Team: JAS TtC

Members: Jafar Ahmad, Abdullah Alotaibi, Saad Alqahtani

Project: Grid connected T-Type converter

Client: Dr. Venkata Yaramasu

T-type motivation

The T-type converter is an advanced application of power electronics and renewable energy that solves problems of the NPC converter such as:

- uneven heat dissipation
- Switching losses between inner and outer IGBT

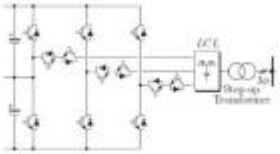

Fig. 1 Grid-connected T-type converter.

Fig. 2 T-type module from Fuji Electric.

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T-type advantages

- Bi-directional switching
- Three level output waveform
- Lower electromagnetic interferences
- Increased equivalent switching frequency
- Lower size of output harmonic filters
- Many more!

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Requirements and constraints

- The requirement for this project is to obtain experimental results of complete system with T-type converter, Modular Predictive Control and grid connection.
- As for the constraints the team had to:
  - Overcome noise issues with PCB design
  - Work with the Photovoltaic source
  - Work with grid currents

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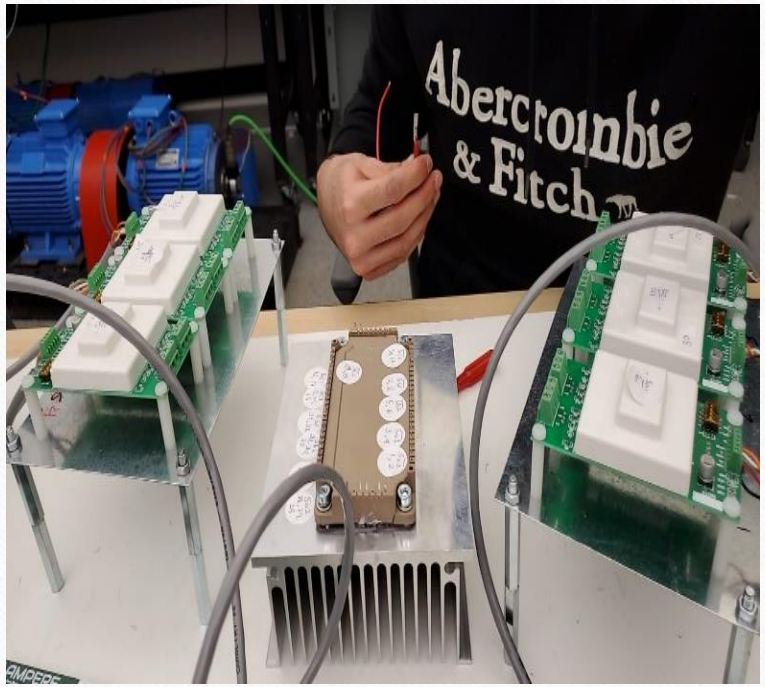
Prototypes

- Failed first attempt
- Rebuild the circuit from scratch
- More organized
- PCB
- Better understanding



