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Distributed Real-time Framework for Experimental Multi Aerial Robotic Systems

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Abstract : There exists a shortage of open-source firmware for allowing researchers to focus on implementing high-level planning and control strategies for multi aerial robotic systems in simulation and experiment. Within this body of work, practical firmware is presented, which performs all supplementary tasks, including communications, pre and post-experiment procedures, and emergency safety measures. This allows researchers to implement high-level planning and control algorithms for path planning, traffic management, flight formation and swarming of aerial robots. The framework is built in Python using the MAVSDK library, which is compatible with flight controllers running PX4 firmware and onboard computers based on Linux. Communication is performed using Wi-Fi and the MQTT protocol, currently implemented using a centralized broker. Finally, a graphical user interface (GUI) has been developed to send general commands and monitor the agents. This framework enables researchers to prepare customized planning and control algorithms in a modular manner. Studies can be performed experimentally and in simulation using PX4 software in the loop (SITL) and the Gazebo simulator. An example experimental use case of the framework is presented using novel distributed planning and control strategies. The demonstration is performed using off-the-shelf components and minimal setup.

Keywords : aerial robotics, distributed framework, experimental, planning and control
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