Finalizing PCB layout and traces

Engineering Design Accomplishments

Execution and Validation Status

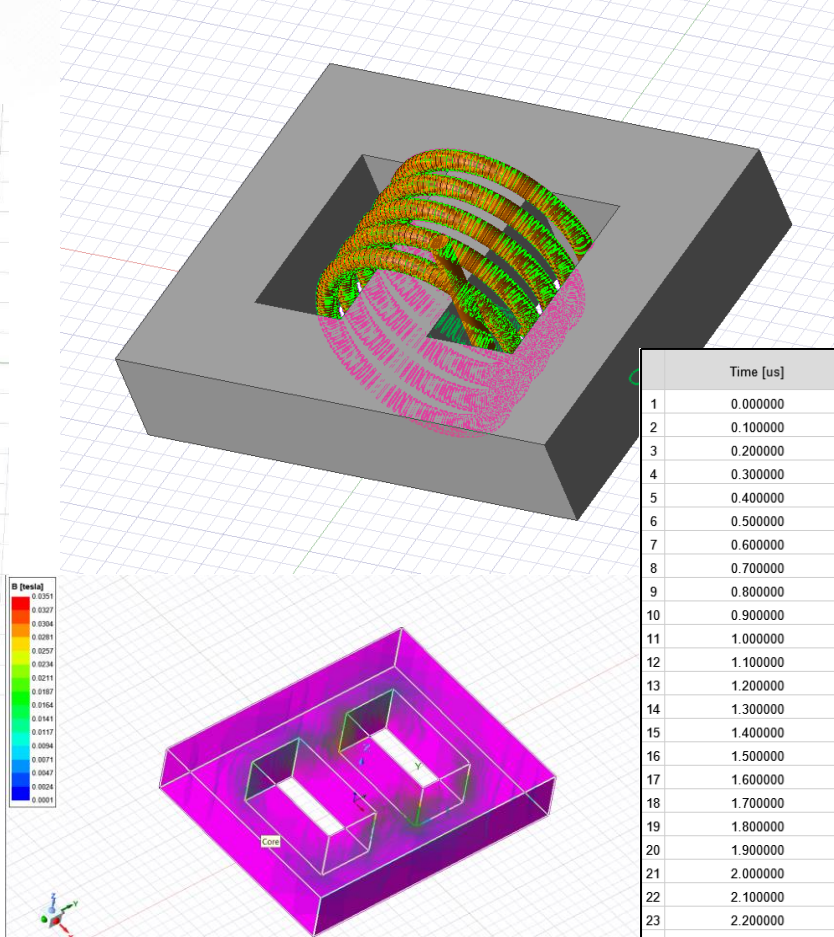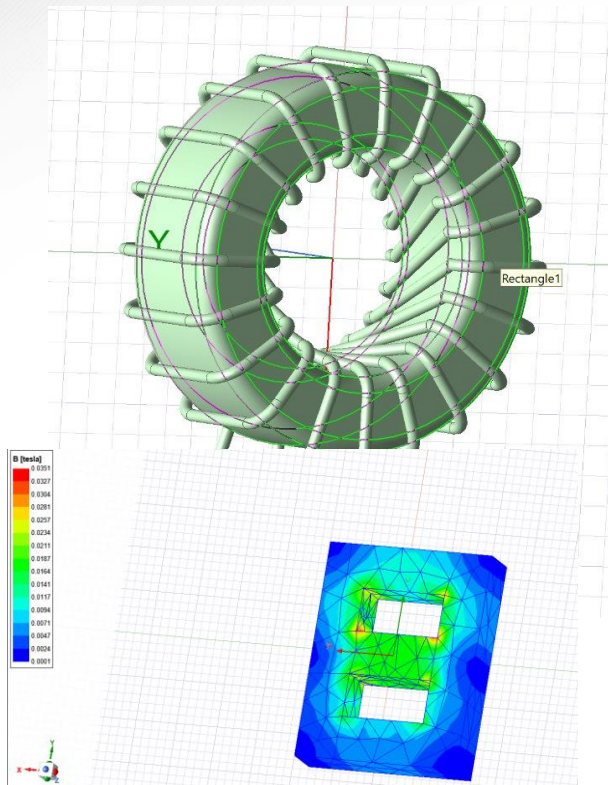| Task	Due Date	Status
Gate driver schematic	9-19	Complete
Voltage sensor schematic	9-26	Complete
Matrix converter schematic	10-10	Complete
PCB layout	10-31	Complete
PCB tracing	11-21	In Progress

Remaining Tasks

- Finish PCB trace, refine board design, order parts, assemble PCB

- Next semester we will be testing the single-phase circuit, then implementing the full 3-phase design, and collecting data on the converter's performance

Engineering Design Accomplishments

- Parametric core models for both torroid and E core shapes completed. Simulations for inductor design have been ran.

- In process of modifying parametric core dimensions to achieve specific performance metrics for inductor design

- Will use experience gained from inductor design to direct transformer design

Engineering Desian Accomplishments

Execution and Validation Status

Task	Due Date	Status
Compile Research Document for HF Transformer Design	10-17	Complete
Learn how to use ANSYS modeling software and develop parametric model	10-31	Complete
Develop E-core model as alternative to original torroid and run simulations	11-14	Complete
Modify parametric models to fulfill inductor performance metrics	11-28	In Progress
Design transformer	Beginning of next semester (using winter break to catch up due to change of scope of task in mid-October)	In Progress

Remaining Tasks

- Rest of semester will be used to fine tune inductor design and simulation, and then I will move onto transformer design.

