**Digital Camera Technology**

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For my research paper, I will explain the technology found in digital cameras. In a time when every memory is captured in detail via a phone, we may forget that there was a time when cameras had no real technology at all. Film cameras use film that is covered in a light-sensitive chemical. When you press the button to take a photo, the aperture opens quickly to let a certain amount of light through the lens to the film, this causes a chemical reaction on the film therefore capturing the photo. But to see the photos you have taken you would need to develop the film at a local pharmacy which could take up to a week. Then to even take it to the pharmacy, you would have to use up the entire film reel which can hold up to 35 photos. Many, would just waste the film on random things just to be able to see the four or five pictures that they actually cared about. With the growing inconvenience of simply taking photos, there came a solution: digital cameras.

Digital cameras may look and feel like regular film cameras, but they work far differently from them. Obviously, there is no film in a digital camera, there is a light detector that takes the incoming light rays and turns them into electrical signals. There are two types of light detectors, a charge-coupled device (CCD) or a CMOS image sensor. So, when you press the photograph button, the aperture still opens to let light through the lens but the CCD or the CMOS image sensor takes the place of the film’s chemical reaction. When the picture reaches the sensor, it breaks it up into millions of pixels, measuring the color and brightness of every pixel and saving it as a numeric value. Every picture you have taken with your phone is just a long sequence of numbers that describe the details of every single pixel. The best thing about digital cameras is that you can immediately see the photos and even export them to your computer.

The one setback to digital photos is the amount of storage that they can quickly take up on your computer. Due to the camera storing millions of numbers for just one picture, the file size can get up to four megabytes when it should be around 200 to 500 kilobytes. The solution that they came up with is called “compression”. Compression is a technique that crushes digital photos so they can have fewer numbers, which shrinks the size. A well-known form of compression is called “JPG”, it’s “lossy” meaning that the shrink in size causes some information to be lost forever. All digital cameras have settings where you can choose either a high-resolution or a low-resolution which determines the size and clarity of the photo. Interestingly, a film camera basically has an “unlimited” resolution and if you were to scan it to become a digital file, it could take up around 18 megabytes. Back when digital cameras were new, film cameras still had higher quality photos but now, digital cameras are seen as the standard and are just as good if not better than film cameras.

There are a few different types of digital cameras, old “point and shoot” cameras that just have the bare necessities of a digital camera, a lens, and an image sensor. There is usually a very low-quality screen to show you the image that you are about to take. Many people had these types of cameras in the early 2000s, they were the predecessor to the smartphone camera. Then there’s the Digital Single Lens Reflex (DSLR) which has a hinged mirror inside that reflects light up to the viewfinder to show you what the lens sees and what the photo you are going to take will look like. Many professional photographers use the DSLR because the viewfinder is very accurate to real life since the image is coming straight from the lens. Within the last 12 years, mirrorless digital cameras have grown in popularity. They get rid of the mirror function of the DSLR and instead have an LCD viewfinder that shows exactly what the image sensor sees, giving you a very accurate depiction of the photo. They are slowly taking over the professional photography landscape, while people still use DSLR cameras, many have migrated to mirrorless cameras. Most notably, the final digital camera is the smartphone.

Everyone has one and everyone takes photos with them but are they better than a mirrorless camera or a DSLR? No, although smartphones like Apple or Samsung are getting better through the years, they can never replace mirrorless or DSLRs. This is simply because smartphone cameras have smaller image sensors than mirrorless or DSLRs. The size of the sensor is important because larger sensors tend to have better image quality, and they also do better in low-light situations. Smartphones can take good photos during the day but just go out at night and take a photo. There will be a massive amount of grain (visual distortion) due to light not reaching the small sensor. Mirrorless and DSLRs do not have this problem because they can adapt to any lighting. Another reason why smartphones will never become a photography standard is because there just are not enough camera options. Mirrorless and DSLR cameras have so many different options like shutter speed, aperture, white balance, etc. that can lead to more creative photos. A major setback to smartphones is the lack of “optical zoom”. Optical zoom refers to when you can zoom in on the subject of a photo and the picture enlarges due to the lens magnifying the image. Smartphones have “digital zoom”, that’s when you zoom in on the subject but instead the pixels are being enlarged which reduces the quality significantly.

Another interesting quality of mirrorless/DSLR cameras is the ability to change the lenses. Interchangeable lenses allow the camera to have different “focal lengths” which is the distance from the point where light meets the image sensor. So, while you can zoom in, it does not change the actual focal distance. It’s almost like a magnifying glass, so the higher the focal length, the longer the distance and the higher the magnification. Different types of lenses allow you to have larger or shorter focal lengths. It’s an important part of photography that gives the user creative freedom when taking photos.

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