

Postprint on the Application of UAV Aerial Photography in Television Program Production

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Date: 2023-10-08T00:00:00+00:00

Abstract

In recent years, with the continuous advancement of technology and the progressive development of information technology, aerial photography technology—characterized by its extensive operational space, high intelligence, and strong flexibility—has been widely applied in television program production. This technology not only provides a novel and unique perspective for television program creation, but also enhances the visual impact of television programs, effectively overcoming the limitations of traditional filming modes. To fully leverage the application advantages of aerial photography technology, this paper takes the application of “unmanned aerial vehicle (UAV) aerial photography” as an example to outline the artistic value of UAV aerial photography systems and imagery, and to scientifically apply UAV aerial photography in domains such as breaking news production, documentary production, and new media art education production. The full integration of UAV aerial photography with television program production will elevate the standard of television program creation, delivering a completely new visual experience to audiences. It is hoped that this research can provide effective reference and guidance for technical personnel.

Full Text

Preamble

Application of Drone Aerial Photography in Television Program Production

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Abstract: In recent years, with continuous improvements in technological standards and ongoing development of information technology, aerial photography technology—characterized by large operational space, high intelligence, and strong flexibility—has been widely applied in television program production. It not only provides a novel and unique perspective for television creation but

also enhances visual impact and effectively overcomes the limitations of traditional shooting modes. To fully leverage the advantages of aerial photography technology, this paper takes the application of “drone aerial photography” as an example to outline drone aerial photography systems and the artistic value of drone aerial imagery, exploring its scientific application in breaking news production, documentary creation, and new media art education. The integration of drone aerial photography with television program production improves creative standards and delivers fresh visual experiences to audiences. This research aims to provide valuable reference for technicians.

Keywords: drone aerial photography; television programs; artistic aesthetics; photography and videography; professional skills

CLC Number: G222

Document Code: A

Article ID: 1671-0134(2021)09-111-03

DOI: 10.19483/j.cnki.11-4653/n.2021.09.035

Citation Format: He Xin. Application of Drone Aerial Photography in Television Program Production [J]. China Media Technology, 2021(09): 111-113.

Drone aerial photography, as a novel and advanced image creation technology, has been widely applied in television program production against the backdrop of China’s improving technological standards. In practice, drone aerial photography utilizes unmanned aerial vehicles to capture aerial shots, producing bird’s-eye views that clearly display geographic locations. These provide audiences with authentic, vivid motion footage that creates an immersive experience and effectively satisfies aesthetic demands. To create superior television programs, technicians must consider how to effectively apply drone aerial photography technology to television production.

1. Overview of Drone Aerial Photography Systems

The scientific application of drone aerial photography technology in television program production requires understanding drone aerial photography systems, which primarily consist of unmanned aerial vehicles, navigation and flight control systems, and cameras. The system composition is shown in Figure 1 [Figure 1: see original paper].

1.1 Drone Flight Platform

The drone flight platform comprises three main components: helicopters, fixed-wing aircraft, and multi-rotor vehicles. Helicopters primarily utilize rotor tilt forces to generate multi-directional forces for scientific adjustment and control of the airframe. Fixed-wing aircraft achieve automated control by altering airflow. Multi-rotor vehicles control the rotational speed of multiple rotors to generate varying torque in multiple directions, thereby scientifically controlling

flight trajectories. Multi-rotor vehicles feature simple structures and compact sizes, facilitating efficient production and making them widely applicable in drone aerial photography.

1.2 Power System

Current drone aerial photography systems primarily employ power systems consisting of three components: power motors, speed control systems, and power supplies. Brushless motors serve as common power motors, operating by changing current in the motor's stator coils to create a stable electric field around the windings, which drives the rotor to ensure stable and reliable rotation. Motor performance is closely related to factors such as magnetic steel strength and input voltage values. After DC power is successfully input, [2] current under the influence of electronic speed controllers can be rapidly converted into three-phase AC power, while remote controllers receive control signals to scientifically control and adjust motor speed, establishing a solid foundation for meeting user requirements.

