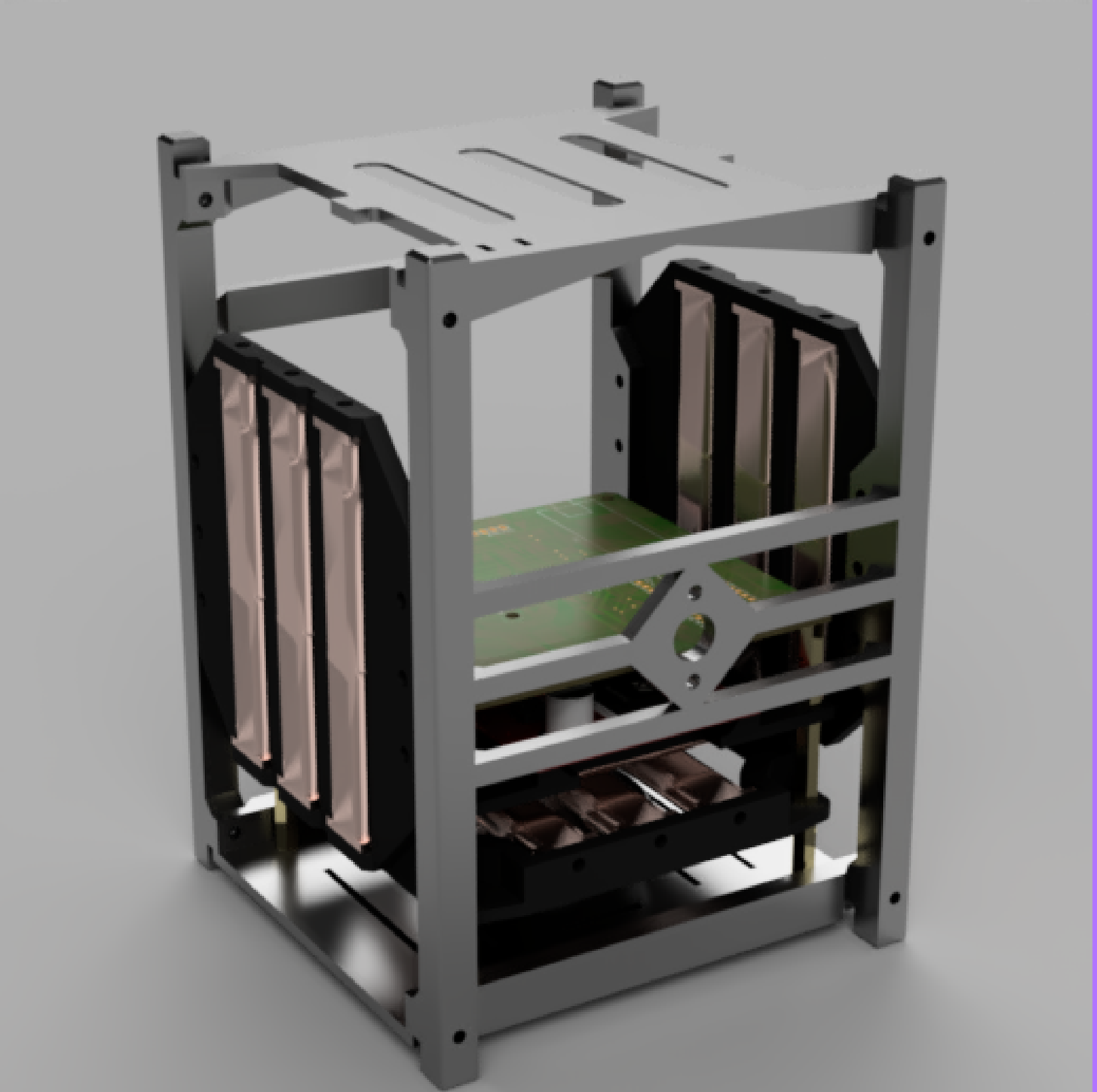
TETISAT

AN INTEGRATED PLATFORM TO SUPPORT CUBESAT SYSTEM DEVELOPMENT

TIRTA INOVAN'S PROJECT PORTOFOLIO



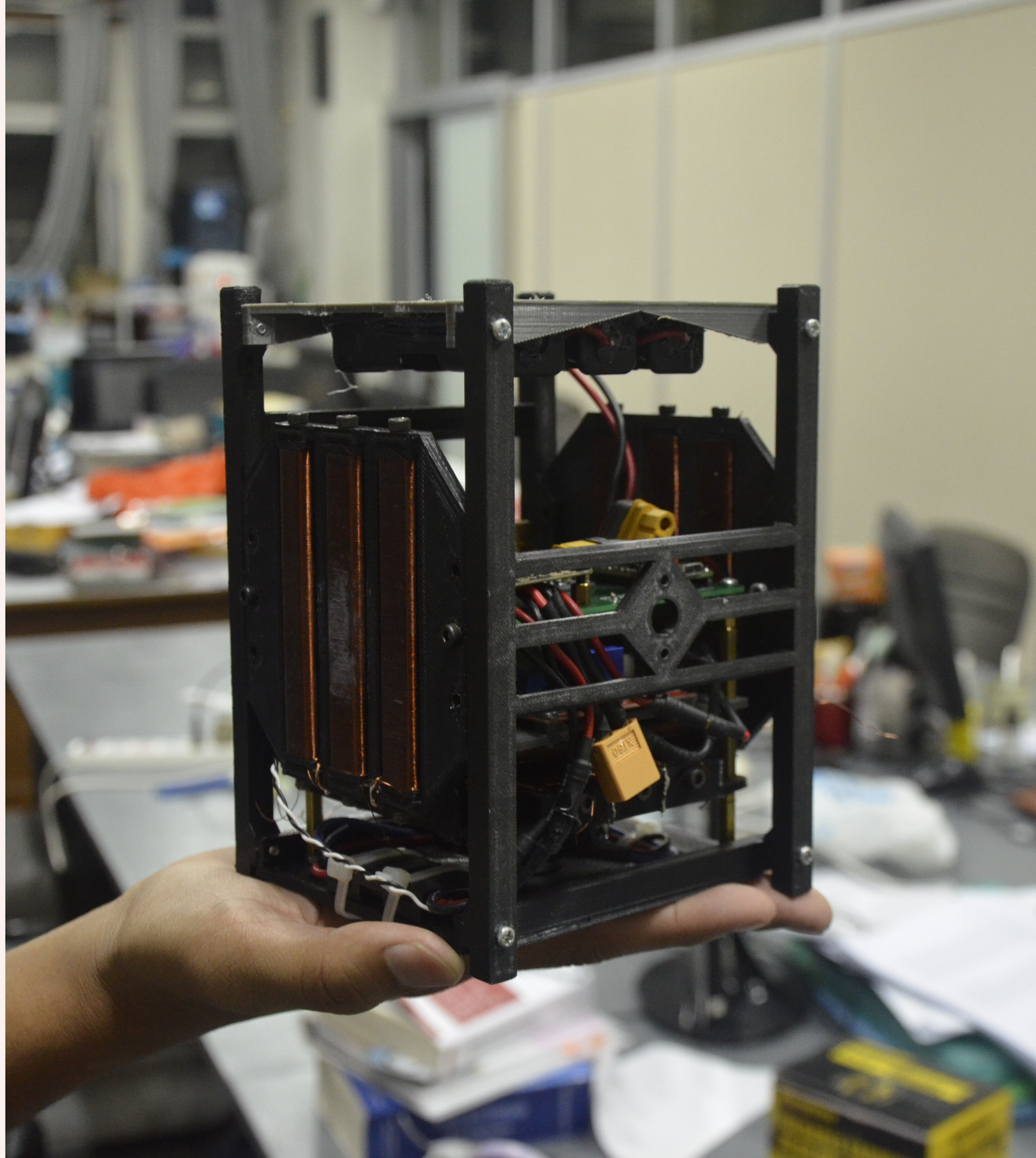
A BRIEF OUTLINE

This is a project that I had done as a Thesis required for my Electrical Engineering Bachelor Degree. The project revolves around creating a fully working Attitude Determination and Control Subsystem (ADCS) with 3-DoF control integrated within a Cubesat U-1 that is fully compliant with NASA's P-POD System used in various smallsat ridesharing programs.

