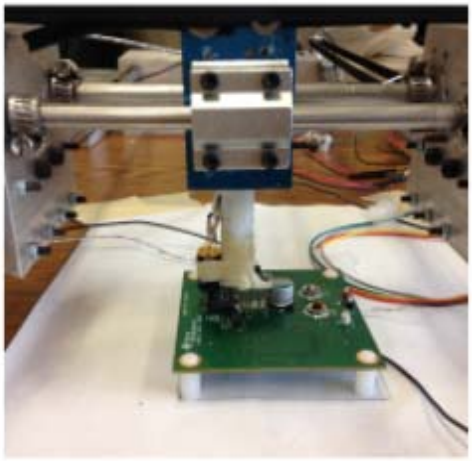
DOPES

Design Solution

Shamar Christian

In realizing the best solution for achieving the aim of the DOPES project (developing a sensory network for data extraction pertaining to power electronic failure), multiple designs were established. Each design details how the objective was achieved and the positive and negative outcomes that arose from each design.

Design 1



This design consisted of an oscillating robotic arm with our sensors, which took readings of our buck converter (power electronic device) under different specified loading conditions as to develop some excursion state to determine failure. The robotic arm oscillated in a predetermined pattern as well so that the data received would be consistent.

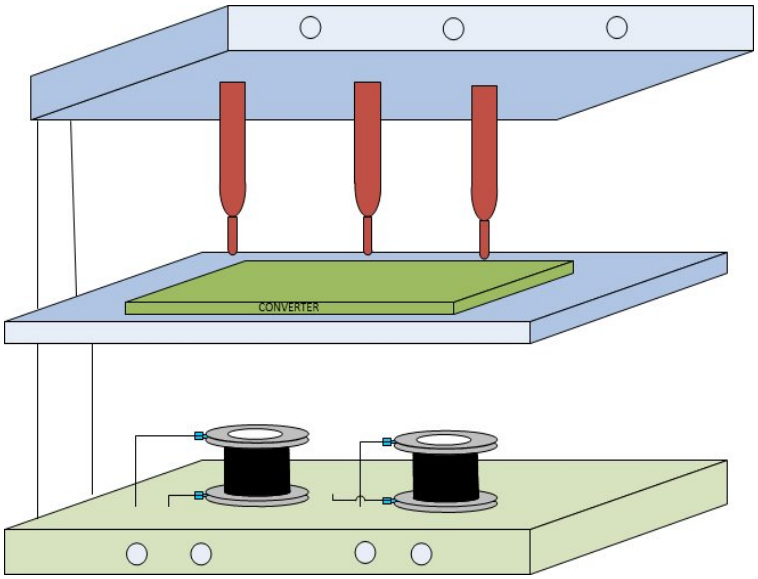
Design 1 pros:

1. Reliable – We were always able to obtain somewhat steady data from this setup

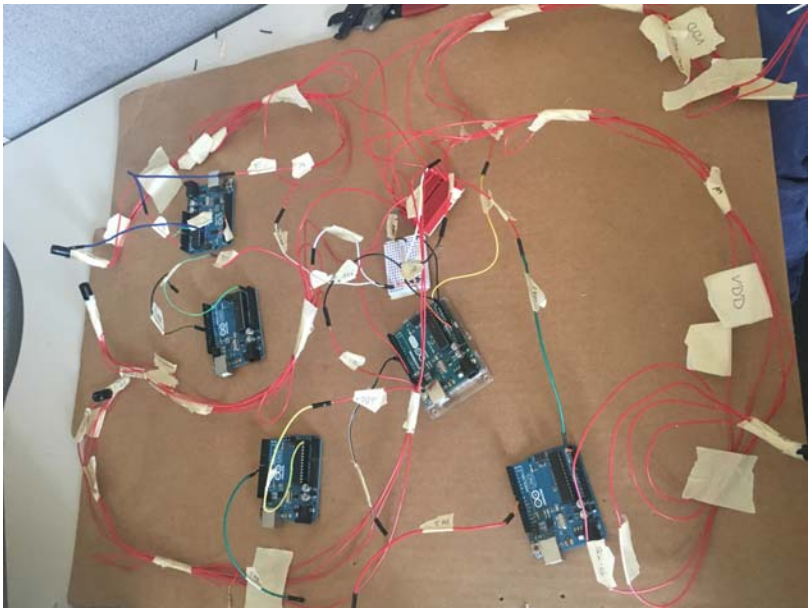
Design 1 cons:

