摘要

将相机放在旋翼飞行器上进行拍摄，正迅速成为摄影师们的拍摄方式之一，目前，专业人士通过手动操作旋翼飞行器进行拍摄，因此，这种拍摄需要一定的技巧和灵活性。

斯坦福大学的学者们通过和专业摄影师与摄像师的交流，提取出一组系统设计原则。根据这些原则，他们开发了一套专门为具有自主执行能力的旋翼型相机而设计的视频拍摄工具。本文正文部分对其进行了详细的介绍。

这套工具能使用户：通过关键帧在视觉上指定镜头；在虚拟环境中预览拍摄结果；根据曲线精确计算出拍摄时机；最后在现实世界中通过点击旋翼飞行器上的按钮获取拍摄结果。

通过用户调查与反馈，这套工具能够全自动拍摄，被证实能够为新手和专业摄影师进行挑战性拍摄时提供很大的方便。

**关键词**：机器人，旋翼飞行器，相机动画

Abstract

Cameras attached to small quadrotor aircraft are rapidly becoming a ubiquitous tool for cinematographers, enabling dynamic camera movements through 3D environments. Currently, professionals use these cameras by flying quadrotors manually, a process which re- quires much skill and dexterity. In this paper, we investigate the needs of quadrotor cinematographers, and build a tool to support video capture using quadrotor-based camera systems. We begin by conducting semi-structured interviews with professional photogra- phers and videographers, from which we extract a set of design principles. We present a tool based on these principles for designing and autonomously executing quadrotor-based camera shots. Our tool enables users to: (1) specify shots visually using keyframes; (2) preview the resulting shots in a virtual environment; (3) precisely control the timing of shots using easing curves; and (4) capture the resulting shots in the real world with a single button click using commercially available quadrotors. We evaluate our tool in a user study with novice and expert cinematographers. We show that our tool makes it possible for novices and experts to design compelling and challenging shots, and capture them fully autonomously.

**Keywords：**robotics, quadrotors, camera animation