PROJECT OUTLINE

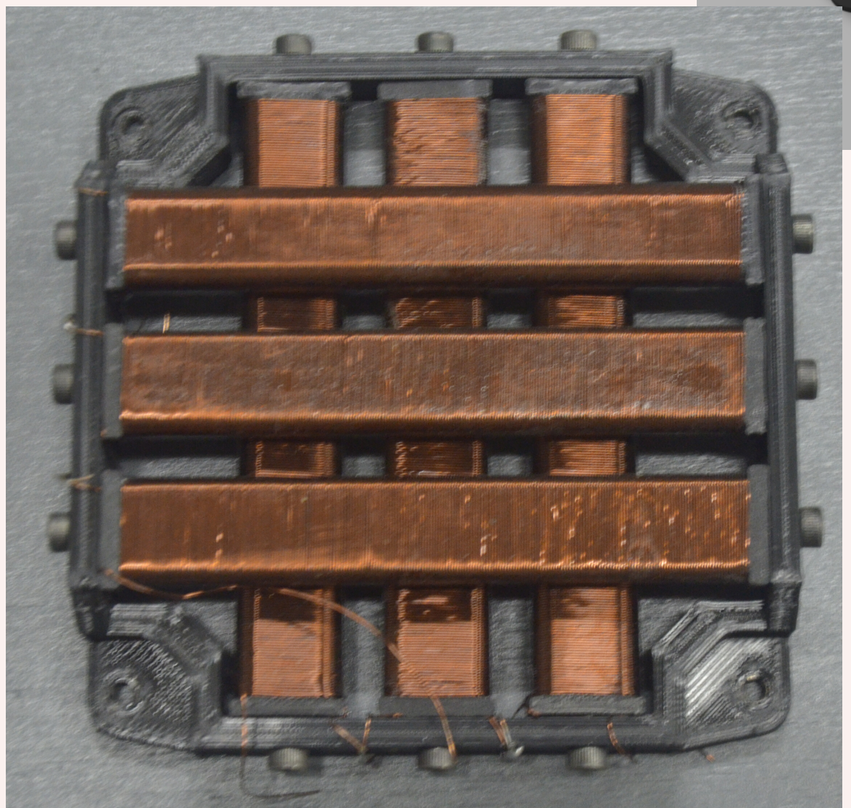
The project consisted of multiple parts that needed to be designed and fabricated of which are:

- U-1 Cubesat Frame
- Electrical systems including ADCS
- Magnetorquers
- Reaction Wheels
- Gimbal mounted test-frame



