PhD Studentship on Aerial Terrain Relative Navigation for Pinpoint and Safe Landing of Unmanned Aircraft

Australian Research Centre for Aerospace Automation (ARCAA)
Joint Venture between CSIRO and QUT

ARCAA invites applications for a PhD position with start on **January 2012** or as soon as possible hereafter and for a period of three years. The Australian Research Centre for Aerospace Automation (ARCAA) aims to develop technologies that will allow the safe, reliable, and cost-effective operation of unmanned aircraft systems (UAS, also known as UAV) for scientific and civilian applications. ARCAA is engaged in different research areas including aerospace automation, flight control, static and dynamic sense and avoid, 3D perception and guidance for various classes of UAS. More than 30 researchers and engineers are working on different projects and in multidisciplinary areas. ARCAA offers access to state-of-the-art facilities including small UAS, autonomous helicopters, fixed-wing UAS of different sizes, a manned Cessna aircraft, and many other infrastructures for deployment and field testing. ARCAA is a world-leading research centre based in Brisbane and has an excellent national and international reputation for high-quality theoretical and experimental research funded by aerospace industry, government and other organizations. The details of the research activities and projects within ARCAA can be found at
http://www.arcaa.aero/
http://research.ict.csiro.au/research/labs/autonomous-systems/field-robotics/field-robotics

Supervisors:

- Dr. Farid Kendoul, Research Scientist at CSIRO Autonomous Systems Lab and ARCAA.
- TBD, Lecturer/Researcher from QUT or UQ.

Project Details:
The aim of the project is to develop and demonstrate a system that will enable unmanned aircraft to perform non-GPS accurate (pinpoint) and safe landing at a designated site. The proposed research will investigate two different approaches: 1) adapt and apply the technologies developed by NASA JPL for spacecraft landing on Mars [1][2] for force landing of unmanned aircraft; and 2) attack the problem from a different angle altogether, using the way birds and insects navigate to their goal as insight and inspiration. The work involves:

- Landmarks extraction and topological-metric map building.
- Landmarks recognition and visual route/place cognition.
- Absolute position estimation.
- Visual odometry or path integration between mapped landmarks.
- Real-time implementation of the developed algorithms and flight testing of the system using real unmanned aircraft.

In addition to these main research activities, the PhD student will be also involved in other projects and collaborative activities with other international universities and leading aerospace companies such as *Boeing* and *Insitu Pacific*.

Qualifications:
Applicants should have completed a bachelor degree with first class honours or a Master's degree in Engineering, Mathematics or Computer Science, and

- Be able to demonstrate knowledge within one of the following disciplines: mechatronics and/or robotics, avionics and/or aerospace, computer vision, electrical engineering.
- Be able to demonstrate good problem solving and analytical skills.
- Be interested in and capable of conducting high-quality research in the field of autonomous aerial vehicles.

Funding: The successful student will be eligible for the Australian Postgraduate Awards ($22,500 per annum for 3 years, tax exempt). He may also be eligible for the CSIRO and QUT top-ups.

How to apply for this position:
Applicants should send a CV, copies of transcripts (obtained grades) and a cover letter detailing their suitability and interest for this project to Dr. Kendoul via email or mail:
Dr. Farid Kendoul
Autonomous Systems Lab.
CSIRO ICT, QCAT
1 Technology Court
Pullenvale, QLD 4069
Email: farid.kendoul@csiro.au

For further information on the project or for an informal discussion, please contact:
Dr. Farid Kendoul, Tel: (+61) (0)7 3327 4050, Email: Farid.Kendoul@csiro.au

Closing date: 10th September, 2011

References:

[1] Mourikis, A.I.; Trawny, N.; Roumeliotis, S.I.; Johnson, A.E.; Ansar, A.; Matthies, L.; "Vision-Aided Inertial Navigation for Spacecraft Entry, Descent, and Landing" IEEE Transactions on Robotics, Vol 25, Issue 2, 2009.

[2] N. Trawny, A.I. Mourikis, S.I. Roumeliotis, A.E. Johnson, J. Montgomery "Vision-Aided Inertial Navigation for Pin-Point Landing using Observations of Mapped Landmarks" Journal of Field Robotics Vol 24, Issue 5, 2007.