

## Digital images

The term digital image means a softcopy image that can be stored in a computer Central Processing Unit or displayed on a computer monitor.

Mathematically the photograph can be described by a continuous function  $F(x, y)$ , called an image. Where the function is becomes discrete then the result is a digital image. Consequently digital images are considered as non-continuous function in the variables  $x, y$ . There are special variables  $(\Delta x, \Delta y)$  known as sampling; the discrete  $\Delta x$  and  $\Delta y$  is the pixel the  $\Delta g$  is the gray level. By these elements a digital image can be represented by  $f(\Delta x, i, \Delta y, j)$  where  $i = 0, \dots, n-1; j = 0, \dots, m-1$ ,  $i$  and  $j$  are the pixel addresses ( $n$  is the number of rows and  $m$  is the number of column). This image function  $f(x,y)$  can be illustrated clearly in Figure below.

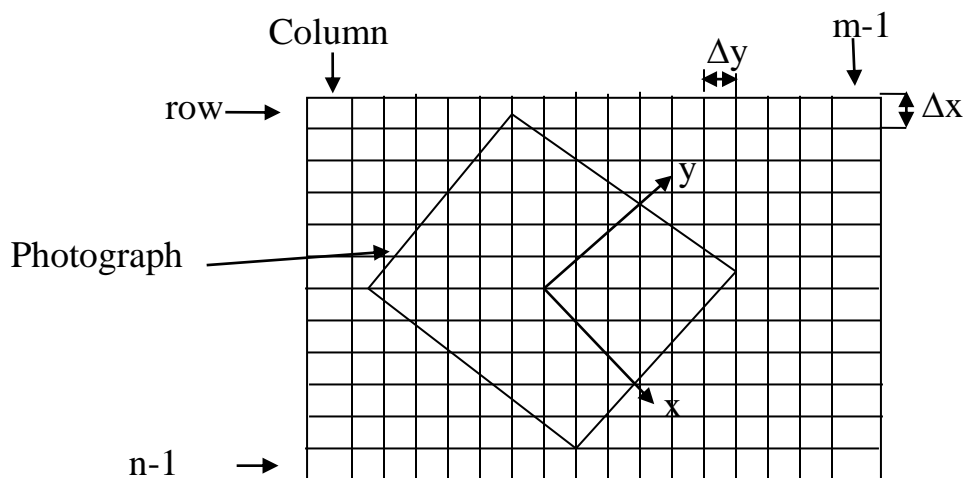


Figure (2.12) Coordinates system of a digital image.

A digital image can be recognized in a computer by a file containing a group of digits, confined between the two numbers, 0 and 255 for a black and white image digital number 0 means complete blackness and 255 means total brightness. The rest of numbers which are confined between these two numbers represent the gradient of the gray. The final complete image is made up of a two- dimensional array.

On the other hand, the colored image file contains three sets of intensity values for each pixel which is an integrated colors of red, green, and blue bands due their ability to form the image.

### **Configuration of the Digital Image**

Digital photogrammetric systems use the digitized aerial photographs or digital images as the primary source of point definition. Digital imagery can be obtained in ether indirectly or directly.

- The indirect method consists digitizing existing analogue photographs use frame camera.

### **Frame Cameras**

In conventional or classical photogrammetry as the photogrametrists say, there are many types of frame cameras used to produce photographs for topographic mapping or other types of maps. The selected camera depends mainly on the purpose of the exposed

images. Anyhow there are four main types of frame cameras used in photogrammetry these are:-

- 1- Single-lens frame cameras,
- 2- Multi-lens frame cameras,
- 3- Strip cameras, and
- 4- Panoramic cameras.

#### ✓ **Single-lens Frame Cameras**

Single-lens frame cameras are used to obtain photographs for mapping purpose. This type of cameras provide the highest quality geometric picture compared to the other three types, because they are characterized by the use of a single lens.

#### ✓ **Multilens Frame Cameras**

Multilens frame cameras have the basic characteristics of single-lens frame cameras, except that they have two or more lenses and expose two or more pictures simultaneously.

#### ✓ **Strip Cameras**

Strip cameras expose a continuous photograph of strip of terrain beneath the path of the aircraft.

#### ✓ **Panoramic Cameras**

A panoramic camera photographs a strip of terrain from horizon to horizon, the strip being transverse to the direction of the flight.

### Conventional Photogrammetric Camera Components

An imaging camera is considered as the backbone which is based upon the general concept of photogrammetry. There are many aerial photograph cameras in commercial markets. However, they vary in their shapes and specifications referred to their different manufacturers. Nevertheless, they all agree in three main components as illustrated in Figure (2.1) below.

