Project name: WBG Devices-Based Matrix Converter
Team members: Jack Alagood, Kyle Bedrich, Ian Farrar

Problem Statement

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

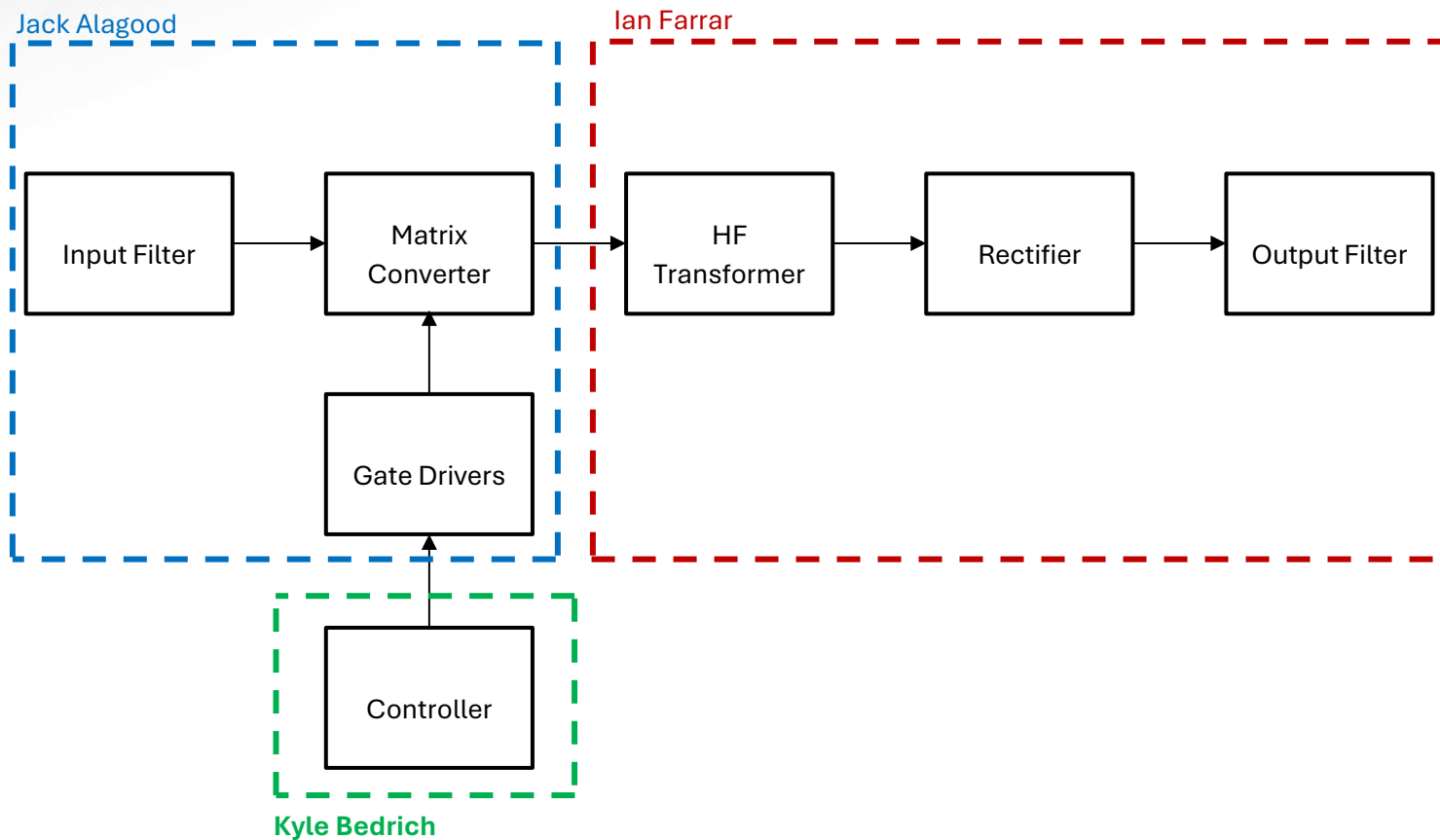- Though many solutions have been presented, there remains room for improvement in efficiency and cost