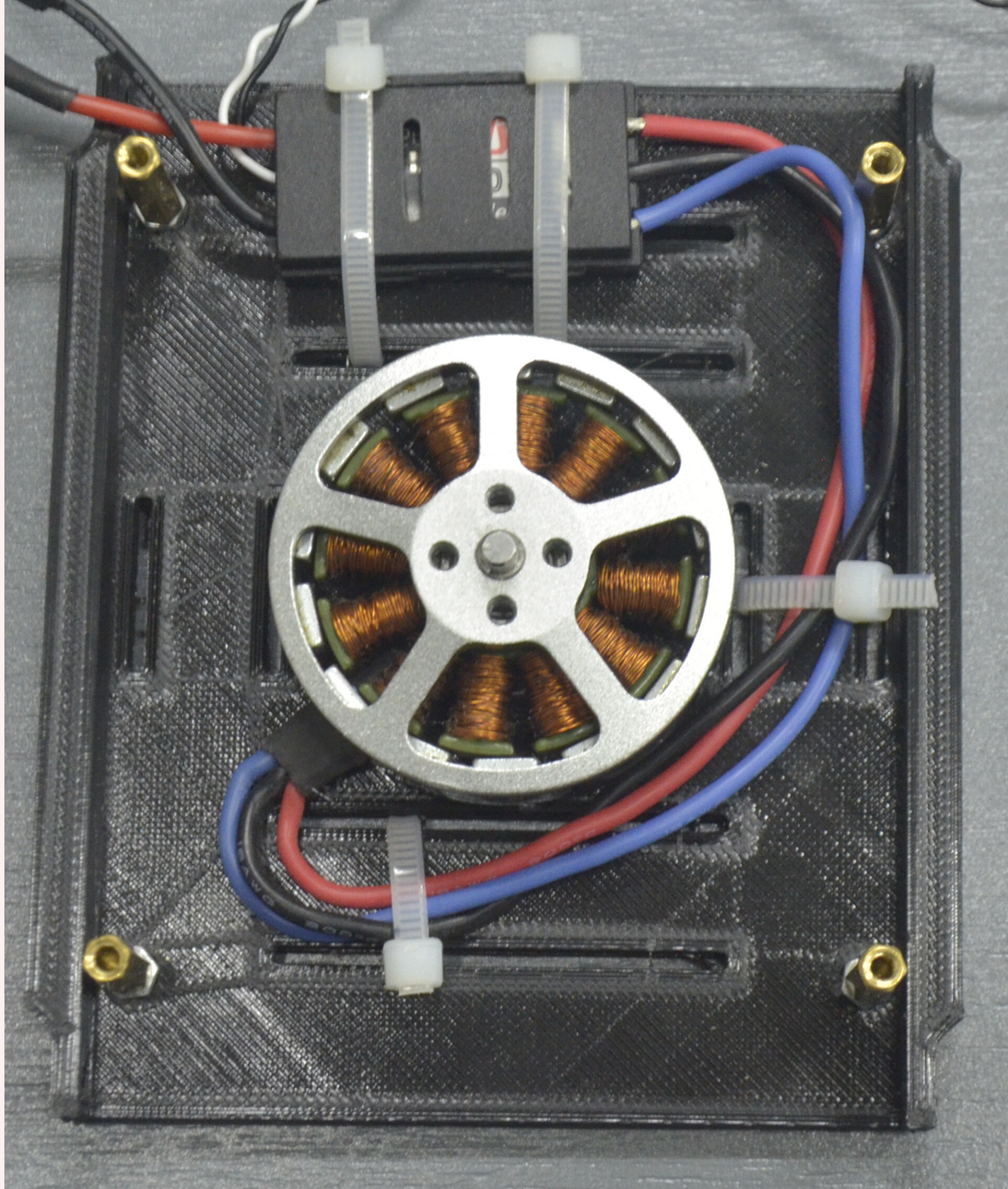
MAGNETORQUERS

For attitude control, an air-core magnetorquer is used. 4 sets of 3 Magnetorquers each are used to control the Cubesat in 2 Axis, each set is theoretically capable of generating up to 0.5 Nm of torque



