DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

408U- Inductive Reasoning

Wireless UAV Charging

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Problem Definition

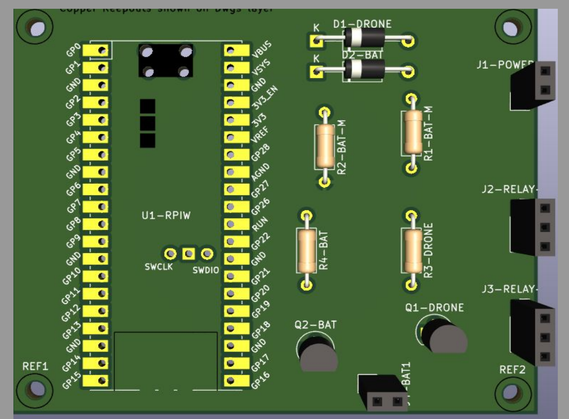
Current drone operations are limited by battery life, requiring frequent manual intervention for recharging or battery replacement. This constraint significantly restricts the operational endurance and autonomy of unmanned aerial vehicles (UAVs) like the Starling PX4 drone, especially in applications requiring persistent, long-duration deployments. The objective of this project is to design and implement a fully autonomous wireless charging system for the Starling PX4 drone.

Design Calculations & Analysis

- The bowl of the docking station is designed to align the drone: the receiving and transmitting antennas become concentric.
- The transmitter and receiver circuits each contain a Raspberry Pi Pico. Relays control the flow of power based on the battery's charge level.
- A LiDAR sensor pointing horizontally detects if the drone is roughly in position. The charging process initiates once it detects the drone has landed.
- Multiple parts, including the bowl, undercarriage, and the legs were designed using OnShape and 3D printed.

Final Design

- The final design features minimal changes from the initial prototype.
- The antenna charges at 2.5 A, and a full charge takes roughly 35 minutes.
- The drone utilizes Python and ROS2 for flight movement and positioning.
- A PCB board was designed and printed for the receiver circuit to optimize space and reduce weight.



Prototype & Test Results

- The docking station prototype contained inserts for the drone's legs to slide in, but was scrapped due to difficulties in centering the drone.
- Different leg designs and lengths were used, with longer lengths being prioritized due to the size of the undercarriage.