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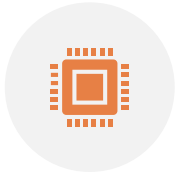
Electrical and computer engineering

Worcester polytechnic institute

Engineering Design Portfolio

Engineering Portfolio



This document supplements my resume with additional information about the design and work experiences I have had at the Martinos Center for Biomedical Imaging. Additionally, there is a project that I completed for one of my courses that began as a personal project. I am pursuing an internship in engineering to work on the cutting edge of science while solving both human and technical problems. The examples shown in my portfolio represent that desire.

If you have any questions about my application or hesitations about my qualifications, I would be pleased to address them. I can be reached by email at amanohar@wpi.edu or by phone at (315) 708-1111.

Additional figures can be found in the appendices section at the end of the portfolio.

Portable MRI Pre-amp PCB

Key Take-Aways

- Challenge: Design a more spatially efficient pre-amp PCB to be used in a portable MRI machine
- I was tasked to optimize the board seen in figure 1, to take up less space which included redesigning the schematic in Eagle, manufacturing the board in house using a router table, soldering the components onto the board and testing said board.
- After completing the task I found that using Eagle makes it easy to rearrange components in an efficient manner. Additionally, I learned that for MRI/RF applications, it is important to have short, clean and thick traces to ensure the highest quality signal.
- Figure 2 shows the redesigned board, figure 3 shows the testing of the board and figure 4 shows the intended location of the board in the portable MRI machine.

Figure 1.

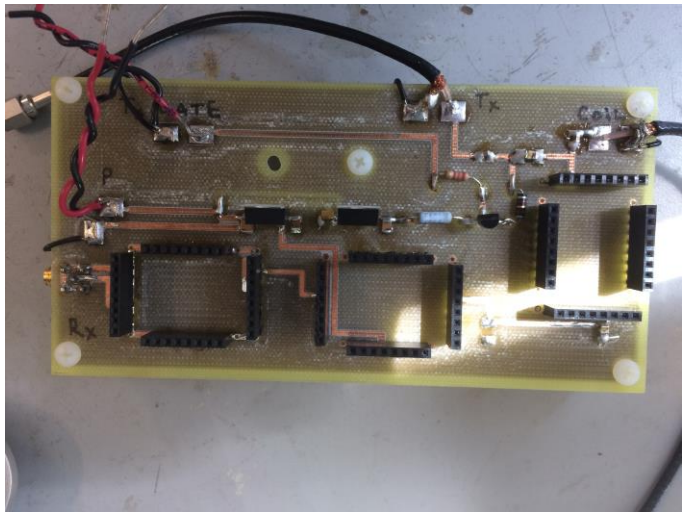


Figure 2.

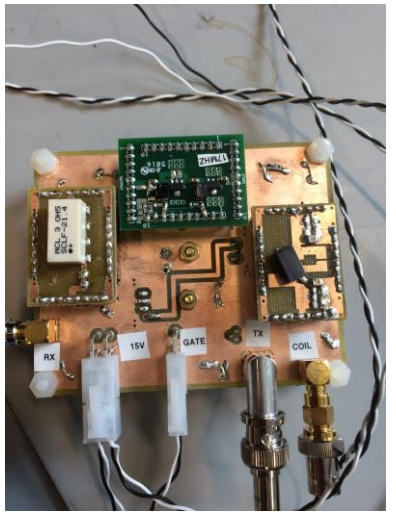


Figure 3.