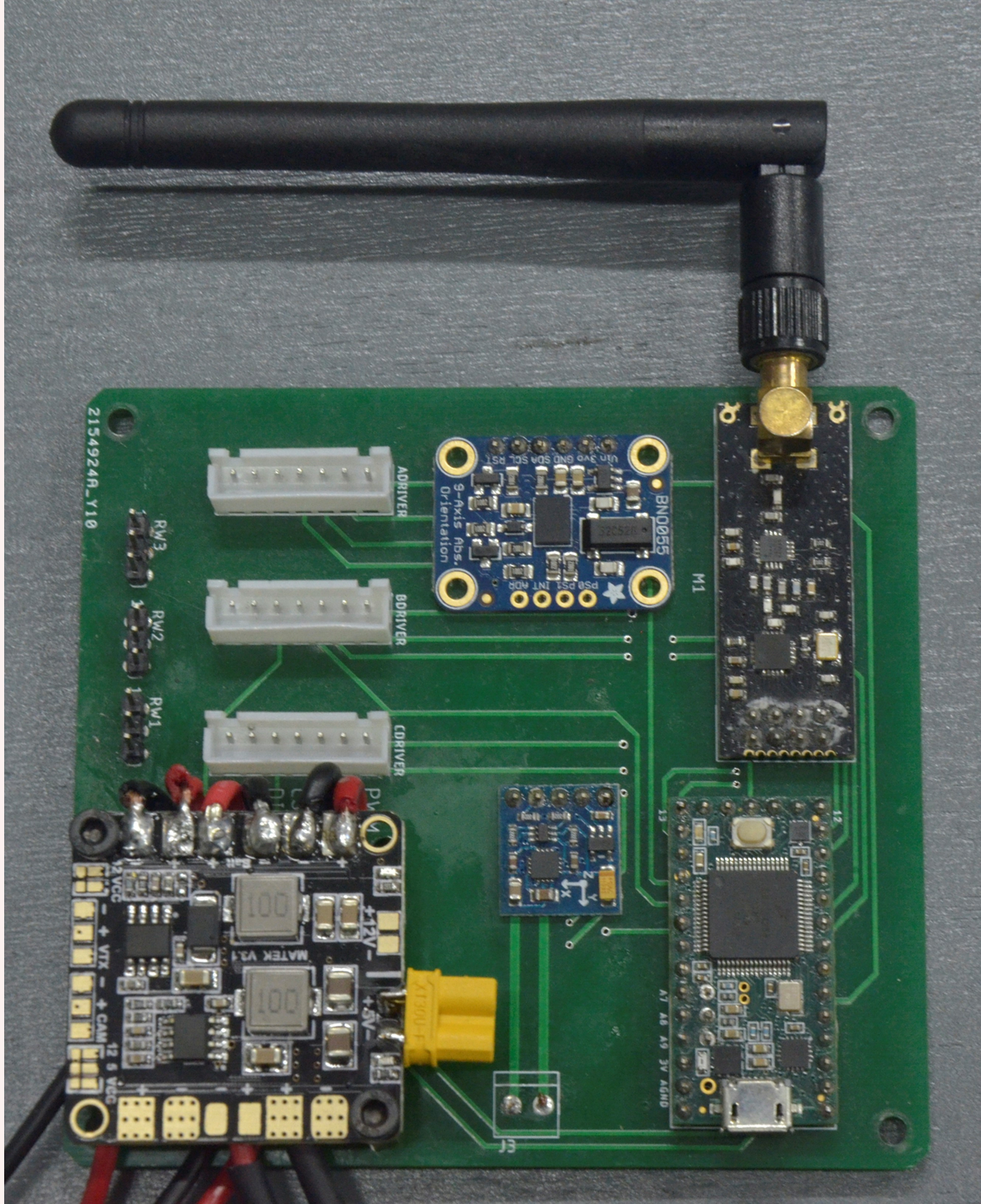
REACTION WHEELS

By its nature a magnetorquer is only able to produce torque on an axis that is perpendicular to its external magnetic field, thus to achive full 3 Degrees of Freedom control, a reaction wheel is needed.A Brushless 360kc DC Motor is used for its ease of use and reliability



