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“Qi” Standard Wireless Recharging Platform
For Multiple Pico Quadrotors
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Abstract

There has been an increasing interest towards MAVs (Micro Aerial Vehicle) mainly because these aerial robots have the capacity to perform tasks and access areas that are dangerous to human operators. However, due to limited battery energy density and payload, these aerial robots often have a short flight time. To address this problem, we designed, tested and implemented a recharging system for multiple Pico Quadrotors (Fig.1). Test results show that the system can reduce human intervention and increase automation when using multiple MAVs to perform persistence missions. Finally, we demonstrate extended missions with three recharging stations and four robots.

Objectives

• To design a charging station that is easy-to-land on and can recharge the onboard lithium polymer battery using inductive coupling

• To design supporting software that enables multiple robots to execute persistence missions and autonomously recharge

Recharging Station Design

Design of the recharging station (Fig. 2). The recharging station consists of two parts:

• Laser-cut acrylic slope structure

• “Qi” standard wireless power transmitter

The use of sloping sides can greatly reduce the ground effects in flight while landing. This design also increases the error margin (by up to 6x) for landing on the inductive coil. The use of a multiple-coil transmitter increases effective charging area for the quadrotor’s secondary coil to align. We use the Vicon Motion Capture System to localize and control the robots with a sub-millimeter accuracy.

Software System Design

Figure 3 shows the schematic of the software design, modified from the original schematic[1]. This modifies several components in order to integrate the recharging system into the existing quadrotor control framework.

• Receiver that receives battery voltage

• A Task Allocator controls the recharging and mission delegation among the robots

• MAV system Mission Control that controls the specified quadrotors to perform certain task

Conclusion

The design, test, and implementation of a fully autonomous recharging system for MAV system has been conducted. The system can run autonomously until the task being preformed by the MAV system is finished.

Future work involves improving the design of the charging stations to further reduce ground effects when landing and increase robustness. Scalability of the recharging system can also be investigated, as future MAV system can consist of tens even hundreds of aerial robots.

References

1. MEAM 620 Instructors(2014), MEAM 620 Lab Manual, University of Pennsylvania