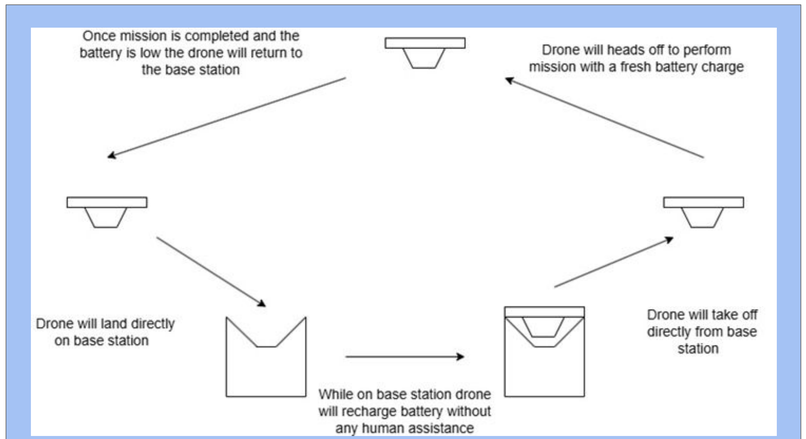
SDSU College of Engineering

RECON ROOST - Battery Swapping Drone

Project overview

Our project aims to create a simple yet effective method of robotically swapping the battery on a quadcopter drone. This reduces the down time from charging the drone and eliminates the need for a person to assist in this process. With the rising popularity of drones in the 21st century, one issue that has continued to plague drones is power storage. Because of the current limitations of battery storage due to their size and weight, drones have relatively short flight times before their battery is depleted, and have long charge times before they can fly again. To remedy this issue, our project swaps the entire battery out of the drone, drastically improving the down time, and gets the drone back into the air, fully powered and ready to go.

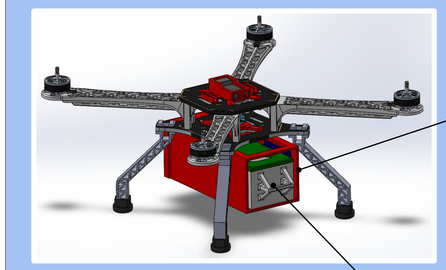
Mission Profile



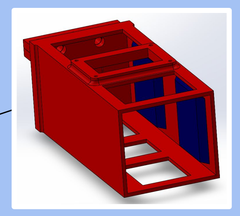
The design is split into two primary parts: the ground station, which contains the spare batteries and performs the swapping process, and the quadcopter drone. The drone begins at the station and takes off to perform its intended mission. Once the drone reaches low-battery (~10% of usable battery capacity), it returns to our designated landing zone on the station, which includes conical holes for the drone's legs. After the drone has landed, our linear actuator will move a specially-designed claw forward that latches onto the battery cartridge. It then drags the cartridge back into our revolving battery storage. Once the old battery is back in the revolver, the revolver rotates to present the fresh battery. The actuator then pushes the fresh battery back into the drone, supplying it with power, and allowing it to take off once again to continuously perform its mission.

Design process

Quadcopter

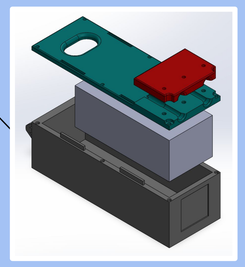


Full Drone CAD



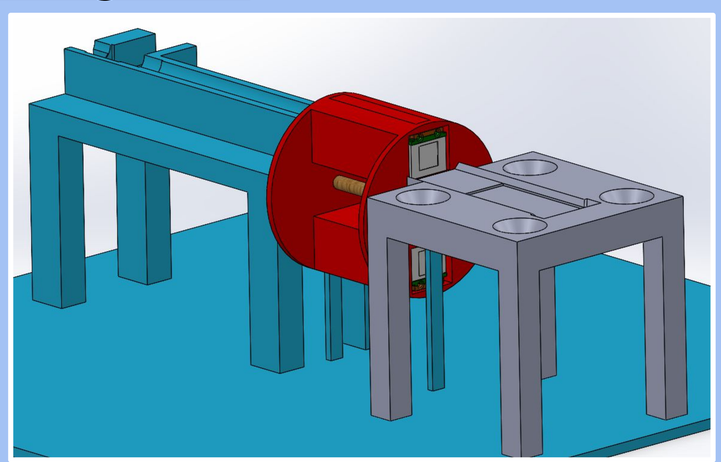
Battery Cage: holds Cartridge in place and creates connection between drone and cartridge

PET-CF Carbon Fiber Frame: high-strength, lightweight, and modular

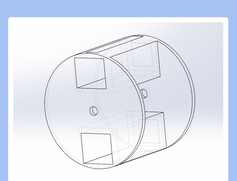


Battery Adaptor Cartridge: houses and connects to the battery

Landing Station



Full Station CAD Model



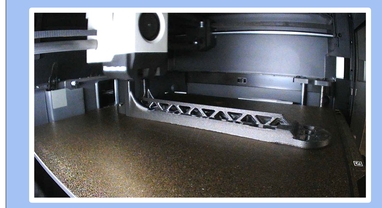
Revolving Cylinder: stores all spare batteries

Arduino UNO: controls all station components

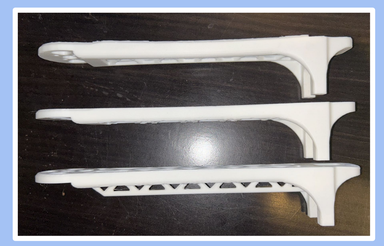
Linear Actuator: pushes and pulls the target battery

Manufacturing

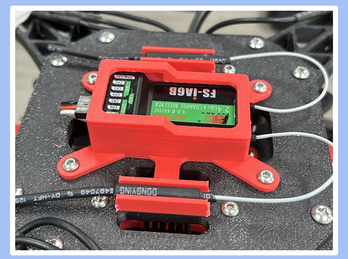
Our primary method of manufacturing is FDM 3D printing. This allowed us to rapidly prototype our early designs before moving on to our final design. By using 3D printing, we were able to utilize a multitude of different materials to optimize strength, weight, cost, and ease of manufacturing parts. The materials we used are polylactic acid (PLA), Polyethylene terephthalate glycol (PETG), and Polyethylene terephthalate - Carbon Fiber (PET-CF).



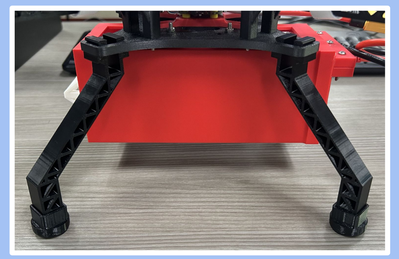
PET-CF part being 3D printed



Early 3D printed prototype in PLA



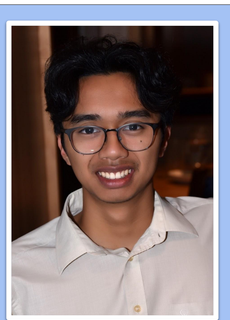
PLA Electronic Component Mounts



PETG Landing Legs

Meet the team

Joshua Baker



Joel Sampol

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Acknowledgments

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