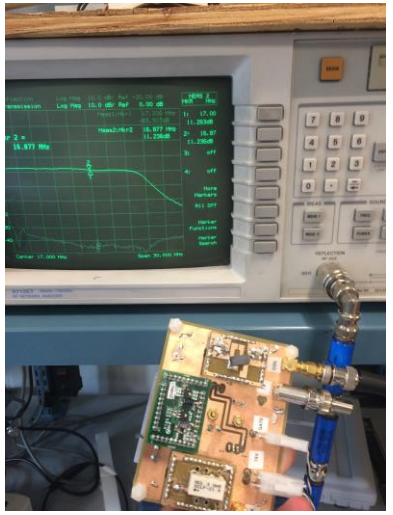
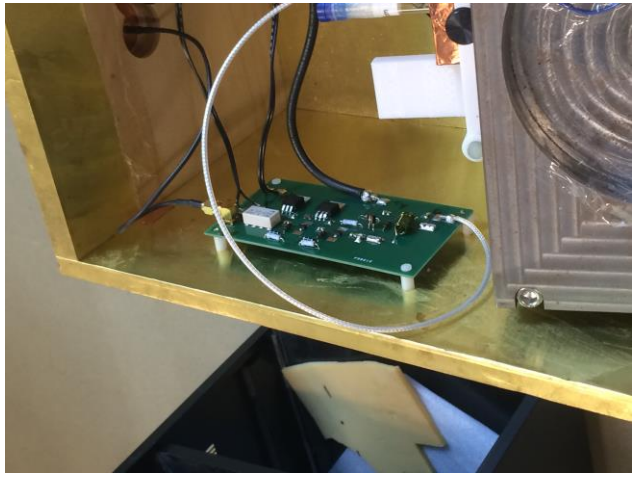


Figure 4.

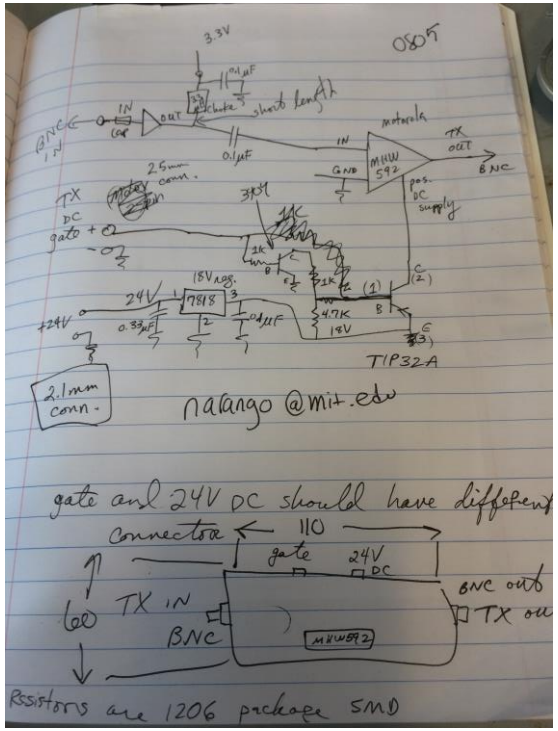


Tx amp board (Transmitter amplifier board)

Key Take-Aways:

- Challenge: To design a small PCB to be enclosed in a box, add a gain stage, put a 50-ohm resistor in series and parallel to give multiple options during the application. A detailed outline of the parameters can be seen in the appendices section.
- I was tasked to take the schematic seen in figure 1 and to design the layout in Eagle. Then, I was tasked to manufacture the board using an LKPF Router table which can be seen in the appendices section. Next, I soldered the components onto the board, and tested the board on the oscilloscope.
- In figure 2 we can see the completed board. Figure 3, shows the board inside the metal enclosure. Finally, in figure 4 we can see the completed product with the inputs/outputs labelled correctly.

Figure 1.



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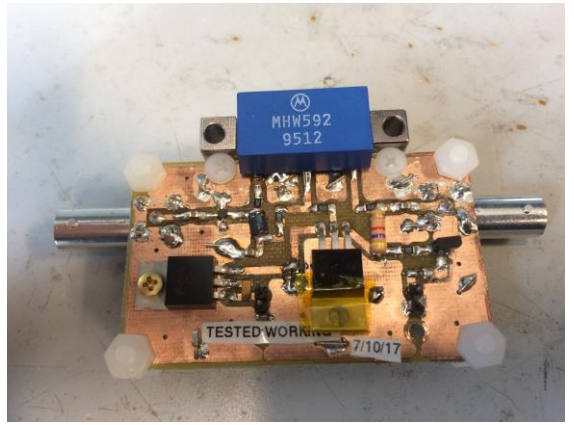
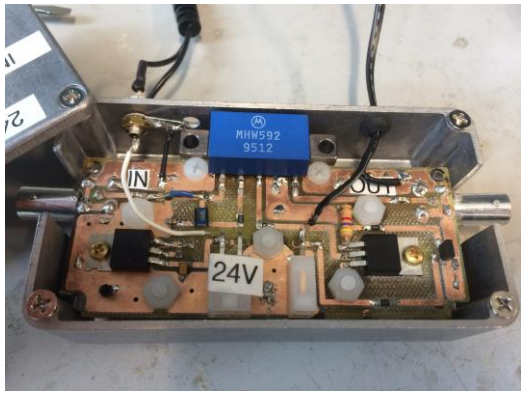


Figure 3.