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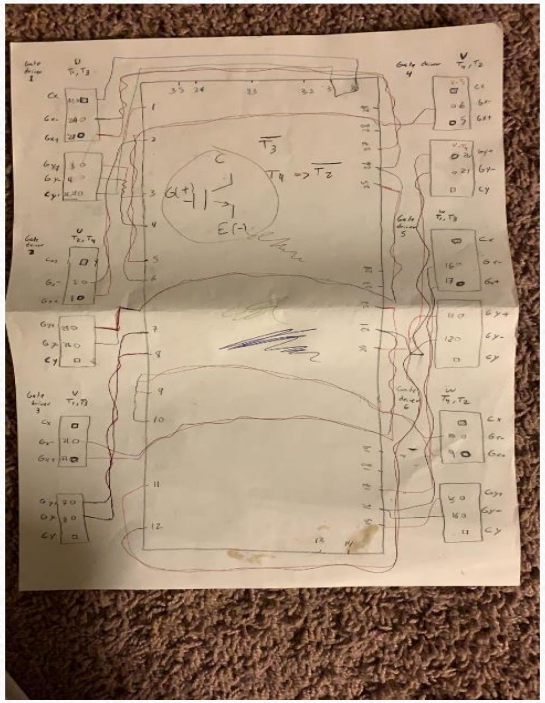
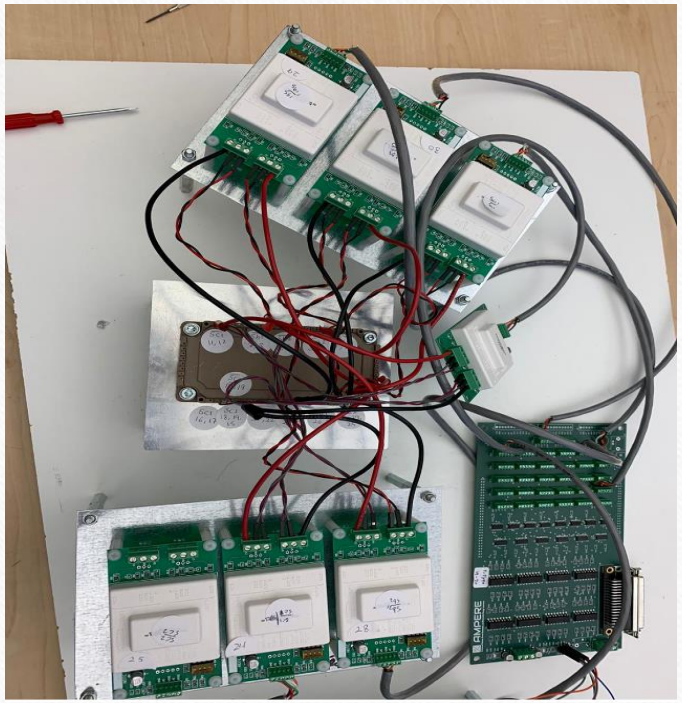
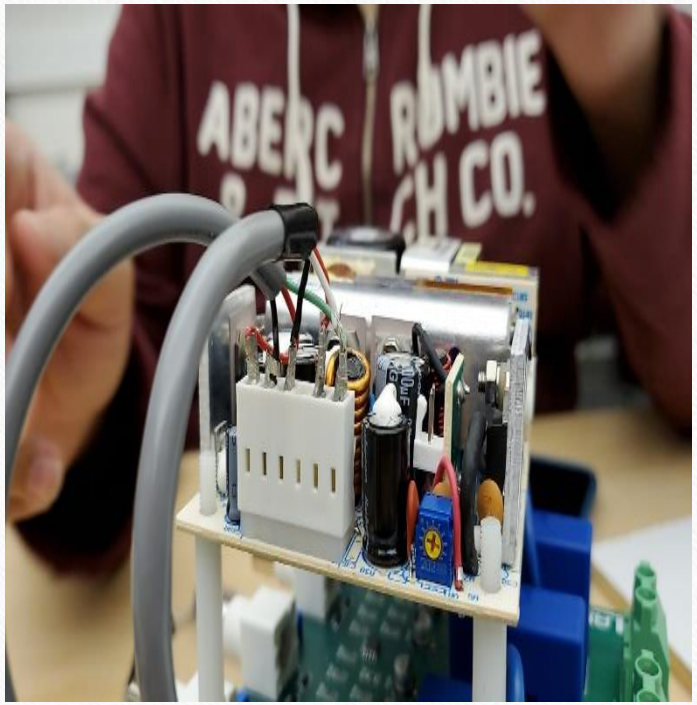
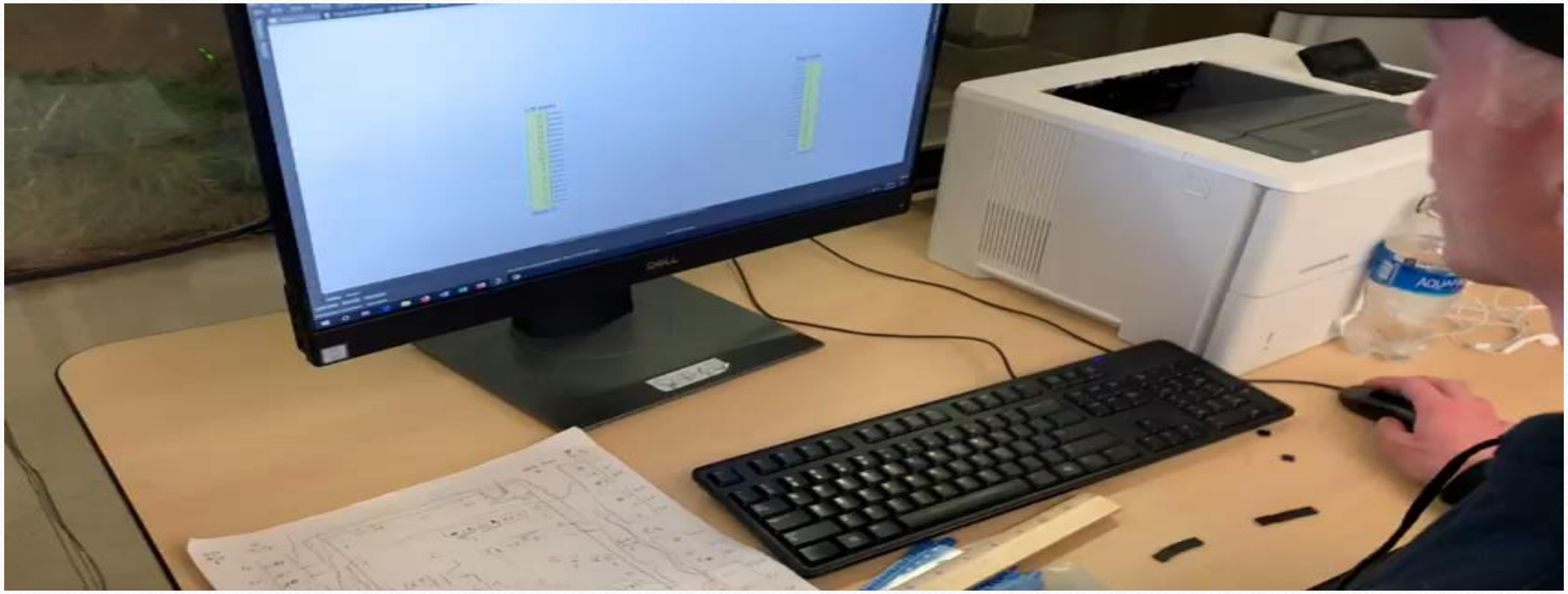
Prototype examples