1. A hassle to setup – At times when the board was tested to absolute failure and had to be changed, the process of swapping components always proved to be extremely tedious and meticulous.
2. Non-Essential data – While there are components that are important in terms of data obtainment, there are also non-essential components and even blank spaces that the robotic arm also scans. This can lead to data confusion which is detrimental to the overall aim of the project.

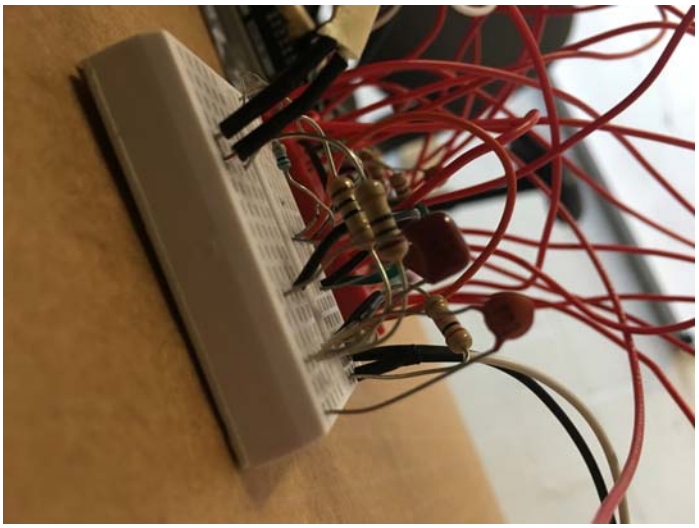
Design 2



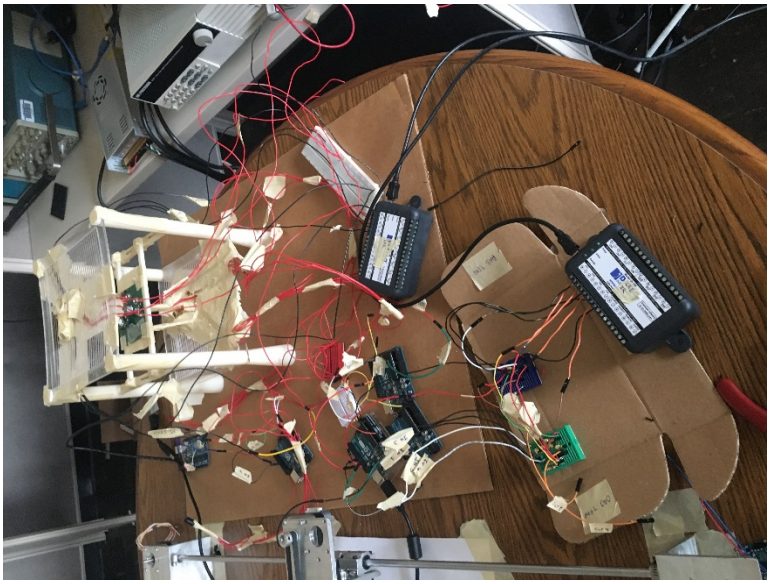
This design consisted of a 3D printed table with our buck converter centered and our sensors placed over key components only. The data extraction system was also modified to increase automation.



