VR environment for UAV pilots training with automated flight assessment system

PhD. Antoni Kopyt, B.Eng. Dominik Tokarz, B.Eng. Stanisław Gajek

Abstract:

Recent legal changes performed by European Commission visualise both private and public markets' demand for safe and reliable unmanned aircraft systems. Although the development of automatic, or even autonomous, control systems has moved strain of manoeuvring off the pilot, it is still a necessity for a human to take responsibility for drone's actions. In face of such needs, an adequate, new approach to pilot training must be taken, in order to ensure the effectiveness of such a course.

The core of the simulator is based on open flight controller software (such as ArduPilot or PX4) which is easily integrated with real RC controller, thus increasing the quality of training by easily switching between simulated and real flight conditions by using identical control equipment. This approach also provides open identification of dynamic models and their modifiability. With this solution, it is possible to implement new dynamics models for training or software testing purposes in the SITL(Software-in-the-loop) approach. The architecture also allows devices to be tested in a HITL(Hardware-in-the-loop) approach by replacing a flight controller simulated on a PC with a real unit. The environment is to function in virtual reality (VR) technology, with the possibility of using augmented reality (AR) functions for the creation of artificial obstacles. The instructor panel will be an extension of the simulator, from which it will be possible to modify environmental parameters, change mission settings or react to the trainee's behaviour and decisions during training. These functions will be coupled with an automatic function of pilot skill assessment based on selected flight characteristics.

The paper describes development of a simulated environment, hasting advancements in trainee's flight skills. The main objectives of this project are building a custom flight environment, providing a tool for creating uncharacteristic mission scenarios and aiding instructors with automatic flight analysis module. The simulator should enable practicing in harsh and often unrepeatable in real life mission settings, that could be prepared both before an exercise, or induced during one with a specifically assembled instructor’s panel. Data gathered during the activity is subjected to thorough dissection by a set of algorithms, resulting in breakdown of subject’s performance in time, as well as its overall grading. The results may be directed to the instructor, providing them with an overview on pilot’s progress and helping with preparing the optimal guidance during the rest of the course.

The paper concludes with a summary of milestones achieved during recent project development, as well as a prediction of steps required to further advance with the project. Given there are a brief depiction of program's performance optimisation methods, graphical user interface adjustments and consideration of possible integration with a biofeedback system, developed in parallel to described simulator.