- I aim to have the transformer design done by the start of next semester. Next semester will start by assembling the designed transformer, testing, and implementing in full 3x1 matrix converter.

Engineering Design Accomplishments

- Designed control system and validated functionality in PowerSim software.
- Currently validating controls system using HIL in conjunction with the TI F28379D board.

Engineering Design Accomplishments
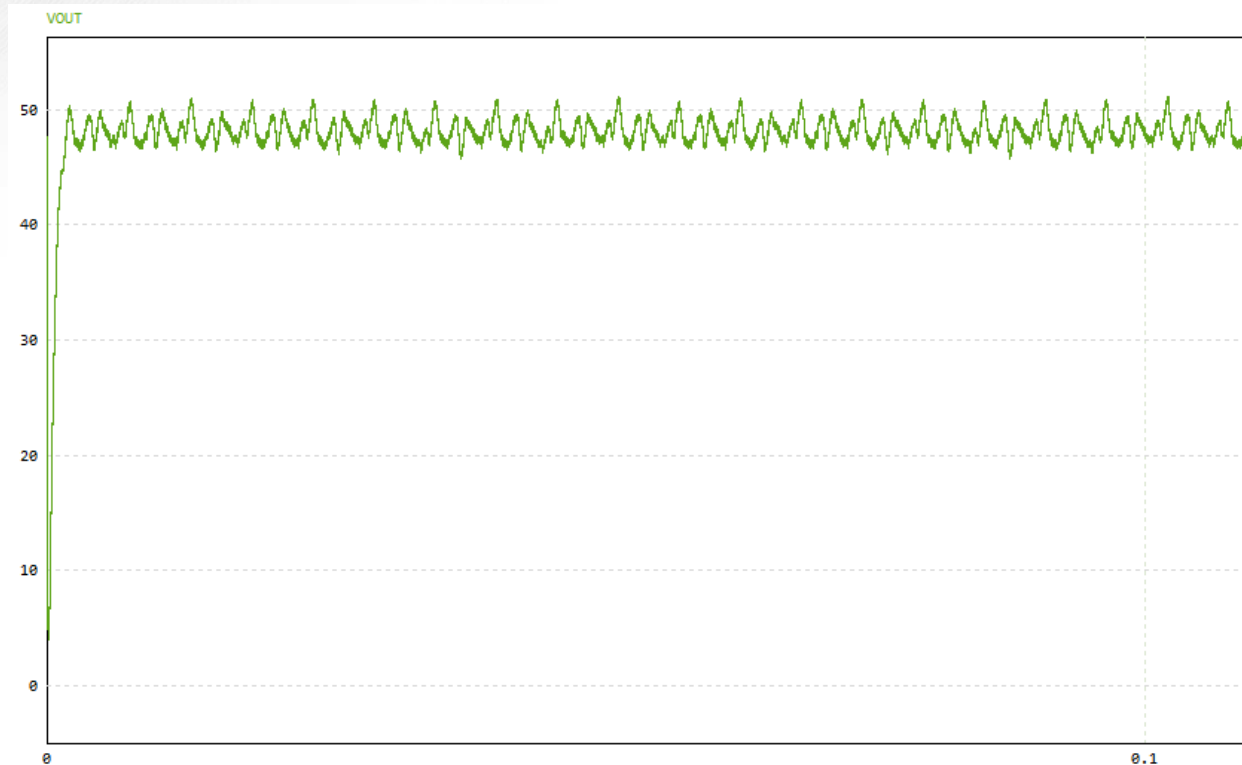
- Picture of simulated output voltage in PowerSim with validated control logic

Execution and Validation Status

- Validation currently underway for control system

- Utilizing Typhoon HIL system to test control system blocks and switch output

Remaining Tasks

- Execution will occur after every portion of the control subsystem is validated

- Implementation onto PCB

- Full controls test with power system

Execution and Validation Status

Task	Deadline		Status
URS Program Application	9/3/2024	🟩	Complete
Analyze Prior Studies	9/5/2024	🟩	Complete
Acquire Software Licenses	9/5/2024	🟩	Complete
Concept of Operations Report	9/15/2024	🟩	Complete
Research	9/19/2024	🟩	Complete
Functional System Requirements	9/26/2024	🟩	Complete
Interface Control Document	9/26/2024	🟩	Complete
Validation Plan	9/26/2024	🟩	Complete
Design and Simulation	10/10/2024	🟩	Complete
Status Update Presentation	10/23/2024	🟩	Complete
Midterm Presentation	10/10/2024	🟩	Complete
PCB Design	11/21/2024	🟦	In Progress
PCB Assembly		⬜	
Testing		⬜	
Final Presentation	11/20/2024	🟩	Complete
Final Demo		⬜	

Execution and Validation Status

	8/19/2024	8/26/2024	9/2/2024	9/9/2024	9/16/2024	9/23/2024	9/30/2024	10/7/2024
URS Program Application								
Analyze Prior Studies								
Acquire Software Licenses								
Concept of Operations Report								
Research								
Functional System Requirements								
Interface Control Document								
Validation Plan								
Design and Simulation								
Midterm Presentation								
PCB Design								

	10/14/2024	10/21/2024	10/28/2024	11/4/2024	11/11/2024	11/18/2024	11/25/2024	12/2/2024
PCB Design								
PCB Assembly								
Testing								
Status Update Presentation								
Final Presentation								
Final Demo								