

Cooperation of Unmanned Vehicles for Accomplishing Missions

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Abstract : The use of unmanned systems for different purposes has become very popular over the past decade. Expectations from these systems have also shown an incredible increase in this parallel. But meeting the demands of the tasks are often not possible with the usage of a single unmanned vehicle in a mission, so it is necessary to use multiple autonomous vehicles with different abilities together in coordination. Therefore the usage of the same type of vehicles together as a swarm is helped especially to satisfy the time constraints of the missions effectively. In other words, it allows sharing the workload by the various numbers of homogenous platforms together. Besides, it is possible to say there are many kinds of problems that require the usage of the different capabilities of the heterogeneous platforms together cooperatively to achieve successful results. In this case, cooperative working brings additional problems beyond the homogeneous clusters. In the scenario presented as an example problem, it is expected that an autonomous ground vehicle, which is lack of its position information, manage to perform point-to-point navigation without losing its way in a previously unknown labyrinth. Furthermore, the ground vehicle is equipped with very limited sensors such as ultrasonic sensors that can detect obstacles. It is very hard to plan or complete the mission for the ground vehicle by self without lost its way in the unknown labyrinth. Thus, in order to assist the ground vehicle, the autonomous air drone is also used to solve the problem cooperatively. The autonomous drone also has limited sensors like downward looking camera and IMU, and it also lacks computing its global position. In this context, it is aimed to solve the problem effectively without taking additional support or input from the outside, just benefiting capabilities of two autonomous vehicles. To manage the point-to-point navigation in a previously unknown labyrinth, the platforms have to work together coordinated. In this paper, cooperative work of heterogeneous unmanned systems is handled in an applied sample scenario, and it is mentioned that how to work together with an autonomous ground vehicle and the autonomous flying platform together in a harmony to take advantage of different platform-specific capabilities. The difficulties of using heterogeneous multiple autonomous platforms in a mission are put forward, and the successful solutions are defined and implemented against the problems like spatially distributed tasks planning, simultaneous coordinated motion, effective communication, and sensor fusion.

Keywords : unmanned systems, heterogeneous autonomous vehicles, coordination, task planning

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