AERIAL PHOTOGRAPHY AND THE USE OF PHOTO CAMERAS ATTACHED TO DRONES

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Abstract: In aerial photography performed with the help of the drones, it is advisable to use a recommended camera, which, based on the tests performed on it, proved to be able to get the best photographs. In order to obtain professional aerial photographs using drones, it is necessary to use basic camera settings such as ISO, shutter speed, aperture, focus and measurement together with stabilization of the thorn, which are the most important factors for achieving this goal.

In this context, some of the most important camera settings used in aerial photography will be presented in this paper. Knowing and implicitly applying these camera settings is imperative in making the most successful and faithful both aerial and land photography.

Using appropriate camera settings that a drone is equipped with will help prevent distortions of photography, such as chromatic aberrations and cylinder distortion. These settings will simplify the image processing tasks required in a host of important applications such as feature extraction, land recognition, and so on. This in turn simplifies the processing tasks required in a number of important applications, such as feature extraction, landmark recognition, etc.

Keywords: drone aerial photography, ISO, shutter speed, aperture, gimbal stabilization.

1. INTRODUCTION

An important application of robots is to clarify, limit and combat areas where there is a great danger that staff access is very risky and sometimes impossible. Thus, Kay Daniel [1] presented a project focused on the use of drones in the event of incidents caused by uncontrolled emissions of liquid or gaseous contaminants (e.g. explosive or toxic gases, nuclear, biological or chemical weapons). Another research project - Air Shield [2] - funded by the Federal Ministry of Research and Development German Education in the field of "Civil Security Research", refers at the protection of vital and sensitive infrastructures and population in case of threats to men or natural disasters.

The Air Shield project proposes the use - sometimes partial - of flip-flops (partly autonomous) in order to recognize and support in the anticipation and prevention of emergencies.

The drone can carry several types of cameras. Different remote data levels can be combined to provide some more comprehensive information such as: 15-30 m resolution imaging from space-borne sensors to determine the uniform landscaping; <1 m satellite or aircraft data to evaluate the ecological status model in an area of interest; 5 cm UAV images to measure the gap and patch sizes, as well as the percentage of bare soils and respectively covered with vegetation [3].

One of the aims of this paper was the presentation of those settings of each camera type that are the best in the case of both aerial and landing photography.

Therefore, using in aerial photography an adequate camera and their main specific above-mentionned settings, the distorted photos such as chromatic aberrations and barrel distortion will be avoided [4].

In the case of drone aerial photography, it's important to use a proven and recommended camera to get the best photos every time. Understanding camera settings, such as ISO, shutter speed, aperture, focus and measurement along with thaw stabilization are the most important factors to obtain accurate professional aerial photos.

2. DRONE AERIAL PHOTOGRAPHY CAMERA SETTINGS

The main camera / movie settings used on drones are as follows:
2.1.Optical zoom

Practically all today's digital cameras are equipped with a zoom lens. The zoom lens allows you to control how much of the subject is included in the image without having to change the distance to or from the subject. The zoom range of a digital camera is given according to its 35 mm equivalent. This is because many users are familiar with the 35mm film lens. Zoom is ideal when the original scene looks clustered or has too much distraction [4].

2.2. Shutter-speed

This is probably the most important camera setting for a good aerial shot. The camera shutter commands the amount of time light allowed to reach the CCD (in simple terms, the CCD is the place where digital image pixels are created). Shutter speeds are displayed as multiples of one second. The setting of the shutter speed is a very creative setting to control the movement of an image.

In the case of aerial photography, the depth of field is not a problem, so set your camera on the shutter priority. Select between 1/500th and 1/1000th of a second (1/750th of a second blocks the largest blur with lenses up to 100mm in length on a full-frame camera). Higher trigger speeds (1/500th) tend to freeze the subject's movement, while lower speeds (1/30th) allow to the subject's movement to be recorded as a blur in the image.

2.3. Focus Methods

Digital cameras are connected to an autofocus system (AF). Of course, there are differences from manufacturer to manufacturer. The two basic AF modes are: *Single* and *Continuous*, often referred to as *One-shot* and *Servo*.

Most modern rooms have fast and efficient self-focusing capabilities. *Continuous AF* mode is better for aerial photography and moving targets - such as children playing - because continuous focus is on the subjects.

In the case of static targets on a land or in a stationary vehicle, the *Single AF* mode is used because it will work very well, since autofocus locks on the target when applying a slight push on the trigger button and stays fixed in time hold down the button until you press the button fully to take the shot (picture).

2.4. Stabilization / Vibration

If you purchase a drone from a top manufacturer, you will virtually guarantee that you will get an excelent quality gimbal for stabilizing of the image. Some of the best drones are DJI, 3DR, Walkera, Yuneec, Aerialtronics and Service-Drone. The gimbal holds the drones stable, accessing and adjusting of hundreds of seconds per second to keep the drone in a steady and perfect condition for airshots and aerial photographs. The dampers reduce vibrations. Currently, DJI are world leaders in air technology using gimbal.