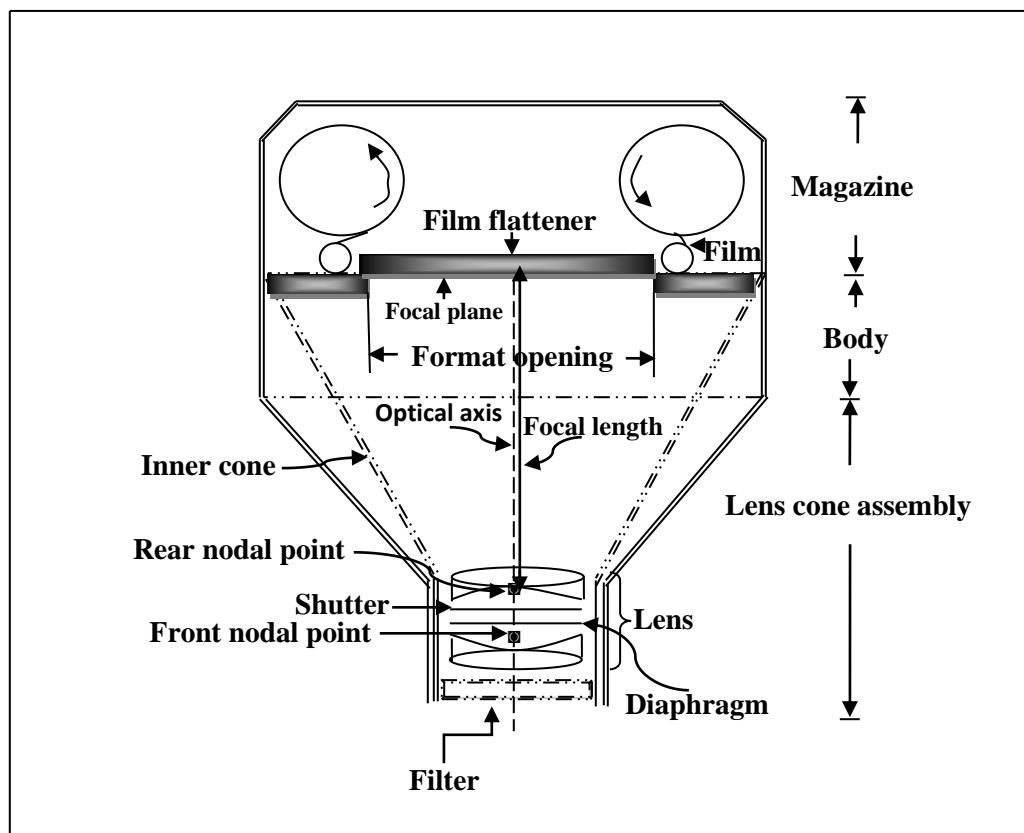


Figure : Generalized cross section of a frame aerial camera.

### **1- Camera magazine**

The camera magazine houses the reels which hold exposed and unexposed film is also contains the film advancing and flattening mechanism.

### **2- Camera body**

The camera body is a one piece casting which usually houses the drive mechanism.

### **3- Lens cone assembly**

The lens cone assembly contains a number of parts and serves several functions. Figure (2-1) above defines each part in the assembly words.

- a- Lens: it is the most important part of a camera. It gathers light rays from the object space and brings them to focus in the focal plane behind the lens.
- b- Filter : It serves three purposes:
  - i- Reduces the effect of atmospheric haze.
  - ii- Helps providing uniform light distribution over the entire camera.
  - iii- Protects the lens from damage and dust.
- c- Shutter and diaphragm: They, together, regulate the length of time a given amount of light is allowed to pass through the lens to make the exposure. Shutter controls the length of time that light is permitted to pass through the lens.

d-

### 2.2.1.3 Characteristics of Aerial Frame Cameras

There are many geometrical properties whereby aerial frame cameras can be distinguished. These characteristics help in the extraction of information, and the definition of the image coordinates system. The most important of these elements are the focal plane of an aerial camera. This is the plane in which all incident light rays are brought to focus. Therefore, aerial frame cameras have their focus fixed for infinite object distances .

Camera fiducial marks are one of the important features of the frame camera. These are usually four or eight marks in number, situated in the middle sides of the focal plane opening or in its corners or in both locations. Fiducial marks can be utilized in a variety of tasks such as, to define the location of the principal point by the intersection of the lines joining opposite marks. This point of intersection is an exceedingly important reference in photogrammetric work. In addition to that the fiducial marks also provide a rectangular coordinate axis system for measuring image positions on a photograph, which is the major unit of data in photogrammetry. It is of vital importance that the camera selected for a particular project is capable of exposing an image of sufficient quality for the required task. The collinearity equations refer to plate and camera coordinate systems and, in the majority of cases in photogrammetry, it is necessary for the camera employed to define these coordinate systems on the photograph.

