Overview

Many methodologies for implementing VTOL UAVs have been developed to improve the performance of existing UAVs. Currently, there are mainly two types of VTOL UAVs, namely, Tilt-Rotor and Tail-Sitters. They have different architectures to perform transition between take-off, landing and forward flight. This section evaluates and compares each type of VTOL UAV by reviewing previous studies. Finally, a short conclusion is given based on the findings.

Aims and Objectives

This paper aims to test the quad rotor tail-sitter VTOL UAV prototype developed at HKUST through a Robot Operating System (ROS) based communication and visualization platform. Starting by building a physical model in a computer, a preliminary flight controller is designed and be tested under different modes of flight, including hover, transition and forward flight. The test result will be collected as a reference for the future indoor flight test demo in the real world.

The tasks that are necessary to complete:
1. Import 3-D model of UAV with physical properties
2. Complete the UAV modeling
3. Test for simple rotor control
4. Build the test environment
5. Complete indoor and outdoor environment with its physical properties
6. Test for hover mode in the simulation environment
7. Test for forward flight mode in the simulation environment
8. Test for transition mode in the simulation environment
9. Complete the preliminary flight controller

Methodology

In this project, the simulation of the UAV is done by building a flight controller and a simulation environment in computer.

For the flight controller, the UAV model is obtained by importing the 3D model of the designed UAV with its measured physical property. Then, we have to design the rotor control by applying control theories. Hover, transition and forward flight are the three proposed motions that the UAV should performed stably.

For the simulation environment, we apply physical laws into the simulation platform in order to obtain result that is closest to the real world. Also, different physical environments are built to test the performance of the UAV in different situations.

Implementation and testing

- Testing the upward movement by joystick panel
- Integrate controls for both hover mode and forward mode
- Setting Up Workspace and Test-running
- Constructing UROF Files
- Preparing ROS Package
- Writing and Modifying Codes
- Adding Individual Aerodynamic Calculation
- Building Flight Controller

Conclusion

Our project aims to test the quad rotor tail-sitter VTOL UAV prototype by visualization software platform and flight controller. We use ROS as the development platform and use Gazebo to visualize the UAV model converted from a SolidWorks model. We mainly apply joystick control for flexibility and also with the alternative command control for detailed testing. The hovering mode is stable because of the well-developed stability system. However, the transition and forward flight mode is still under development at the time of this report. Further work can be done by designing a stable system for the flight controller during the transition and forward flight mode.