Proposed Solution

- GaN technology promises greater power density than SiC

- Matrix converters offer bi-directional power flow, adjustable input power factor, and greater power density due to less storage elements
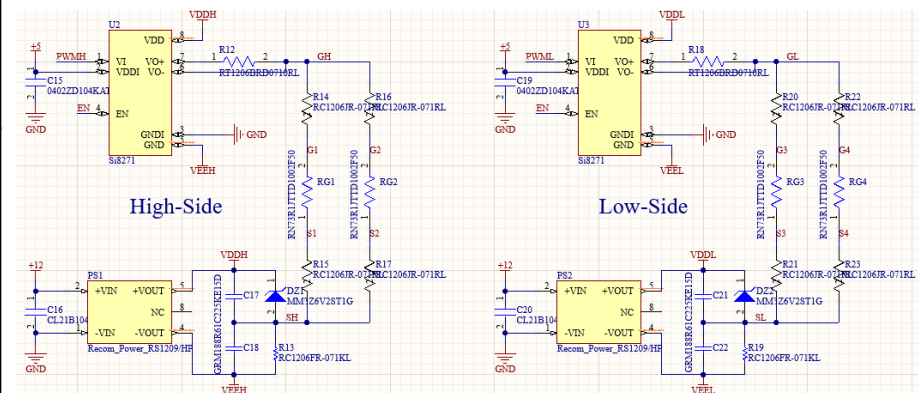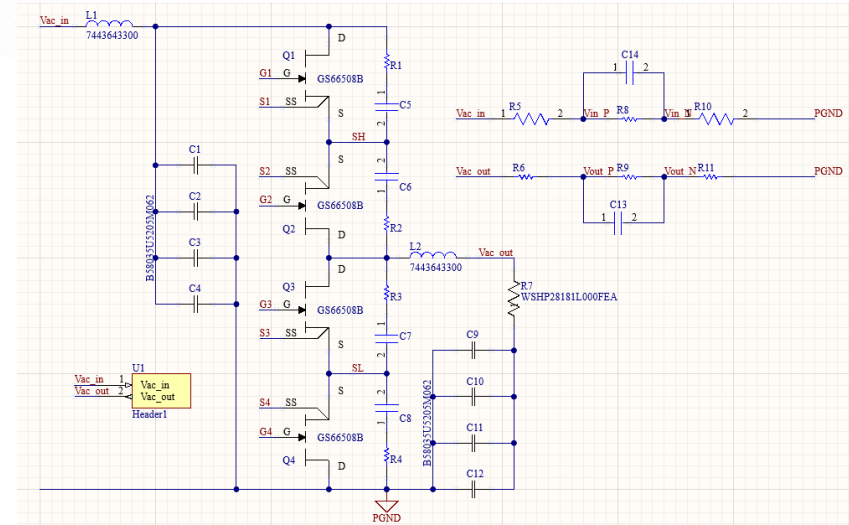
System Diagram

Jack Alagood

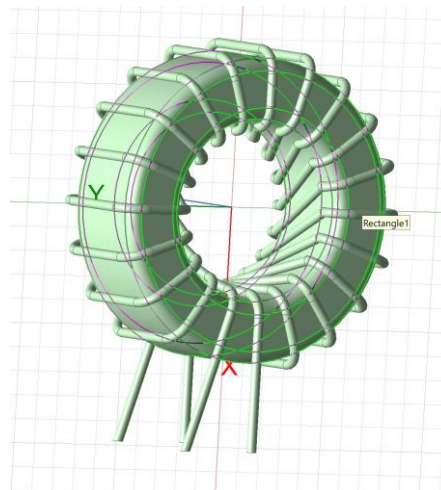| Accomplishments since the last presentation |
| --- |
| • Familiar with matrix converter elements (~10h)
 • Familiar with Altium's schematic and PCB design interfaces (20h)
 • Proposed schematics for voltage sensor, gate driver, and single-phase ACDC converter (20h) |
| Ongoing progress/problems and plans until the next presentation |
| • Replace inadequate components (must be rated appropriately)
 • Design PoC PCB
 • Link and test schematics with control devices |