The new Phantom 4 Pro, Phantom 3 and Inspire 1 (top-drones), have 4k high-quality cameras. Inspire 1 Pro with the Zenumse X5R gimbal and the Zenumse X5R photo-camera is the world's first aerial camera Micro Four Thirds capable of recording 4K videoclips without losses in RAW.

FIG.1[4] Enchanting Evening Over Chicago's Navy Pier

FIG.2[4] The Inspire 1 Pro with Zenumse X5R Drone

2.5. ISO For Aerial Photos

The ISO setting allows subjects to be photographed in a wider range of lighting conditions. For example, changing to a higher ISO value will allow you to continue taking pictures even when the light is weaker, relatively dark without using the built-in camera flash.

The aerial photographies are strongly correlated with the resolution, so the ISO is lower, the better. Using the lowest ISO settings available with your equipment helps ensure maximum image resolution. It is also recommended not to use the digital ISO settings under the lowest rating of your camera.

Fig.3[4] Heavenly Morning In Historic Spello, Italy

Below are presented some guidelines for different ISO settings:
Low ISO setting (100-200)
Outdoor topics in sunlight. Landscape or static indoor topics using a tripod.
This setting is used when maximum image quality is required.
Medium ISO setting (250-400)
Closed weather scenes. Capturing movements in good light conditions.
In this case are obtained the clear images.
High ISO settings (500-800)

- Scenes with low light, pop concerts and night shots, fast capture of movement in slow or indoor conditions.
- Pop concerts and Night photography
- Capturing fast movement in dull or indoor conditions.

2.6. Diaphragm Aperture

The aperture is one of the three pillars of the photo, the other two being ISO and shutter speed. Undoubtedly, this is the most discussed topic, as the aperture adds a dimension to a photo by blurring the background or by magically inserting all the objects into the lens. An adjustable iris incorporated into a camera lens controls the diaphragm. This iris can be opened or closed to control the amount of light reaching the CCD. The size of the iris hole is marked with f-numbers, written as fractions. For example: f /11, f /5.6 and f /2.8. The higher the number "f", the smaller the iris aperture.

Each lens has a limit on how much or how small the diaphragm size can be varied. If you look at your lens specifications, you'll find out which is the maximum opening (the smallest number "f") and the minimum opening (the largest number "f") of the lens. The maximum aperture of the lens is much more important than the minimum because it shows the shutter speed.

FIG.4[4] Stunning Aerial Photo Of Oahu, Hawaii

2.6.1.Aperture in Aerial Photography

It is known how the diaphragm affects the depth of the field. Unlike the ground photos, the depth of the field is almost a problem in aerial photography because we focus almost infinitely. Set the aperture to the maximum lens sharpness setting. Focus on shutter speed and framing your subject.

You know the f-stop (diaphragm) that gives you maximum clarity for your special purpose. As a general rule for most goals, maximum clarity is generally two downsides to the maximum setting (the widest). For example, a f /2.8 lens will normally achieve maximum clarity at about f /8.

2.7. Metering For Aerial Photography

Metering signifies how your camera determines what the correct shutter speed and aperture should be depending on the amount of light that goes into the camera and the sensitivity of the sensor.

Today, every DSLR has an integrated light meter that automatically measures the reflected light and determines the optimal exposure. The most common metering modes in digital cameras today are:

- Matrix Metering also known as Evaluative Metering and
- Center-weighted Metering; Spot Metering.

In aerial photography use „*Matrix full-frame metering"* rather than "*Spot metering"* mode to reduce exposure issues.

FIG.5[4] Aerial photo over Lake Bled, Slovenia

3. CONCLUSIONS

Using photocameras and settings that are suitable for aerial photography will allow you to avoid distorting photos such as chromatic aberrations and drum distortion. This will in turn provide a much cleaner data stream useful for a wide range of processing tasks such as: features extraction, landmark recognition, various learning applications, and more, which can constitute subsequently the nucleus of more applications like extremely dangerous, autonomous and vital missions that must be intelligently undertaken, including search and rescue military recognition and operation, air inspection, etc. [5]

In the case of the use of aerial drones for aerial photography, it is important to use a camera that was previously tested and certified so that every time the best photographies should be obtained. Camera settings, such as ISO, shutter speed, aperture, focusing, and metering, along with gimbal stabilization, are important factors in the obtaining of clear professional aerial photographies.

Therefore, to obtain an excellent aerial photography, it is necessary to have some excellent piloting skills, a deep knowledge of the principles and parameters which influence the aerial photographies, a vaste experience and the best equipment.

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