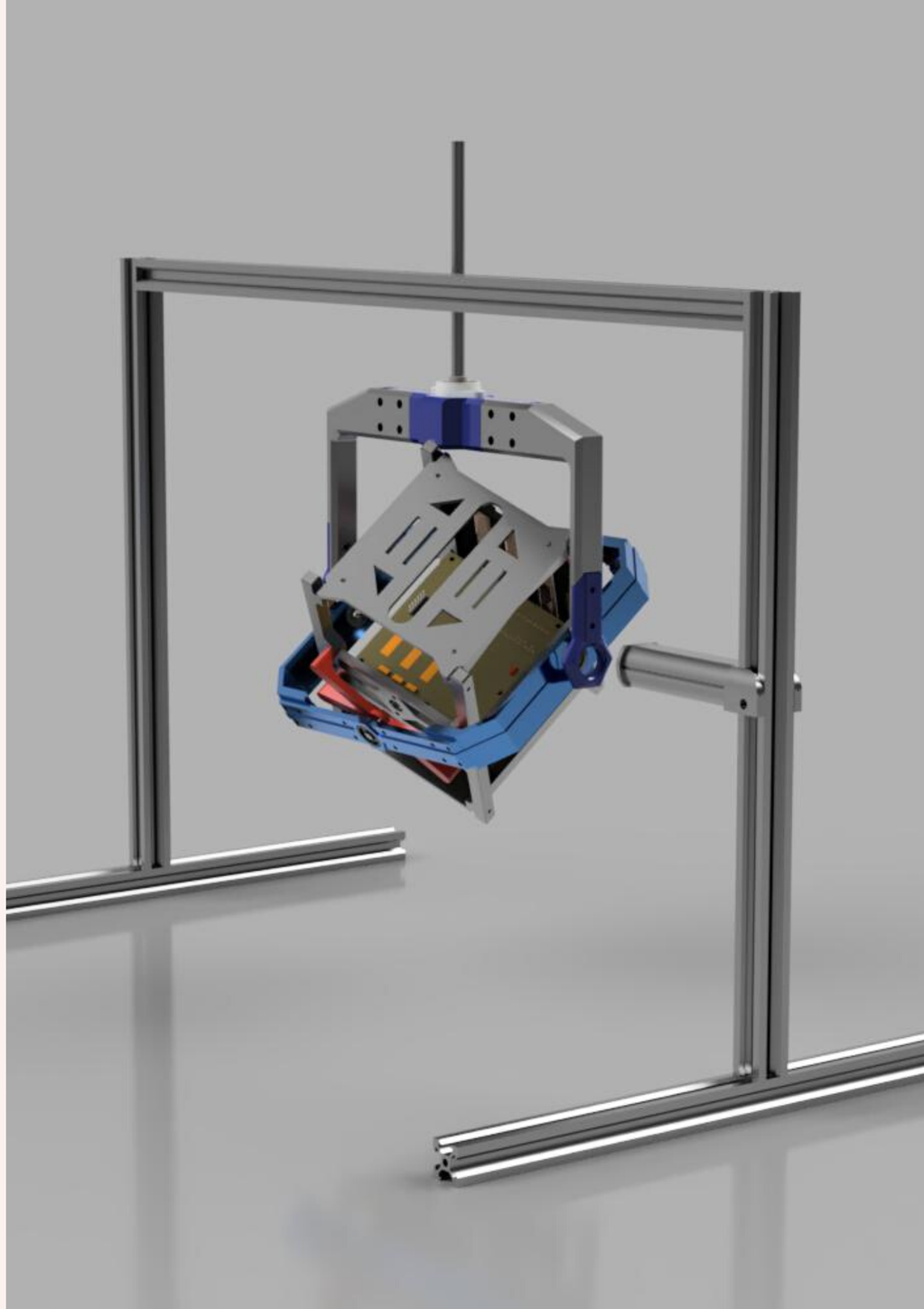
ATTITUDE DETERMINATION AND CONTROL SUBSYSTEM (ADCS)

The ADCS is responsible for monitoring the Cubesat's attitude in real time and give commands to actuators to correct for any alignment errors depending on the current mission

