Next generation radiation mapping using UAS assisted dynamic monitoring networks

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Abstract

Nowadays, unmanned aerial systems (UASs) have become increasingly popular in a wide range of applications, from military to recreational. The Interface Analysis Centre (IAC) at the University of Bristol has developed a UAS, called the AARM (Advance Airborne Radiation Monitoring) system, which could be used to provide visual and thermal monitoring of radiation after a release of nuclear material. AARM system has successfully measured radiation in one of the most highly contaminated prefecture areas in the Fukishima Daiichi nuclear power plant after the disaster caused by the earthquake and tsunami in March 2011.

The purpose of this project is to advance the existing capability for radiation surveillance at civil nuclear sites of the first generation AARM system. There are many approaches that can be followed to improve the existing system. In the context of this project the following progressions have been proposed:

* Equipping the UAS with advanced sensors. An extensive testing of proximity sensors has been conducted to identify the strengths and the weaknesses of the existing commercial of-the-self (COTS) sensors.
* Developing a realistic simulation and assisted flight method. It is an imperative requirement to evaluate and test UAV in difficult or dangerous scenarios without any harm to real and expensive UAV hardware. Most of the time it is faster to run a simulator instead of starting the whole scenario on a real robot. Because of these reasons, a comprehensive simulation based on ROS and gazebo has been developed. Using that simulation, an assisted teleoporation mode for obstacle avoidance has been implemented.
* Creating advanced human robotic interfaces. The main mission of the UAS is to map the radiation levels. An iOS mobile application for visualising the individual gamma energies and intensities (cps) on a map has been developed. In addition, a second iOS application was implemented which can be utilized to teleoperate a ROS enabled UAV. The operator gets feedback from the onboard devices and sends control commands.
* Designing the next generation AARM system. Having examined a wide range of improvements a specific design is proposed using the computational power of a companion computer onboard.

Acknowledgements

(It will be added)

Supporting Files

All the project’s related files, including source code, videos and documentation can be found in the online repository: [github.com/plusangel/radiationUAV](https://github.com/plusangel/radiationUAV)

Note

The first draft of the dissertation is printed in gray scale. The final submission will be printed in color.

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