PCB Work



Gantt chart

Tasks	10-20 Jan	20 Jan – 10 Feb	10 – 17 Feb	17 Feb – 13 Mar	13 – 20 Mar	20 Mar – 6 April	6– 13 April	13 – 27 April
Voltage & Current boards and Interface boards								
Testing of T-type converter with classical control								
MATLAB Results & Data Analysis								
Refining circuitry & PCB design								
Connecting to the grid using a PV model								
Testing of T-type converter with MPC during grid-connection								
A full analysis of the full grid experiment								
Final Report format and Demo								

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Subsystem 1: Circuitry progress

- figuring the connections
- Connecting the wires (G to T-type)
- Connecting from (T-type to interface board)
- Connecting the power supply to the grid
- Connecting the power supply to the stack (current, voltage and interface boards)
- Connecting the PCB to T-type

10 – 20 Jan, 17 Feb – 13 Mar
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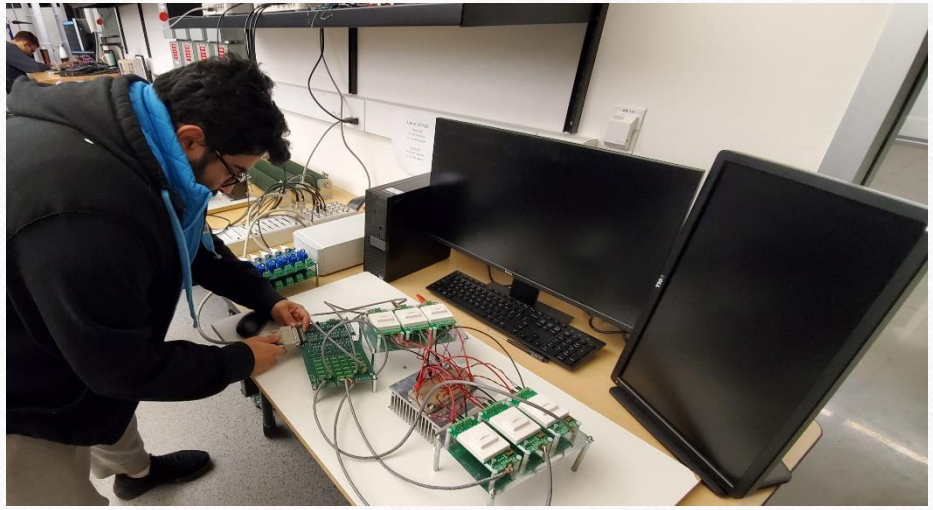
Subsystem 2: Matlab and dSPACE

- Programming the dSPACE with MATLAB/Simulink
- Creating the code for Pulse Width Modulation (PWM)
- Creating the code for the grid experiment
- Creating the code for the PV module
- Connecting the dSPACE with the circuit