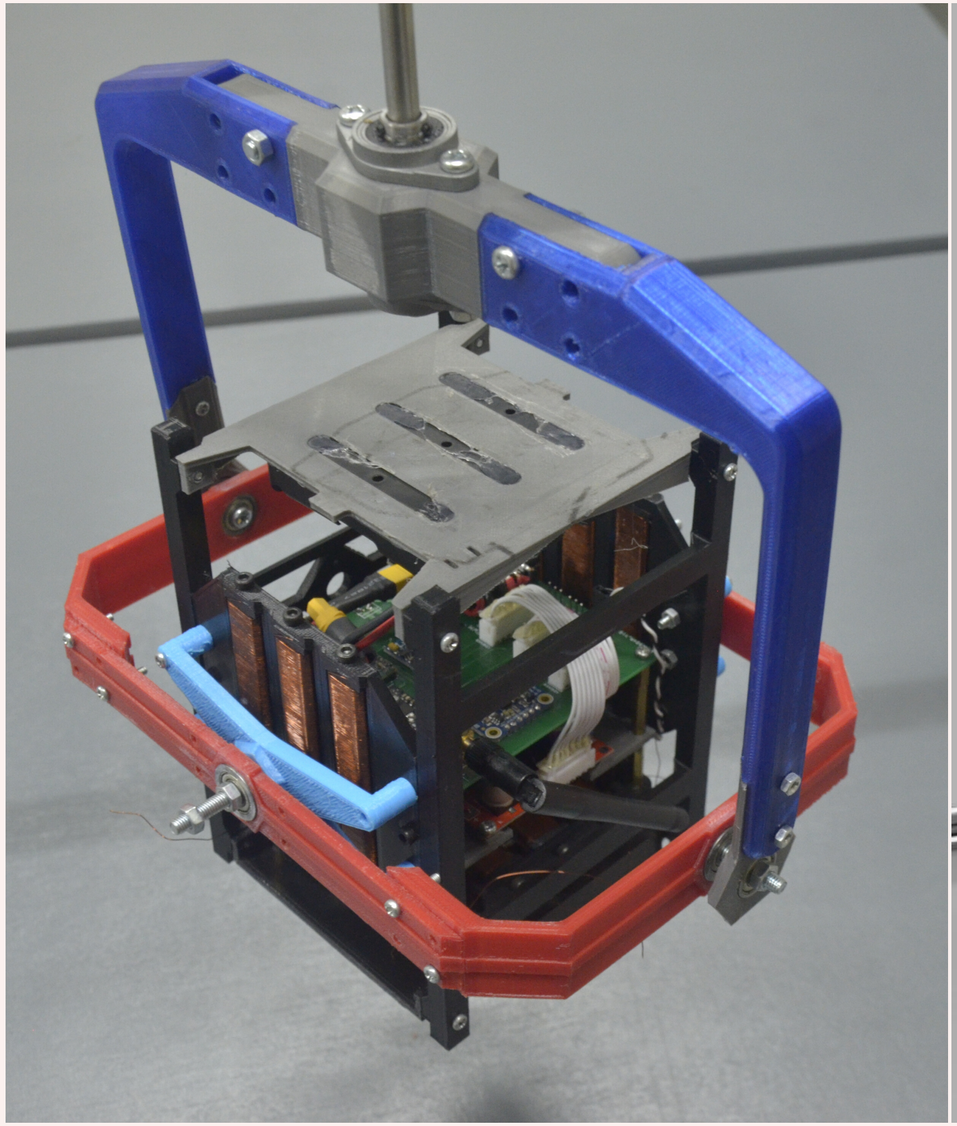


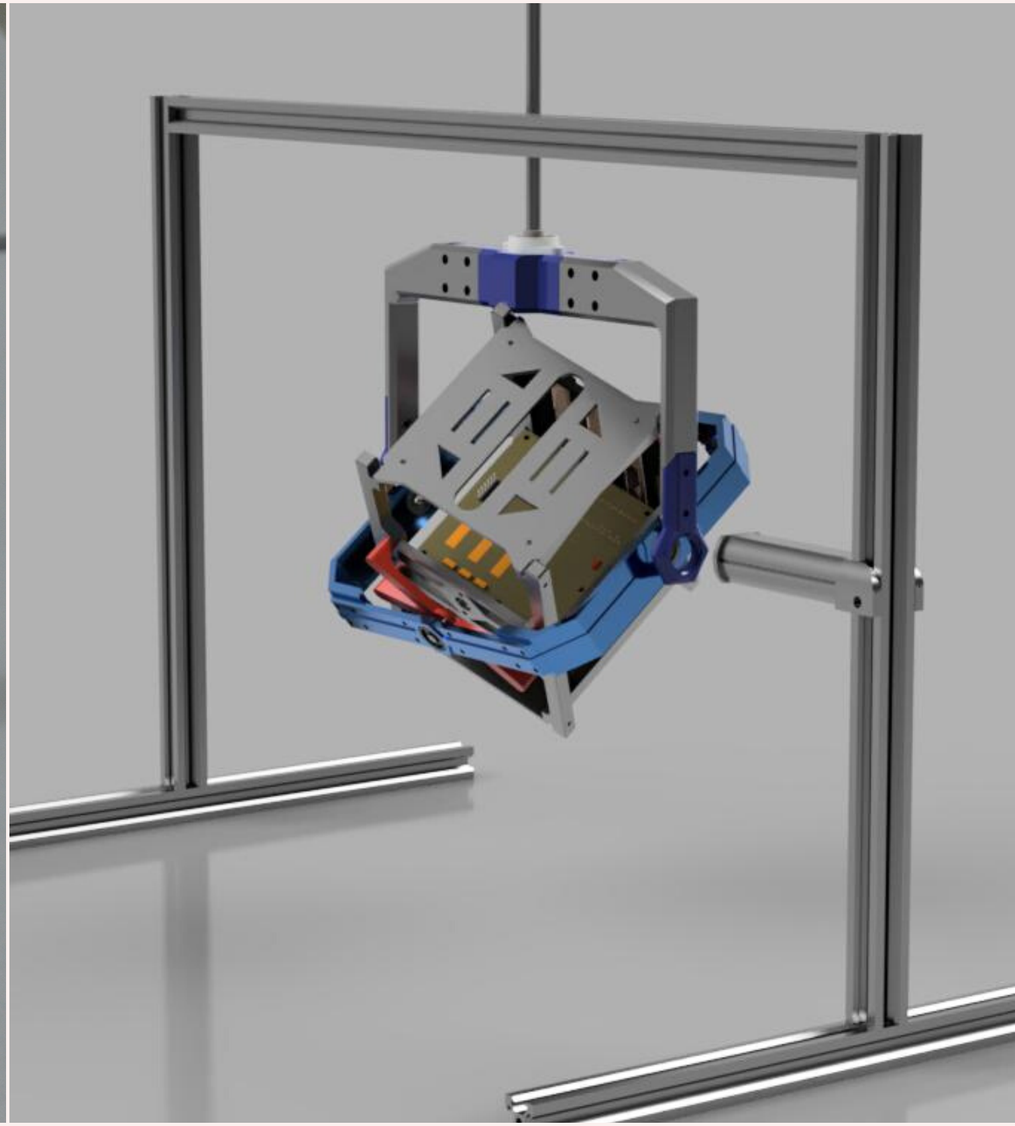
GIMBAL MOUNTED TEST-FRAME

To allow for ground testing that replicates the rotational motions of zero gravity a gimbal mounted test-frame is built. the gimbal allows for freedom of rotation in all axis, the frame also has an extra solenoid to simulate specific external magnetic fields



GIMBAL MOUNTED TEST-FRAME





PROJECT NOTES

INEFFICIENT USAGE OF PAYLOAD SPACE

As can be seen in the pictures TETISAT uses half of its payload volume for the ADCS and supporting components, this was intentionally done to help distribute the mass of the satellite as there are currently no payloads available to be mounted in it, the absence of the mass will cause problem when mounting it on the gimbal. The current system can easily be compacted into 1/3rd of its current size should the need arise

3D PRINTED FRAME

Most of the mechanical parts of this projects are 3D Printed, and have been verified to survive the harsh forces associated with space launch. If needed the system allows for easy reinforcements of important structural parts

AUTHOR NOTES

OTHER PROJECT PORTOFOLIOS

This particular portfolio focuses on the development of TETISAT which I consider to be the work that have pushed my skills over their limits and learn new things. However if needed I will happily provide portfolios for my other projects some examples are:

- IoT Edge-computing device utilizing LoRaWAN
- Open Coffee Scale
- Hypercube 3D Printer
- 3D Modelling and Printing projects for functional parts
- Ugrasena UAV
- etc.

Thank you for taking your time to read through my portfolio, should it be needed my contact info will be on the next page.

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