Open Internship in the ESA Advanced Concepts Team in 2014
on
AstroDrone: robotic landing mission app with a Parrot ARDrone

Topic Description

In contrast to human beings or other animals, robots have the possibility to directly exchange knowledge and capabilities such as sensory-motor skills. In order to arrive at generic results, it is desirable to have robots learn from many environments and situations. One way to achieve such learning is to create a robot internet, as in the RoboEarth project [1, 2]. In that project, robots are connected to a central database on the internet. The robots can upload their experiences and knowledge to the database, and download the experiences and knowledge of other robots. However, no tests have been performed yet with large numbers of robots.

Recently, the Advanced Concepts Team has introduced a different way of gathering robotic data, namely by crowd-sourcing the toy robots made for augmented reality games. In particular, ESA has created the “Astro Drone” game for the Parrot AR drone [3]. In the game, a player flies an AR drone in the environment of their choice (living room, office, outside …), while performing space missions in an augmented reality. After playing, the player can choose to contribute to a scientific experiment by going to the high-score table. In the first level (experiment), visual data was gathered to improve robotic obstacle avoidance capabilities. In the 5 months after the release, the game was downloaded ~11,000 times and ~750 robotic data samples were uploaded to the database, resulting in new findings for visual obstacle detection.

The AstroDrone game currently uses the frontal camera and hence has levels involving mostly forward flight. The objective of the internship is to extend the AstroDrone game to include landing levels that utilize the downward looking camera.

Candidate's tasks

The successful candidate will:

- modify the game to estimate the virtual spacecraft's state also based on sonar / the ground marker provided by Parrot (ideally both the Android and iOS versions)
- create a new level, together with 3D models to make realistic landing environments on Mars / the Moon
- update the program's structure to accommodate additional levels in the database / high-score table / etc.
- help setting up / implementing a vision-based landing experiment

The ideal candidate

- Strong programming skills (C++, Java, Objective C)
- Interest in (embedded) programming, game design, robotics, vision-based control.

References

[1] Waibel, M.; Beetz, M.; Civera, J.; D’Andrea, R.; Elfring, J.; Galvez-Lopez, D.; Haussermann, K.; Janssen, R.; Montiel, J.M.M.; Perzylo, A.; Schiessle, B.; Tenorth, M.; Zweigle, O.; van de Molengraft, R.; RoboEarth – A World Wide Web for Robots, Robotics & Automation Magazine, IEEE, vol.18, no.2,pp.69-82, June 2011. doi: 10.1109/MRA.2011.941632

[2] Tenorth, M.; Klank, U.; Pangercic, D.; Beetz, M.; , Web-Enabled Robots, Robotics & Automation Magazine, IEEE , vol.18, no.2, pp.58-68, June 2011. doi: 10.1109/MRA.2011.940993.

[3] https://itunes.apple.com/us/app/astro-drone/id597477649?mt=8

[4] http://spaceinvideos.esa.int/Videos/2013/03/AstroDrone