10 – 17 Feb, 6– 13 April

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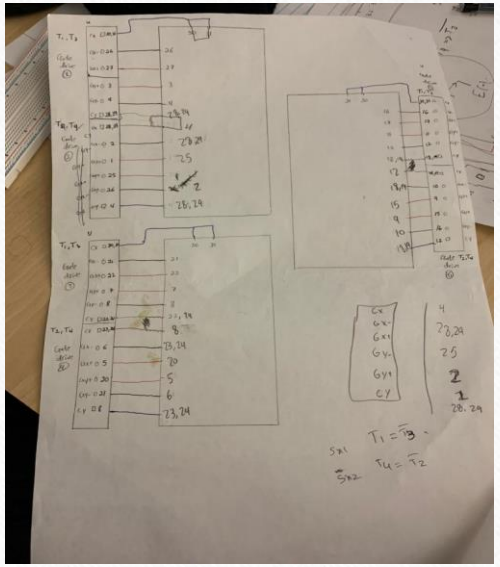
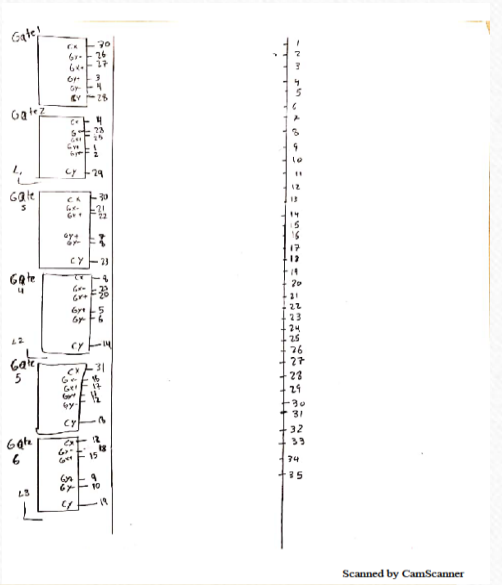
MATLAB and dSPACE

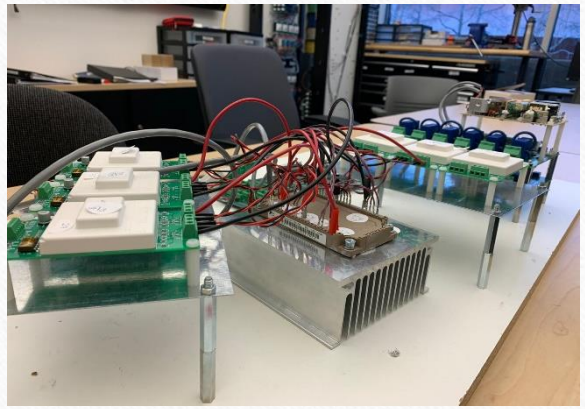
Subsystem 3: Testing and PCB design

- Confirming that the connections work
- Open circuit testing using PWM
- Debugging (a lot of debugging!)
- Re-testing after rebuilding the circuit
- Designing a Printed Circuit Board (PCB)
  - How?
  - Why?

- Testing the PV module using a 2L converter
- Testing using PV module with PCC and MPCC







