ICT Project Nomination Form 2012

The teams choose projects based on this short description. There is no guarantee that your project will be taken, make it sound as interesting and as educational as possible.

**Project Title:**

Pre-flight planning and post-flight visualisation of Unmanned Aerial Vehicle (UAV) remote sensing missions

**Client retains Intellectual Property:** No

**Confidentiality Agreement required:** No

**Project Description:**

The *TerraLuma* project in the School of Geography and Environmental Studies at the University of Tasmania (UTAS) develops unmanned aerial vehicles (UAVs) for environmental remote sensing applications. UAVs offer an exciting new technology for ultra-high resolution remote sensing observations. Our project aims to develop UAV capabilities, based on state-of-the-art sensors and image processing techniques.

We operate several UAV platforms: three vertical take-off and landing (VTOL) multi-rotor helicopters also known as OktoKopters, two VTOL helicopters, and three fixed-wing planes of which the largest has a 3.5 m wingspan and 10 kg payload capacity. We have integrated a range of imaging and scanning sensors: 6-band multispectral sensor, thermal sensor, 340-band hyperspectral scanner, and laser scanner (LiDAR). These novel environmental remote sensing tools are used to map and monitor natural ecosystems, agricultural areas, mine sites, and other environments at an unprecedented level of detail. In doing so, we fill a niche between field observations and full-scale airborne observations. In summary, the three unique aspects of our UAVs are:

- Highest spatial *resolution* imagery available (~1 cm/pixel)
- Fly *on-demand* at critical stages
- Integration of *multiple sensors* imaging outside the visible range

This software engineering project will focus on developing software for UAV flight planning. Before each UAV mission we need to determine the most efficient flight path (spacing of transects, transect direction, and flying height) and the optimal overlap between images or scans. These parameters depend on the area of interest, the UAV platform, the sensor being flown, wind direction, and operational constraints in the field (e.g. power lines). We are keen to have a UAV flight planning tool integrated in Google Earth, Google Maps, or NASA WorldWind that can be used to plan our missions before going out into the field. In addition, we need to be able to adjust the flight path parameters in the field just before take-off. The output of the flight planning tool is a series of GPS waypoints that is in a compatible format with our autopilot software (Micropilot, Ardupilot, and MikroKopter’s MikroTool), so that the flight path can be directly uploaded onto the UAV.
The second phase of the project focuses on the development of a post-flight visualisation tool. Straight after the UAV survey or back in the office we download the UAV’s GPS track and series of sensor images. We would like the UAV flight to be visualized and “replayed” in Google Earth (or NASA WorldWind). The footprint of each photo should be projected onto the 3D globe in Google Earth showing a reduced resolution image of the original. The time slider in Google Earth can then be used to move back and forth through time showing the areas that the UAV sensors covered. This tool should allow us to visually analyse the results of a UAV mission in an efficient and attractive manner.

**Project Technical Information:**

- Google Earth and Google Maps: KML and Google Earth API
- Alternatively, NASA WorldWind could be used
- Has to run on field laptop (caching of satellite imagery from Internet before field trip)
- Preference for open scripting language, e.g. Python
- Flight path output has to be compatible with autopilot software (Micropilot, Ardupilot, MikroKopter MikroTool), e.g. generally ASCII GPS waypoints

**Contact Information:**

Client Name (person who will be student contact): Dr Arko Lucieer

Phone Number (business hours): 0362262140

Mobile Number (if have one):

Email Address: Arko.Lucieer@utas.edu.au

Website (if have one): [http://www.terraluma.net](http://www.terraluma.net) and [http://www.lucieer.net](http://www.lucieer.net)

Address (where students will visit, not PO Box): UTAS, School of Geography & Environmental Studies, Surveying and Spatial Sciences group, Engineering building, ground-floor room 120.