Sensory Network created for use in Design 2



Filters designed and implemented for use in new data extraction method in Design 2



Overall setup of Design 2

Design 2 pros:

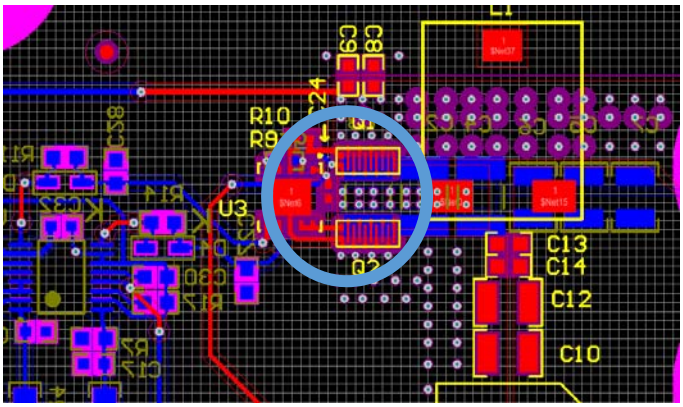
1. Automation – this setup allowed us to run excursion patterns for even longer due to the automated data extraction system,
2. Precision – because we no longer scanned non essential components, the concentration of the accuracy of our data increased.

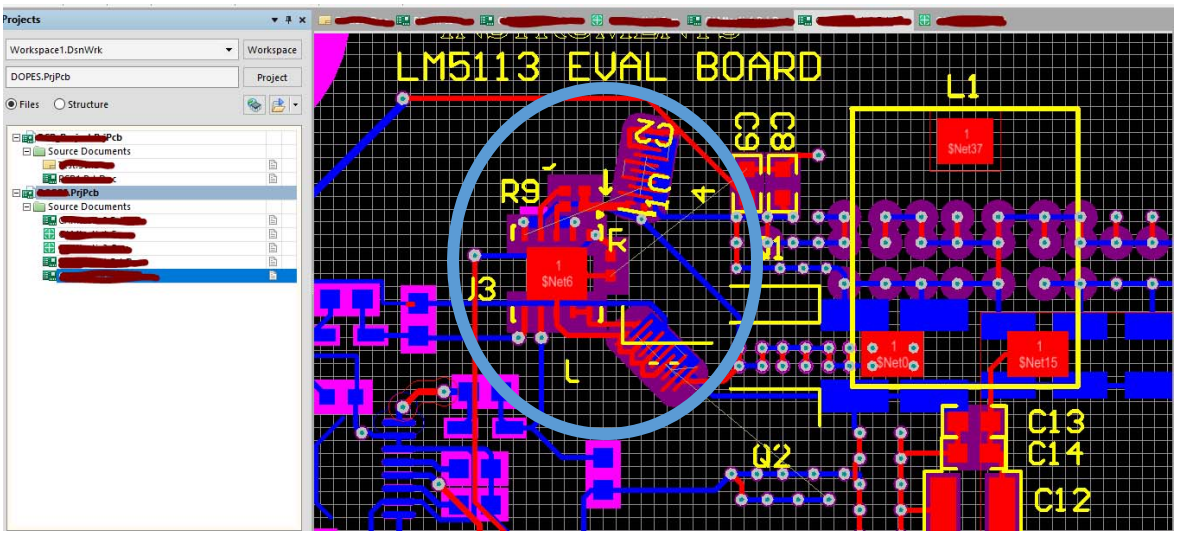
Design 2 cons:

1. Size – In moving towards our embedded sensory network goal, design 2 does not provide a great model to reflect our objective
2. Board swapping – because of how the converter is embedded in the 3d printed structure, it is very difficult to replace it.

Design 3

This is the current design task of this year's project. The solution generated involves reformulating the buck converter on PCB design software from the design files available. The design modification developed involves orienting the transistors differently and adding pads for the sensors, so that the sensory network can be established. Many routes of PCB trace must also be readjusted in order to cope with the design. At the end of it all, the buck converter should lose no functionality with the modifications we make.





Design 3 pros:

1. High accuracy data – the data to be obtained from this setup
2. Embedded – as this design is rolled out, it progresses the DOPES project closer towards the embedded goal as well
3. Automation – this design shares an automated data extraction process as well

Cons:

1. Tedious – the task of redesigning the PCB is difficult due to the complexity of the software and the lack of experience using it at an industrial level

Since the DOPES project is at iteration 3 of its deployment, Design 3 is the design that will be rolled out as we continue to use Design 2 to extract data.