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Image Acquisition and Techniques

Jaydeep Pandya
M.Sc. IT (Information Technology)
Sir Sitaram and Lady Shantabai Patkar College of Arts and Science, Mumbai India

Abstract: *In the present scenario, images became the foremost suitable way to keep our past alive. Nowadays people are very busy earning their livelihood and day-to-day life, even if they need to stay their golden moments alive for the rest of life. Images have touched most the fields like medical, sports, social networking, and lots of more. it's the necessity of your time to understand how the pictures are being captured and stored in memory. A method of image acquisition supported the digital signal processor (DSP) is introduced. DSP, complex programmable logic device (CPLD), and get in touch with image sensor (CIS) are combined within the hardware design, and therefore the time-sequence analysis of the image acquisition process is additionally presented. the sensible application indicates that this method has high accuracy and is rapid enough to satisfy the need of real -time acquisition. To handle images and before analyzing them the foremost important thing is to capture the image. this is often called Image Acquisition. Image Acquisition is reached by a relevant cameras. We use different cameras for various applications. If we'd like an X-Ray image, we use a camera (film) that's sensitive to X-Rays. If we would like an Infra-Red image, we use cameras that are sensitive to Infra-Red radiations. For standard images (family photographs etc.) we use cameras that are sensitive to the visible color.*

Keywords: Digital Image, Spectrum, Quantum detectors, Image Acquisition.

I. INTRODUCTION

Digital imaging has grown more than just a popular pastime in modern culture. Personal computers, additionally to a plethora of hand-held electronic devices, became the well-liked mode of communication for increasingly large portions of the community. Digital cameras and camera phones have made taking, processing, and sharing photos almost instantaneously, making digital images a standard component of hi-tech connections. With all this fast-paced instant gratification going around, one won't notice the extent to which professional industries also believe digital imaging. Publishers of both print and web materials depend heavily on the standard and accessibility of their images. Attention to the details of how a picture is made , how it's stored, who are going to be using or accessing it, and how, is crucial to successful digital imaging. Image Acquisition system plays an increasingly important role in lifestyle , military, industrial production, and research project.

High-performance DSP is additionally widely utilized in real-time image processing [1]. because of an excellent number of image processing data, high relativity of data processing, rigid frame, and field deadlines , if the data acquisition frequency might be controlled by making software programming for DSP and CPLD, fully developing their performance are going to be crucial for improving the entire system performance [1].

An image are often defined as a 2-D function f(x,y) where (x, y) coordinates in two-dimensional space and f is that the intensity of that coordinate [2]. Each coordinate position is named a pixel. Pixel is that the smallest unit of the image it's also called an image element. So digital images are composed of pixels, each pixel represents the colour (gray level for black and white images) at one point within the image. Pixel is sort of a tiny dot of a specific color. A digital image may be a rectangular array of pixels also called a Bitmap. From the purpose of view of photography, the digital images are of two types [3][4]

- Black and white Images
- Color Images

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1.1 Black and White Images

Black and white images are made from different shades of gray. These different shades lies between 0 to 255, where 0 refers to black, 255 refers to white and intermediate values ask different shades of black and white. Gray scale relates to the range of neutral tonal values (shades) of black to white.

1.2 Color Images

Color images are made from colored pixels. Color can capture a way broader range of values than grayscale. "The spectrum – the collection of colors created when light passes through a prism – includes billions of colors, of which the human eye can recognize 7 to 10 million". The electronic capture and display of color are complicated. RGB (Red, Green, and Blue) is that the most ordinarily adopted color system.

Example:

A one-bit image can assign just one of two values to a single-pixel: 1 or 0 (black or white). An 8-bit (28) gray scale image can assign one among 256 colors to one pixel. A 24-bit (2(3x8)) RGB image (8-bits each for red, green, and blue color channels) can assign one among 16.8 million colors to one pixel.

