1. Introduction to Chroma Key

Chroma key compositing, or *chroma keying*, is a visual-effects and post-production for compositing two images or video streams together based on colour hues (chroma range). The technique is also referred to as *colour keying*, colour separation overlay (*CSO*).

It has been used in many fields such as video production, post-production, remove a background from the subject of a photo or video – particularly weather forecast broadcasts, motion picture. Chroma keying is also common in the entertainment industry for visual effects in movies and video games.

Chroma key can be done with backgrounds of any colour that are uniform and distinct, but green and blue background are more commonly used because they differ most distinctly in hue from human skin colours.

2. Technique for processing green background

2.1 What is green background?

Green or blue background is a post-production technique, a cinematic technique used to isolate and remove a certain colour or brightness value from a digital photo or video that causes colour or value, therefore, brightness becomes transparent. This technique is used a lot in broadcasting, especially in news programs, in film production with the aim of replacing the usually green background with a still image or video other.

2.2 Why we use green background?

Any background colour can be used in the Chroma Key technique, but it should be noted that the colour chosen as the background must not match the colours on the object to be extracted. If there is a match, it cannot be separated. *Green* or *Blue* are two of the most perfect colours in Chroma Key, as these colours are considered farthest from human skin colour. Additionally, since human eyes are more sensitive to green wavelengths, locate in the middle of the visible light spectrum, the green analog video channel carries more signal strength, give better signal ratio noise compared to other componet video channels, so the green keys can produce the cleanest Key.

Image 1: Applying green screen in film production

It is undeniable that there are many benefits of applying green background. In film industry, we use this because less cost and time when we not tranfer to different locations. Beside, it is possible to protect actors and actresses by keeping them in the studio and away from the dangerous environments.

3. Main factors

3.1 The light

To create the ilusion that captured characters and subjects are present in the intended background scene, the lighting in the two scenes should be a fair match.

A studio shot in front of a green screen have ambient light in the same colour as the screen, due to its light scattering. This effect is known as overflow. This may look unnatural or cause parts of the characters to disappear, so must be compensated or avoided by using a larger screen located away from actors and actresses.

3.2 HSV colour system

A colour image is a matrix of pixels, each pixel represents a colour point, which each of point is represented by a set of 3 channels (r,g,b). We have known green and blue are not good for the Chroma Key problem so we will switch to HSV colour system for converting from RGB.

HSV represents for

> ➢ H stands for HUE meaning colour region.
> ➢ S stands for SATURATION meaning saturation.
> ➢ V stands for VALUE meaning value or the brightness of colour of a pixel.

If we define the range of values of H channel, it will provide the colour space that we need to identify.

3.3 Gaussian probability distribution function

To determine the colour space, using the Gaussian probability distribution, we find the range of colour values to be determined.

This normal distribution model is characterized by two parameters, firstly, the expected value µ (Muy), as known as the mean value; secondly, the standard deviation σ (Sigma). When running this Gaussian model for the H colour channel, we will find the colour space in the confidence range, where we choose a standard deviation of 2σ.

Therfore, just separating the colours in the chosen colour space using the Gaussian method, we get the object separate from the Chroma Key background.

4. Segmentation

For segmentation, we use masks based on image extraction after computation it. Masks are based on colour detection formula in Gaussian probability distribution function.

$$\sigma^2 = \frac{1}{n}\sum_{i=1}^{n} \blacksquare i = (x_i - \underline{\mu})^2$$

$$\mu = \frac{1}{n}\sum_{i=1}^{n} i = x_i$$

$$range = [\mu - 2\sigma, \mu + 2\sigma]$$