

UAV Research Directions

The lab is currently pursuing UAV research on three related fronts:

1. High level algorithm development on $\frac{1}{4}$ scale fixed wing aircraft using commercial inner loop autopilots.
2. Cooperation and coordination among air and ground vehicles.
3. Low level sensing, instrumentation and control for small indoor rotorcraft.

These provide opportunities for practical and theoretical research by students at all levels of undergraduate and graduate study. Ideally a framework will be established whereby this research is implemented in a modular fashion. People will be able to focus on implementing functional blocks for individual problem aspects. These modules can then be composed to maximize the achievements of the group and the impact of each research project. An initial list of such tasks follows.

Available Tasks

Large Fixed Wing UAV

- Mission level representations and solutions – Developing mathematical representations of UAV missions and implementing numerical solution approaches for a specific task such as target localization, self localization, communications relaying, area search and surveillance.
- Multi robot cooperation – Developing and implementing decentralized control architectures that enable teams of multiple aerial or air and ground robots to cooperatively execute tasks.

Mini Indoor UAV

- Mini-UAV platform evaluation – Determine the suitability of available small hobby aircraft for use as UAVs. e.g. sufficient payload, stability, endurance and ease of customization.
- Onboard sensor suite evaluation and implementation – Choose and implement onboard hardware level sensing, processing and communication to support inner loop control of mini UAVs.
- Onboard camera sensing – Perform remote processing of images from onboard miniature cameras to provide possible attitude, position, velocity and obstacle information.
- Offboard cameras – Use vehicle spotting from ground cameras to provide position and potentially other state feedback.
- Sensor fusion – Combine the distributed on and off-board sensing resources to provide improved estimation of the vehicle states.
- Modelling and identification – Build and identify suitable models of the vehicle dynamics to support improved estimation and control.
- Controller design – Design and implement stability and command augmentation loops to enable regulation of the vehicle velocities.