July 2010

Mechanics of a Digital Camera

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There are many diverse concepts involved in digital photography that can be taught to kids. Artistic concepts such as the use of color and balance are techniques youth and adults can learn. There are also scientific processes and laws that are involved in the mechanics and technology of a digital camera. Principles dealing with aperture settings, shutter speed, ISO settings and computer programming are all principles incorporated into the process of a camera capturing a photograph. It is essential for youth and leaders to understand the mechanics of a camera to improve their skills as photographers.

How a Digital Camera Records an Image

When it comes to the image a photographer will see in the viewfinder there are two categories of cameras, an electronic viewfinder (EVF) camera which will usually have a fixed (non-removable) lens, and a digital single lens reflex (DSLR) camera that will usually have interchangeable lenses.

The image seen in the EVF shows up on a liquid crystal display (LCD) screen located somewhere on the body of the camera. Many EVF cameras will also have an offset optical viewfinder (OVF). That is a viewfinder on the camera that is set to the side or sometimes above the camera lens. (This is just like the old point-and-shoot film cameras.)

The main disadvantage to using the OVF is that the image seen (especially close-ups) is slightly offset from the actual image being recorded by the camera—this may cause a centering problem.

Figure 1.

EVF cameras are not typically very good for fast action shots as there is a delay after the shutter is activated before the image is recorded. Most EVF cameras offer features that can control the film speed, depth of field, and shutter speed. They can typically be used to record videos as well.

DSLR cameras require more equipment, and are generally more expensive, but usually offer more features and options for a photographer. They are very good for action photography as the image is recorded immediately. Many DSLR cameras will also have an LCD screen that can be used for composing a picture from a position that can't be reached with your eye (such as above the heads of a crowd or at ground level). However, pictures taken in this mode will experience the same time-delay problem of EVF cameras. One disadvantage with DSLR cameras is that less expensive models do not have the ability to record movies. Both cameras record images onto a light sensitive surface.

Figure 2.
Non-SLR camera with a built-in zoom lens.

Figure 3.
SLR Camera with an interchangeable lens.

Figure 4 is a simplified diagram that illustrates how a DSLR camera records an image in a way youth can understand. Cameras are much more complex, but this shows the basic mechanics of shooting a picture.

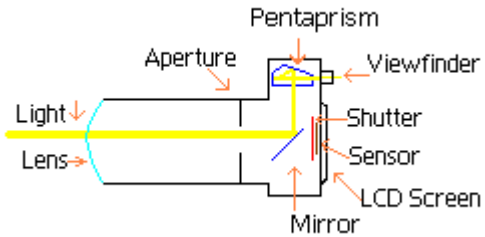

Figure 4.

When light enters the lens and passes through the aperture the image is actually upside-down and backwards in the camera. A mirror sends the image to the pentaprism, which adjusts the image upright so what we see in the viewfinder looks just like what we see in front of the camera.

Figure 5 shows the basic process of what happens when a picture is taken.

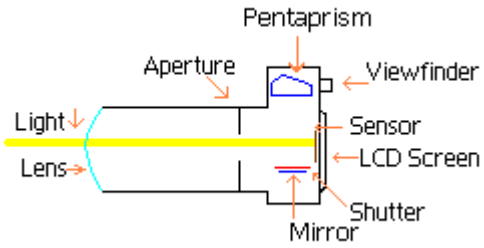

Figure 5.

Two functions occur internally when the camera shoots a picture. The mirror and shutter both move, exposing the light-sensitive sensor to the light rays coming through the lens. The sensor records the image and electronically sends the binary code to the memory chip for storage.

The amount of time that the shutter is open is referred to as the *shutter speed*. It can range from several seconds to 1/2000 of a second on most consumer cameras. The longer the shutter is open the more chance there is for a blurry picture due to subject or camera movement.

After the picture is recorded on to the sensitive surface, it is transferred in a binary code and saved to a memory card. It can then be accessed for viewing on the camera or saved and accessed by a computer.

Basic Features of a Flash

Most cameras have either a built-in flash or somewhere to mount an external flash, or both. The flash is the easiest way to compensate for a lack of light, but if it is not used correctly it can ruin the aesthetic appeal of a picture. Here are some helpful hints regarding the use a flash.

A flash is only effective on a subject at a distance of approximately 25 feet or less depending on the flash. Anything beyond that will have no effect or could illuminate objects that are in the foreground, rendering the distant subject dark and not visible in the photograph. Flashes can enhance the lighting in an area, but if they are not regulated properly they can lead to photographs of poor quality. A flash can lead to overexposed images or red eye on a human subject.

Figure 6.

LCD Screen

The LCD screen is very useful when reviewing pictures or changing menu settings on the camera. However, using the LCD screen to shoot increases

the chance of camera movement, which may result in a blurry picture and can cause a slight disparity between the actual photo and the image on the screen. It also leads to the batteries running down much faster due to the increased energy demand.

Figure 7.

Film versus Memory Cards

Film cameras are becoming rare on the market due to the versatility and quality improvements in digital photography. After the sensor records the image it is saved to a memory card. It will stay there until it is deleted. Before deletion, images may be downloaded to a computer or printed directly from the memory card.

Figure 8.

While a roll of film could hold between 24-36 pictures, a 1 gigabyte (or 1 billion byte) memory card can hold around 500 pictures depending on the resolution setting. It is cheaper than film, and also allows the user to delete and edit images in an easier fashion than film cameras allow. This is more economical and efficient than developing a roll of film. The resolution of digital cameras has also improved to where there is no significant difference between film and digital prints.

Summary

The mechanics of digital cameras are very similar to film cameras with lenses, mirrors and shutters. The main difference lies in how the image is recorded. The electronic sensor inside a digital camera records an image that can be easily accessed by a user. The photographs can be downloaded to a computer or printed directly from the memory card.

The LCD screen on digital cameras can show saved pictures and display menu settings for camera functions. It also can be used as an alternative to the viewfinder, but this does lead to a less steady grip by the operator. The flash is also used to illuminate a room within 25 feet of the camera. Digital memory cards are capable of holding many more photos than a roll of film and editing pictures is also easier. Digital cameras are more economical to use and allow a person to easily discard the unwanted photos that was not possible with a film camera.

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This publication is issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Noelle E. Cockett, Vice President for Extension and Agriculture, Utah State University. (4-H/Photography/2010-02pr)