Bits/Digital Image type	Shades/colors
8 bits black and white image	256 shades
24 bits colored image	16.8 million color
10 bits black and white image	1024 shades
30 bits colored image	1 billion color
12 bits black and white image	4096 shades
36 bits colored image	68.7 billion colors

Figure 1: Shades/Colors Depends on the Bits Required to Represent the Digital Image

II. Image Acquisition

Image acquisition in image processing is often broadly explained because the action of retrieving a photo from any source, usually a hardware-based source, therefore it is often skilled whatever processes got to happen later. Implementing image acquisition in image processing is usually the first step in the workflow order because, without a picture, no processing is possible [5]. The image that's acquired is totally unprocessed and is that the results of whatever hardware was wont to generate it, which may be vital in some fields to possess a consistent baseline from which to figure .one among the ultimate goals of this process is to possess a source of input that operates within such controlled and measured guidelines that a similar image can [5], if necessary, be nearly perfectly reproduced under a similar conditions so anomalous factors are easier to locate and reject. Depending on the sector of work, a significant factor involved in image acquisition in image processing sometimes is that the initial setup and long-term maintenance of the hardware used to capture the pictures . the particular hardware device are often anything from a desktop scanner to a huge optical telescope. If the hardware isn't properly configured and aligned, then visual artifacts are often produced which will complicate the image processing [5]. Improper setup hardware also may provide images that are of such quality that they can't be salvaged even with extensive processing. All of those elements are vital to certain areas, like comparative image processing, which looks for specific differences between image sets.

One of the sorts of image acquisition in image processing is understood as real-time image acquisition. This usually involves retrieving images from a source that's automatically capturing images. Real -time picture acquisition forms a stream of files that will be automatically processed, queued for later work, or stitched within one media format. One common technology that's used with real-time image processing is understood as background image acquisition, which describes both software and hardware which will quickly preserve the pictures flooding into a system.

There are any advanced techniques of image acquisition in image processing that uses the customized device. Three-dimensional (3D) image acquisition is one among these methods. this will require the utilization of two or more cam eras that are aligned at precisely describes points around a target, forming a sequence of images which will be aligned

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to make a 3D or stereoscopic scene or to measure distances. Some satellites use 3D image acquisition techniques to create accurate models of various surfaces. The image acquisition process consists of three steps;

- Energy reflected from the thing of interest,
- An optical system that focuses the energy, and
- Eventually a sensor that measures the quantity of energy.

A. Image Acquisition Concept

To capture a picture a camera requires some kind of measurable energy. The energy of interest during this context is light or more generally electromagnetic waves. An EM wave are often described as a mass -less entity, a photon, whose electric and magnetic flux varies sinusoidally, hence the name waves. A photon are often described in three different ways:

1. A photon are often described By its energy E (measured in eV)
2. A photon are often described by its frequency f (H2)
3. A photon are often described by its wavelength λ(m)

$$E = (hc)/\lambda$$
$$E = hf$$

B. Quantum Detectors

Quantum Detector is that the most vital mechanism of image sensing and acquisition it relies upon the energy of absorbed photon getting used to promote electrons from their stable state to a better state above an energy threshold. Whenever this happens , the properties of that material get altered in some measurable way. Planck/Einstein came up with a relationship between λ of the incident photon and therefore the E that it carries:

$$E = (hc)/\lambda \quad (1)$$

On impact the photon transfer every or none of this quantum of energy to the electron.

III. Image Acquisition Model

The images are created by a mixture of a lighting source & since the reflection or absorption of the energy by the elements of the view being imaged. Lighting could also be introduced by radar, X-ray energy source, infrared energy source, ultrasound energy source, computer-generated energy pattern, etc. To sense the image, we use a sensor consistent with the character of illumination. the method of image sensors is named image acquisition.

Via the sensor, flame power is modified within a digital image. the thought is that incoming illumination energy is transformed into voltage by the combination of input electrical energy and sensor material that's aware of the actual energy that's being detected. The output waveform is that the response of the sensor and this response is digitalized to get the digital image.