17 Feb – 13 Mar, 20 Mar – 6 April

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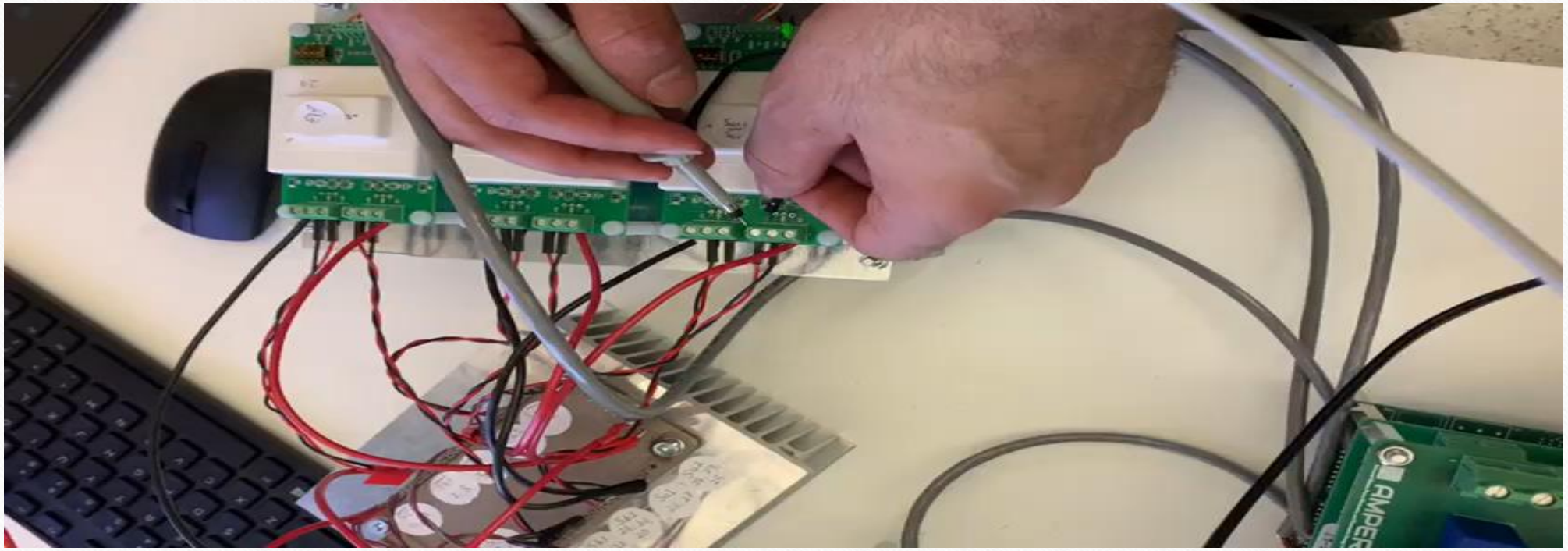
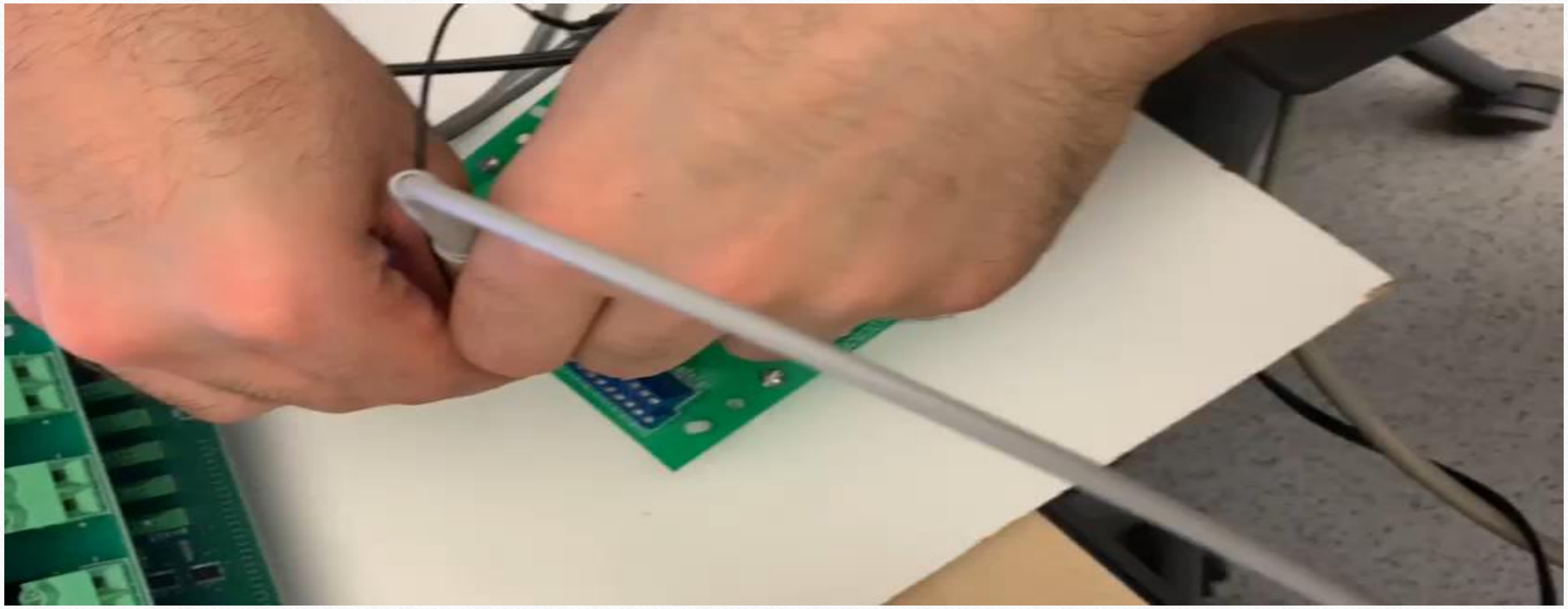
Re-checking the connections



PWM Test



Conclusion

- Progression at this point
- Relation between subsystems
- For the next teams
- The goal and the result

Abdullah Alotaibi