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Controlling unmanned blimp missions using virtual teleportation technology

Novelty of the proposed approach is the integration of control system for an unmanned blimp with supervision functions implemented by using virtual teleportation technology. Blimps used for monitoring have several advantages over fixed wing solutions. They can hover in particular location in space contrary to fixed wing aircraft in which proper controlling of the flight path requires more complex algorithms (due to necessity of moving in the air). An example of flight path control of fixed wing UAV based on angular orientation of the camera has been given by Kruczek and Cyran (2012a). Similarly, in vehicle escorting problem, the flight path of the fixed wing aircraft requires circling around the target in addition to moving in the direction of vehicle movement (see Kruczek and Cyran 2012b). In such situations, aircraft whose lift force does not depend on the relative movement in the air is easier for control. Typically, multi-rotor platforms are used for that purpose, however they have limited flight times because of energetic poor efficiency. Blimps are more energetically effective and that is why we addressed the problem of the from-air-monitoring by using airships. Very comprehensive presentation of control models for unmanned blimps is given in Y. Bestaoui Sabbane (2012). Starting with mathematical models presented there, which relate blimp dynamics with static tensor (due to weight and lift forces), propulsion tensor (due to forces produced by propulsion system), and aerodynamic tensor (due to relative movement of the blimp in the air), our main purpose is to integrate blimp controlling with supervising the aircraft mission by using virtual teleportation technology. First implementation of virtual teleportation technology we made for a robot developed for performing subterranean missions (see for example Cyran et al. 2017). Currently we are developing more advanced virtual teleportation interface for unmanned blimps. It uses newest achievements of augmented reality technology, such as generating 3D immersive environment of the aircraft by Microsoft HoloLens goggles. In such environment, by application of developed by us special computer programs we are able to interactively set up relevant way-points for the 3D flight plans. These latter, can be generated by using algorithmic methods based on mathematical models of aircraft translational dynamics and curvature/torsion properties of the curves (see for example Bestaoui 2010). Together with interactive supervising the mission of the blimp, proposed approach may be therefore used in various monitoring scenarios.

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