EE/CPRE/SE 491 Weekly Report 8 Meeting Time 2:00 – 4:00 P.M. Monday in Durham
Date: Week of March 26, 2018
Group Number 4

High Current Pulse Generator for the Application of Transcranial Magnetic Stimulation

Clients/ Advisors: Priyam Rastogi, Neelam Gaunkar, Jayaprakash Selvaraj, Dr. Mani Mina

Project Objective: Over the course of 2 semesters, design, fabricate, and test a high-current pulse generation device for use in TMS research.

- Objective of Circuit
  - Peak Current of 2 KA +10%
    - EMF feedback must be considered
  - Peak Current Sustained for 400 µs
  - Rise/fall time of 100 µs
  - Up to 36 Hz pulse frequency (Commercial Benchmark)
  - Circuit Input is 120 V wall outlet.
  - Range of Load - 5 micro-Henry (min) to Max(Undefined)
  - 10 pulses a minute max
  - Circuit shall be monophasic;
    - If successfully completed then a biphasic version shall be built.
  - The device shall output multiple waveforms (Square, Sawtooth, etc.)

Team Members:

Brian Kirkpatrick: Head of Circuit Design
Jon Rothfus: Head of Micro-Controllers, Team Communications Leader, Webmaster
Tania Alvarado Carias: Head of Electrical Safety
Abdul Bahashawn: Head of Rectification Circuits
Yan Wang: Head of Component Selection
Curtis Richards: Team Leader

Sub Teams:

Chassis Design: Tania, Curtis, Yan	-Meets Thursdays 2:00-2:30 p.m. Howe
Rectification Circuit: Abdul, Yan, Brian	-Meets Fridays 2:00-3:00 p.m. Marston
Power Circuit: Tania, Curtis, Abdul	-Meets Fridays 11:15-12:00 p.m. TLA
Micro Controller: Jon, Brian	-Meets Wednesdays 1:15-1:45 in TLA

Weekly Summary:

- Power Circuit:

We began mounting parts on the chassis base. However, all efforts later in the week were shifted to the transformer to correct an unbonded neutral.

- Chassis Design:

The chassis base has been drilled to mount parts.

- Micro-Controller (M.C.):

This week we began testing the IGBT using standard test instruments in the labs. As the IGBT gate will be driven by the MC, we needed to verify pinout and basic operation before testing MC control of the IGBT. At this point in testing with low voltages and current the IGBT appears to operate as expected, but testing of switching with much higher voltages and a range of loads applied is needed.

- Rectification Circuit:

We began and completed the soldering process of our rectification circuit. We made three separate full bridge rectifying circuits as the board was large enough and it is good to have backups and we also checked out the transformer's performance using a multimeter.

Accomplishments of the Past Week:

Each member is to write up a reflection on their work throughout the week. The reflections can be found at https://iastate.app.box.com/folder/46145323949

Pending Issues:

I. Due Dates
   a. Weekly Report to be filled out by Saturday at midnight

II. Team Reports
   a. Update your sub team sections accordingly

New Business:

1. Project Plan V2
   a. Proposed Design and Solution - Abdul
   b. Project Time Line - Yan
   c. Risk Feasibility - Tania

d. Standards - Chuck

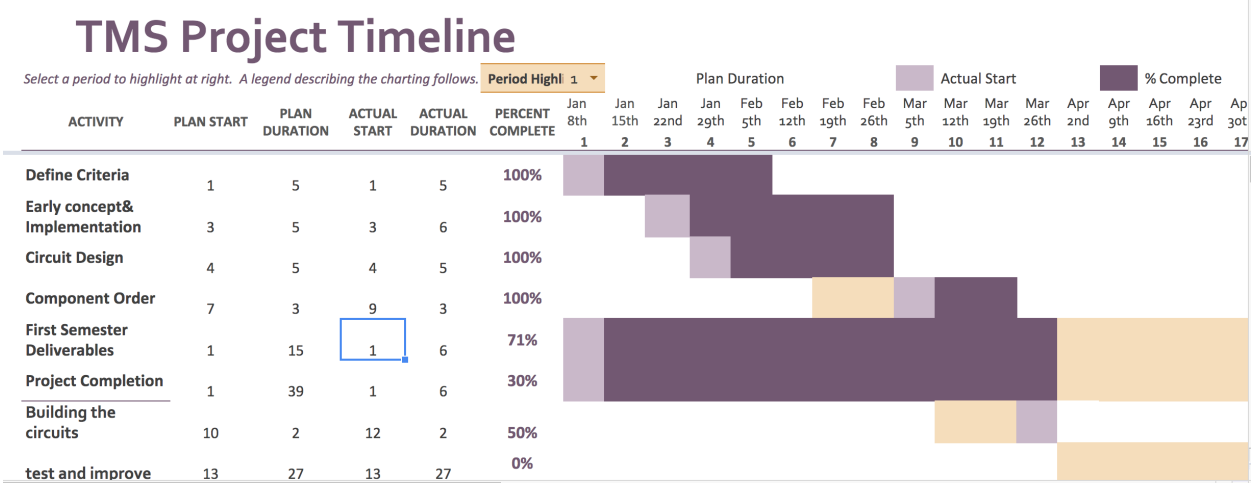
1. Circuit construction should be finished by Friday, so that individual circuit testing may begin Monday.

Individual Contributions:

Group Member	Accomplishments	Time Worked This Week	Total Time Worked
Abdul	Implemented and soldered a rectifier on a PCB and rested it. Prepared for class presentation. Worked on Project Plan, and did some research and calculations on using LED for safety as a sign of charged or charging capacitors.	4	26
Yan	Stripped wires for soldering job. Solder the rectification circuit on PCB based off where the input and output pins were located. Began placing parts on the Chassis "box" as per the design on the template. Used multimeter and recorded the voltage going into certain components after plugging in the transformer. Afterwards to be extra cautious, we plugged the transformer in a different wall outlet and again recorded the voltage across the transformer, rails and boards. Updated the Gantt chart to where we are currently.	6.5	29
Jon	Tested pinout and operation of IGBT using power supplies, function generator and scope/DMM. All testing was done with voltages under 20 V and a load in the Mega Ohm range attached for device protection. IGBT appears to behave as expected expected at this low voltage range.	4	28
Brian	Soldered the rectifier circuit on PCB and made a layout for other team members to get some practice with soldering. Shopped for some capacitor restraints for mounting. Took the baseboard home and laid out paper design and drilled pilot holes for component mounting.	7	34
Tania	Drilled the holes in the chassis box for the components, prepared wires to connect them to the rails, fixed an issue with the voltage of the transformer with Chuck and Yan.	6	27
Chuck	I spent time drilling holes and gluing our rails to the chassis base. Yan, Tania, and I troubleshooted a	8	63

	stray voltage found in the transformer due to an unbonded neutral.		

Current Progress:



Individual tasks to be completed before next meeting:

Everyone:

- Weekly reflection
- Rectification Team
  - Solder Rectifying Circuit
- Power Team
  - IGBT Gate Voltage
- Chassis Team
  - IR Camera
  - Assembly
- M.C.
  - Learn about and test integrated IGBT temp sensor.
  - Continue investigating Hall Effect high current sensors
  - Meet with Gary Tuttle to verify some aspects of IGBT operation