1.3 Navigation and Flight Control System

Based on functionality, the navigation and flight control system can be divided into two subsystems: (1) The navigation subsystem, which provides the drone with reference coordinate-related flight position, velocity, and status information to ensure precise and safe flight along predetermined routes. (2) The flight control subsystem, which monitors and manages the drone's operational states during takeoff, in-flight, and return processes.

1.4 Electrical System

The electrical system provides continuous power for flight control, aerial cameras, and stabilizing gimbals. Therefore, it constitutes a core component of the drone aerial photography system, comprising power distribution systems, power supplies, and electrical equipment. This subsystem ensures reliable, stable, and safe operation of the drone aerial photography system.

1.5 Stabilizing Gimbal

The stabilizing gimbal serves as a crucial component of drone aerial photography systems, primarily providing flight operators with a stable and safe aerial imaging environment. It ensures that aerial cameras can successfully complete shooting tasks in complex high-altitude environments. The gimbal automatically perceives airframe movements through sensors while using motor drive to maintain the camera in its original position, minimizing positional errors caused by airframe vibrations. The aerial equipment used in this paper primarily consists of drones produced by DJI, providing a solid foundation for ensuring camera stability.

1.6 Camera

Unlike traditional cameras, aerial cameras are typically constrained by factors such as image quality, aircraft weight capacity matching, and video format. Foshan Television Station primarily uses gimbal cameras, which feature high integration, compact lenses, streamlined video processing workflows, high compression rates, and convenient storage. Such equipment enables recording of video container formats while requiring appropriate video compression encoding methods to ensure effective processing of aerial footage.

2. Artistic Value of Drone Aerial Photography

Although drone aerial photography technology has developed relatively slowly and remains immature, people's pursuit of its artistic value has never ceased. Under this dedicated pursuit, drone aerial photography has achieved significant development and innovation, enabling perfect integration of technology and art [3] while continuously releasing the aesthetic value of aerial imagery.

Aerial photography combines unique angles and perspectives to enhance cinematic effects that are difficult to achieve with conventional ground shooting. Compared with traditional ground photography [4], television aerial shooting employs three primary angles: horizontal, upward, and bird's-eye view, breaking through cognitive limitations and adding new perspectives. This allows audiences to experience the sensation of looking down from an airplane window, providing novel visuals and dimensions while creating favorable conditions for overcoming traditional shooting limitations and improving aerial photography effects.

2.2 Spatial and Mental Patterns of Aerial Photography

Compared with traditional ground shooting, aerial photography employs a unique spatial positioning method that differs from planar view approaches. During aerial shooting, cameras can move freely through the air according to the director's intentions, breaking through the limitations of single spatial positioning. Using multi-dimensional, multi-angle spatial construction methods can deepen impressions of real scenes [5]. Furthermore, aerial images can transform traditional perceptions while conveying multi-dimensional and diverse artistic thinking, enabling people to intuitively and vividly experience the possibilities of spatial construction and changes in motion trajectories through aerial photography.

3. Specific Applications in Television Program Production

In recent years, with continuous development and popularization of aerial photography technology, drone aerial photography has been widely applied in television program production. For example, Hunan Satellite TV's reality show "Where Are We Going, Dad?" extensively utilized drone aerial photography

footage, providing audiences with a refreshing experience and introducing them to aerial technology for the first time [6]. China Central Television launched the documentary “Aerial China,” which caused a tremendous sensation across society. The production employed both manned helicopters and drones, making it a milestone achievement.

3.1 Panoramic Aerial Photography in Breaking News

Under continuous information technology development, news emphasizes timeliness and authenticity. Rapidly and effectively presenting scene information to audiences in the shortest time is crucial, as it not only obtains comprehensive and authoritative information but also wins greater audience appeal. Panoramic aerial photography, as an advanced and novel technology, plays an important role in news reporting [7]. From a bird’s-eye perspective, it can present magnificent and spectacular scenes to audiences, particularly in breaking news coverage of natural disasters, social security incidents, and accidents, where panoramic aerial photography can directly present the actual scene conditions.