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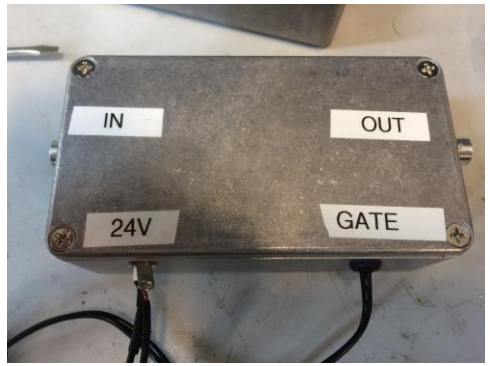
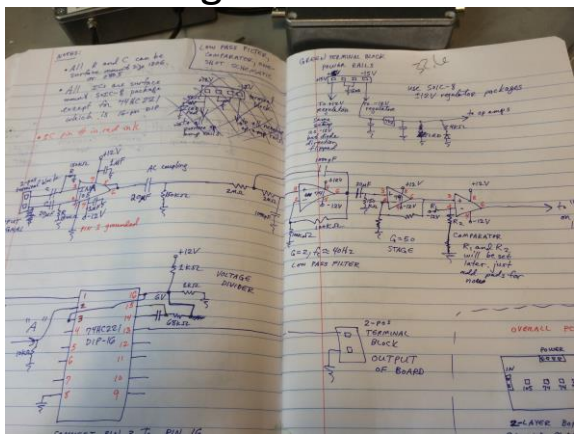


Low pass filter comparator

Key Take-Aways:

- Challenge: To design a low pass filter comparator that can be applied to various MRI machines at various Tesla levels.
- I was tasked to take the schematic seen in figure 1 and to design the layout in Eagle. Then, I was tasked to manufacture the board using an LKPF Router table which can be seen in the appendices section. Next, I soldered the components onto the board, and tested the board on the oscilloscope.
- Figure 2 shows the top view of the board, and figure 3 shows the bottom view. Figure 4 shows the signal on the oscilloscope before the filter is applied and figure 5 shows the filtered signal.

Figure 1.



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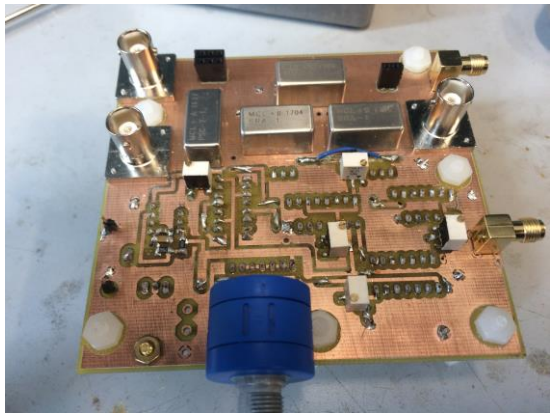

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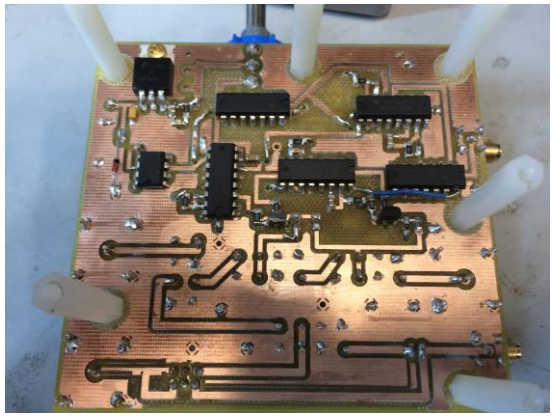

