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Title	Development of Teleoperated and Semi-Autonomous Aerial Vehicles [課題研究報告書]
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Citation	
Issue Date	2014-03
Type	Thesis or Dissertation
Text version	author
URL	http://hdl.handle.net/10119/12047
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Development of Teleoperated and Semi-Autnomous Aerial Vehicles

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February 12, 2014

Keywords: UAV, control of aerial robot, sensor based path planning.

A quadrotor offers a challenging control problem due to its inherently unstable nature. An effective control methodology is therefore needed for such a unique airborne vehicle. A robot with this capability could be useful for many applications including search and rescue, exploration in hazardous environments, surveillance, etc. However, there are many challenges that engineers must face before developing such a robot, including the strict limitations in sensing technologies, power consumption, platform size and embedded processing. A key direction of this research aims at designing a stable system for controlling teleoperated quadrotor that is equipped with limited range of sensors. It is very difficult to achieve autonomous aerial navigation in GPS denied environment toward a goal position avoiding unpredictable collision. In order to safely maneuver within these environments, it would be beneficial for such a robot to be able to hover. This alone introduces many difficult problems including stability control, altitude control, platform drift, collision avoidance, and platform design, all being important for a successful operation. The system must also be able to sense its environment, prevent collisions and maneuver through the environment safely. First part of this project we have developed semi-autonomous aerial vehicle which is capable to control its altitude in GPS denied environment and it is a future platform for developing fully autonomous agile aerial vehicle. Quadrotor UAVs appear in miniature form

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in contrast to typical aerial vehicles, whereby the possibility of aerial vehicle swarming becomes a reality. We can use this terrific technology in different application and different purpose. Therefore, in the second part of this project we have discussed couple of path planning algorithms in cluttered environment where reduction of computational expense has given greater attention; one of them is rescue mission after nuclear disaster. However, in this particular problem we want to localize all of radioactive materials after nuclear disaster. The algorithm of informative path planning for mobile UAVs is addressed to reduce the uncertainty in rapid localization of radiation contaminated quantities that is a prime interest of research in the future world. However, without a priori knowledge on the whereabouts of the source of radiation substances leakages, it is very difficult to select the region of interest and appropriate measurement locations which are deemed to contain the most valuable information. Although sequential surrogate modeling provides a global picture of the radiation exposure of an area, particularly for fast emergency response, all the regions are not as informative as to explore. Therefore, to minimize the number of UAVs and the operating time required to explore the whole area, we propose a single UAV path planning algorithm for building an intensity contour map with the budget based greedy algorithm. We have demonstrated the efficiency of the proposed algorithm to create a surrogate model of intensity contour map with the V-REP robot simulator and analyzed the contour map by numerical simulations using MATLAB.