3.2 Aerial Photography in Documentaries

Documentary production primarily employs drone aerial photography technology to construct novel and unique visuals, better presenting environments inaccessible to humans. For example, the documentary “Seeing Taiwan” primarily used aerial footage, breaking through and innovating traditional perspective limitations while helping people better understand and recognize the land on which humanity survives [8]. In summary, integrating drone aerial photography into documentary production can not only authentically reconstruct current scenes but also achieve reconstruction of real scene processes. In “Seeing Taiwan,” the combination of aerial shots with environmental landscapes completed the scientific construction of complete multi-dimensional forms, creating powerful visual impact for audiences [9].

3.3 Aerial Photography in New Media Art Education

To better apply drone aerial photography in new media art education, technicians must master precise and professional aerial techniques while scientifically controlling and adjusting flight parameters based on shooting requirements, weather conditions, and altitude to ensure stability, reliability, and safety. To improve training quality for drone aerial photography talent [10], art institutions should establish relevant programs based on market demands, enabling students to enhance their artistic creativity and expression, thereby cultivating high-level, high-quality, and highly capable professionals who can scientifically apply drone control, maintenance, and aerial photography technologies in various creative cultural fields.

3.4 Aerial Photography in Special Features

To fully integrate drone aerial photography with television program production and leverage its advantages, the technology has been applied to news feature production to ensure efficiency and effectiveness. For example, during a televised interview with a city mayor, Foshan Television Station's news team was divided into three groups to interview mayors from various cities. Using a three-system aerial approach, they presented the cultural landscapes of cities along the route in a vivid and intuitive manner. The entire aerial shooting task was completed in just one month, covering 5,000 kilometers. The cultural landscape shots from cities along the Nanning-Guangzhou high-speed railway created powerful visual impact, improving information dissemination effectiveness and ensuring successful completion of the news feature project.

4.1 Advantages of Drone Aerial Photography

Drone aerial photography technology integrates aerial photography sensor technology, navigation technology, flight control technology, and other technologies to ensure captured images feature large scale and high clarity. These advantages make drone aerial photography perfectly suited for imaging strip-shaped areas such as rivers, lakes, and roads. Additionally, using unmanned aerial vehicles simplifies and streamlines aerial photography operations [11], greatly improving automated control of remote sensing platforms.

4.2 Prospects and Outlook for Drone Aerial Photography

The emergence and application of drone aerial photography technology provide unique perspectives and thus hold significant value and promising prospects. For example, at disaster sites, dangerous roads often exist that are inaccessible to humans, necessitating the use of aerial photography robots. Understanding actual disaster site conditions represents the relentless pursuit of journalists. However, drone aerial photography technology is susceptible to adverse external environmental influences, and operational risks can lead to frequent "crashes." Therefore, systematic training and guidance for operators are needed to enhance safety awareness and minimize aerial shooting risks. With continuous development and popularization of drone aerial photography technology, numerous photography enthusiasts have joined research in this new field, providing strong guarantees for the healthy and sustainable development of the aerial industry.

In summary, applying drone aerial photography technology to television program production not only enhances image comprehensiveness and information richness but also improves shooting and production effects, delivering superior visual experiences to audiences. Drone aerial photography has achieved excellent results in television program creation. However, aerial photography represents unconventional shooting with inherent risks and complexity, imposing higher requirements on equipment, altitude, and weather conditions. Technicians must

ensure shooting activity stability, reliability, and safety to avoid potential hazards, enabling normal, stable, and orderly television program creation.

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Note: Figure translations are in progress. See original paper for figures.

Source: ChinaXiv –Machine translation. Verify with original.