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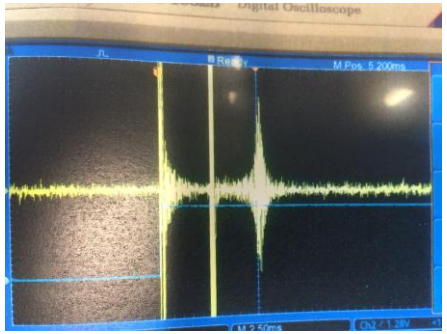
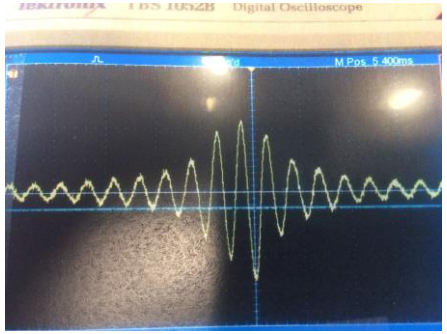


Figure 5.



Smart bar

Key Take-Aways:

- Challenge: To design an IoT (Internet of Things) device that can be used in the home. A proof of concept must be completed in seven weeks.
- For this project, my group partners and I decided to create an Amazon Alexa voice activated drink dispenser. Our device used fish tank air pumps to offset the liquid in the containers to dispense the accurate amount of liquid required. We drove our device using a Raspberry Pi 0 with a Wi-Fi attachment. Our device gave the user the freedom to preset 8 liquids into the device. Additionally, we gave the user the option to add their drinks to the python script to let the user have as much freedom as possible.
- Sensors Used: Eight flow sensors and eight IR sensors to detect if a container was low on liquid.
- Figure 2 shows the power supply, breadboard layout and the Raspberry Pi 0. Figure 3 is a top down view that show the location of the flow sensors. Figure 4 shows the containers and the piping setup used. The figures shown are not the whole product assembled completely as we had to disassemble parts of the device for storage.

Figure 1.

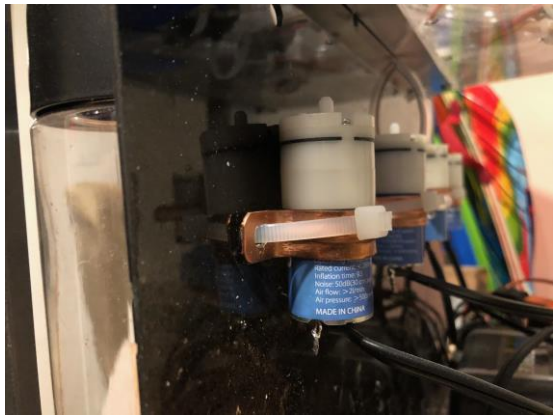
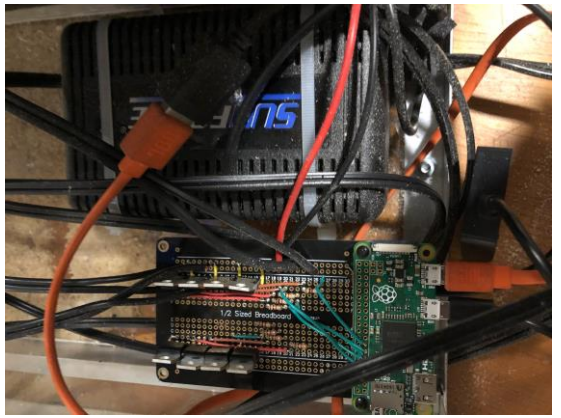


Figure 2.



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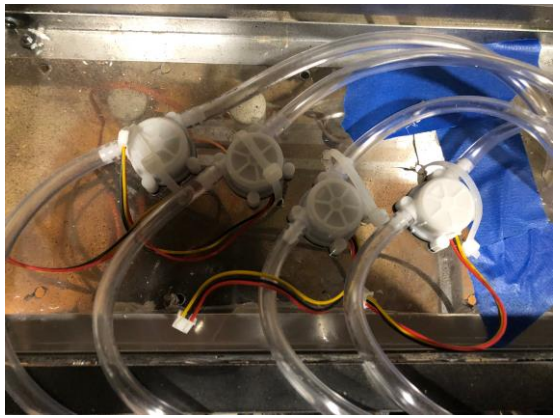

Figure 4.