Accomplishments since the last presentation	Ongoing progress/problems and plans until the next presentation
• Finished bulk of transformer research to narrow down type (material, shape) of transformer and compile list of significant equations (10 hours) • Familiarized self with parametrization of 2D model in Ansys Maxell (10 hours)	• Convert previously built transformer model to be parametric • Setup infrastructure to convert excel files to simulation files to be processed by HPRC

Kyle Bedrich

Accomplishments since the last presentation	Ongoing progress/problems and plans until the next presentation
• Working matrix converter switching signal with correct switching logic (30h) • PSIM code generation working (10h)	• PSIM ABC-DQO transformation for sensing 3-phase voltage phi • Control system HIL testing with TI F2837x and validation
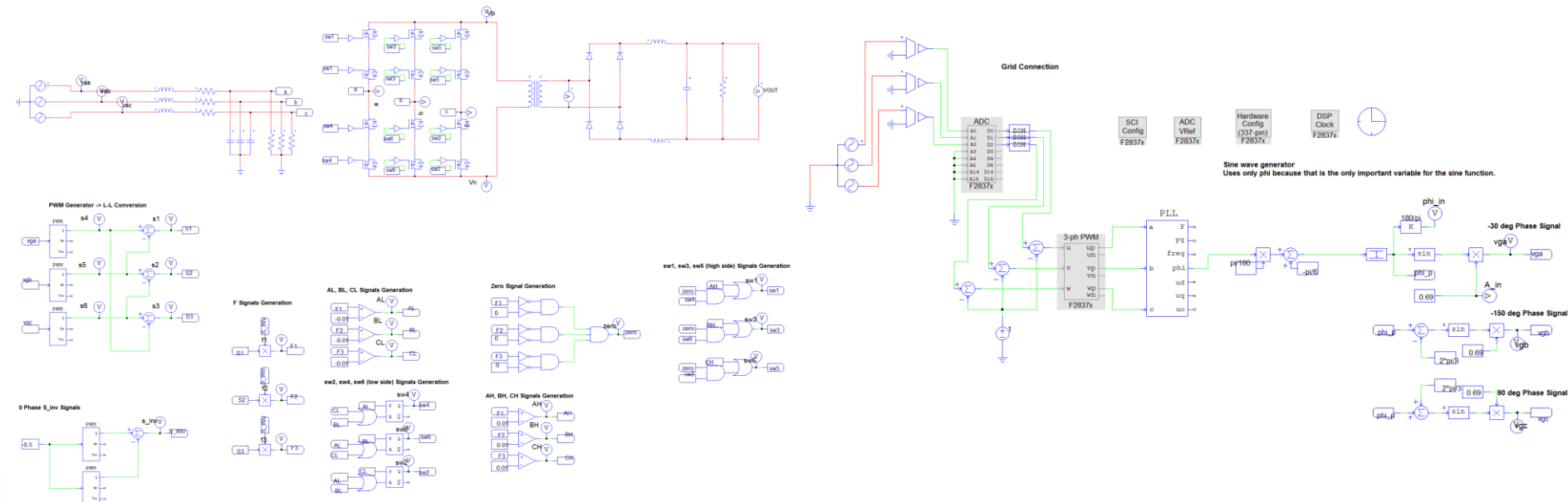
Execution Plan

	8/19/2024	8/26/2024	9/2/2024	9/9/2024	9/16/2024	9/23/2024	9/30/2024	10/7/2024		Legend	
URS Program Application	██	██	█							Complete	🟩
Analyze Prior Studies		██	█							In Progress	🟦
Acquire Software Licenses		██	█							Overdue	🟥
Concept of Operations Report			██	█						Not Started	⬜
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 Assembling				██				
Testing					██	██	█	
Status Update Presentation		██						
Final Presentation						██		
Final Demo							█	

Validation Plan

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	10/31/2024	🟦	In Progress
PCB Assembly	11/7/2024	⬜	
Testing	11/26/2024	⬜	
Final Presentation	11/20/2024	⬜	
Final Demo	11/26/2024	⬜	
			Legend
		🟩	Complete
		🟦	In Progress
		🟥	Overdue
		⬜	Not Started