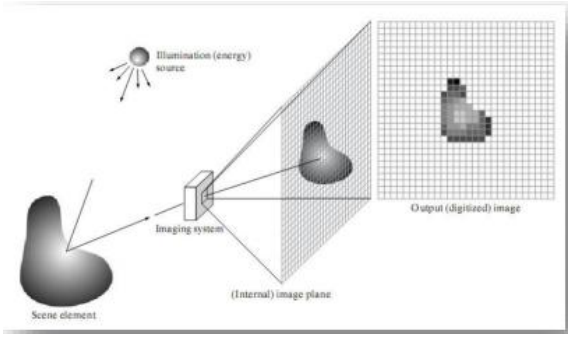

Figure.2: Image Acquisition Model

Image is presented by 2-D function f(x, y). Practically a picture must be the non-zero and finite quantity that's [1]:

$$0 < f(x, y) < \text{“}\infty \quad (2)$$

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- This is further considered that during an image f (x, y), we have factors:
- Some amount of source flame occurrence on the display being imaged. Let's describe it by

j(x, y)

The amount of illumination reflected or absorbed by the object in the scene. Let us represent it by:

p(x, y)

Then f(x, y) can be represented by :

$$f(x, y) = j(x, y).p(x, y) \quad (3)$$

Where $0< j(x, y)<" \infty$

It means illumination will be a non-zero and finite quantity and its quantity depends on illumination source.

$$0< r(x, y)<1$$

Here 0 indicates no reflection or total absorption and 1 means no absorption or total reflection.

IV. Techniques To Perform Image Acquisition

The image Acquisition method depends on the hardware system which can have a sensor that's again a hardware machine. A sensor transforms light within electrical charges. The sensor inside a camera contains the returned power by the view being imaged. The image sensor employed by most digital cameras may be a charge-coupled device (CCD) [6]. Any cameras use complementary metal-oxide-semiconductor (CMOS) technology rather [6].

Both CCD & CMOS image sensors change light into electrons. A simplified thanks to believe these sensors is to consider a 2-D array of thousands or many tiny solar cells. (in this case, the sensors are named photosites). Once the sensor changes the light into electrons, it reads the worth (accumulated charge) of each cell within the picture. A CCD moves the charge over the chip & reads it at one edge of the array. An analog-to-digital converter (ADC) then turns any pixel's value into a digital value by measuring the quantity of charge at every photosite & changing that measurement to binary form. CMOS devices use different transistors at the per-pixel to increase & move the charge using more traditional wires. CCD sensors generate high-quality, low noise pictures. CMOS sensors are generally more vulnerable to noise.

CMOS sensors generally utilize atomic power. CCDs, on the opposite hand, use a process that consumes many power. CCDs use as much as 100 times larger power than the alike CMOS sensor. CCD sensors are mass-produced for a extended period, in order that they are more mature. they have a tendency to poss ess higher quality pixels, and more of them.

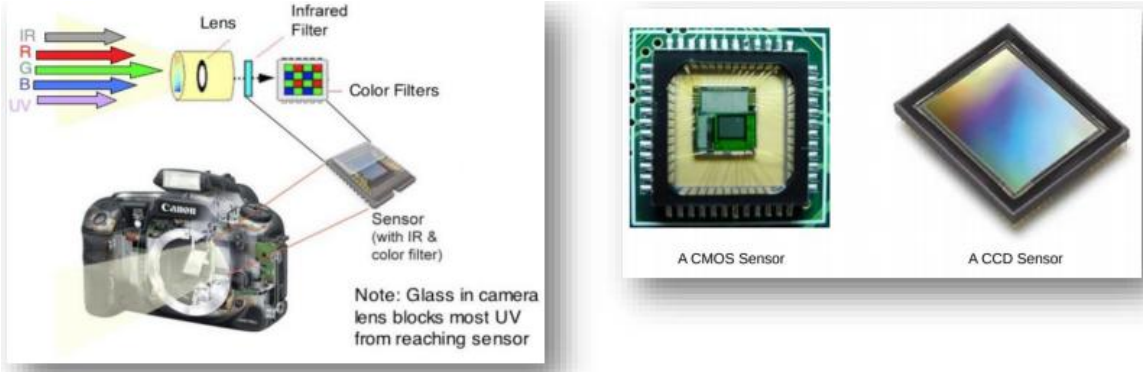

Figure 3: Inside a Digital Camera

V. Conclusion

The Image Acquisition is only Hardware Dependent Process, during which reflected light energy from the thing being imaged is converted into electrons and cover the interior sensor chip which is sort of a 2-D array of cells is cell is named photosite and contain the amount of charges which is further converted to digital form using (A to D) Converter. Now, this digital image are often used for enhancement, restoration, segmentation, and other manipulations.

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