

An Image Based Visual Servoing (IBVS) Approach Using a Linear-Quadratic Regulator (LQR) for Quadcopters

Authors : C. Gebauer, C. Henke, R. Vossen

Abstract : Within the Mohamed Bin Zayed International Robotics Challenge (MBZIRC) 2020, a team of unmanned aerial vehicles (UAV) is used to capture intruder drones by physical interaction. The challenge is motivated by UAV safety. The purpose of this work is to investigate the agility of a quadcopter being controlled visually. The aim is to track and follow a highly dynamic target, e.g., an intruder quadcopter. The following is realized in close range and the opponent has a velocity of up to 10 m/s. Additional limitations are given by the hardware itself, where only monocular vision is present, and no additional knowledge about the targets state is available. An image based visual servoing (IBVS) approach is applied in combination with a Linear Quadratic Regulator (LQR). The IBVS is integrated into the LQR and an optimal trajectory is computed within the projected three-dimensional image-space. The approach has been evaluated on real quadcopter systems in different flight scenarios to demonstrate the system's stability.

Keywords : image based visual servoing, quadcopter, dynamic object tracking, linear-quadratic regulator

Conference Title : ICUAS 2020 : International Conference on Unmanned Aircraft Systems

Conference Location : Zurich, Switzerland

Conference Dates : January 13-14, 2020