Anaglyph 3Dimesional Image Processing Using NI-LabVIEW

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Abstract

3Dimesional Imaging has become highly emerging trend in recent times. But conversion of 2Dimesional Images to 3Dimesional Images is not so easy and cannot be done in less cost. This paper deals with the conversion of 2D images into 3D with the help of NI-LabVIEW software. Two cameras which are mounted side by side serves as Left and Right eye to view the 3D image. Every Image has Red, Blue and Green components. By taking Red Component of Left image and Blue, Green Component of Right Image and merging these images will give you the Red-Cyan Image which is the traditional 3D image. The Extraction of Red, Blue, Green Component and Merging will be done through NI-LabVIEW. The Depth Image will be seen through a Red-Cyan 3D glass.

Keywords: Cameras, Red-Blue-Green Component, 3D Imaging, NI-LabVIEW.

I. INTRODUCTION

Stereoscopy (also called stereoscopies or 3D imaging) is a method for producing or improving the illusion of depth in an image by means of stereopsis for binocular vision. The word *stereoscopy* arises from Greek *stereos*, meaning "firm, solid", and *skope*, meaning "to look, to see"[1]. Any stereoscopic image is called stereogram. Originally, stereogram referred to a couple of stereo images which could be viewed using a stereoscope.

Most stereoscopic approaches present two offset images individually to the left and right eye of the observer. These two-dimensional images are then joined in the brain to provide the perception of 3D depth. This technique is eminent from 3D displays that show an image in three full dimensions, allowing the viewer to increase information about the 3-dimensional objects being displayed by head and eye movements.

Anaglyph 3D is the term specified to the stereoscopic 3D effect attained by means of encrypting each eye's image by means of screens of varied (usually chromatically opposite) colors, stereotypically red and cyan. Anaglyph 3D images contain two differently filtered colored images, one for each eye. When observed from sideways the "color-coded" "anaglyph glasses", each of the two images reaches one eye, producing a combined stereoscopic image. The visual cortex of the brain fuses this into perception of a three dimensional scene or composition.

The first method to produce anaglyph images was developed in 1852 by Wilhelm Roll Mann in Leipzig, Germany.[2]
It was W. Roll Mann who in 1853 first illustrated the principle of the anaglyph using blue and red lines on a black field with red and blue glasses to perceive the effect, but this was for line drawings only. In 1858 Joseph D'Almeida began projecting three-dimensional magic lantern slide shows using red and green filters with the audience wearing red and green goggles. Louis Ducos du Hauron first printed anaglyphs, produced in 1891.

This procedure contained of reproducing the two negatives which form a stereoscopic picture on to the same paper, one in blue (or green), and one in red. The observer would then use colored goggles with red (for the left eye) and blue or green (Cyan) (right eye). The left eye would see the blue image which would appear black, whilst it would not see the red; similarly the right eye would see the red image, this recording as black. Thus a three dimensional image will be obtained.

NI LabVIEW is a program design language which permits simple interfacing with measurement hardware. With its sole graphical programming atmosphere, archives covering information of thousands of devices and useful toolkits, obtaining data using LabVIEW is much easy. LabVIEW was created by Jeff Kodosky 25years ago, he was also known as the “Father of LabVIEW”[3].

First it was released for the Apple Macintosh in 1986, the graphical language at the core of LabVIEW is named "G". The hint at that period was to reform the measurement and automation industry, and the technology brought about the computer-generated instrument - serving engineers and experts to modify measurement schemes to fulfil their needs. Till 1992 that LabVIEW was accessible for platforms other than the Macintosh and later it has experienced several revisions.

NI-LabVIEW has several numbers of Functional Blocks which perform various programming tasks graphically. It uses Graphical Controls and Indicators and produces Real time flow of processes and programs virtually. The interfacing measuring instruments such as sensors, transducers, meters etc. do not need any complex installation procedures, but needs devices like NI-DAQ, NI-ELVIS, NI-MYRIO etc.

Programs in LabVIEW are called Virtual Instruments. LabVIEW VI has three major components, they are: Front Panel, Block Diagram, Connector Panel. LabVIEW creates the user interface with the help of Front panel of the software. Front panel consists of Controls and Indicators. Block Diagram consists of Programming functions and Blocks (such as interfacing blocks, mathematical-trigonometrical functions, Digital Processing system interfaces). Connector panel connects and creates VIs with SubVIs.

II. 3D STEREO PROCEDURE

3D imaging technology has come a long way from its ancestries in theoretical exploration labs, and cheers to modernizations in instruments, illumination and most prominently, embedded processing, 3D vision currently seems in a diversity of machine automated applications. From vision-guided robotic bin-picking to high accuracy metrology, the newest group of processors can now handle the huge data sets and refined algorithms essential to extract depth info and rapidly create decisions. The LabVIEW Vision Development Module makes 3D vision handy to engineers through seamless integration of software and hardware tools for 3D within one graphical development atmosphere.

To demonstrate how binocular stereo vision works, Figure 1 illustrates the diagram of a basic stereo vision arrangement, where both cameras are fixed faultlessly corresponding to each other, and have the precise focal length.

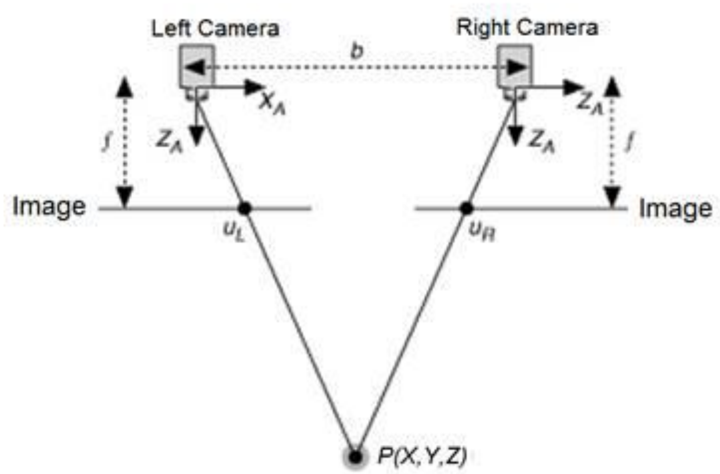

Fig. 1: Basic Stereo Vision Arrangement [4]

III. HARDWARE SPECIFICATIONS

The Hardware components needed for this system are:

(1) Personal Computer installed with LabVIEW 2013 or LabVIEW 2014.
(2) Web Cameras – 2 Nos.
(3) USB Hub (Optional)

A. *Personal Computer:*

Personal Computers can be of either a Desktop or Laptop, but it should have LabVIEW software version 2013 or 2014 installed in it. This is because LabVIEW versions 2013 and 2014 have Virtual Imaging System Blocks installed which is necessary for 3D image Processing while the predecessor versions do not have Imaging systems.

Fig. 2: PC with LabVIEW

B. Web Cameras:

Web cameras play a vital role in this system since they are the ones which capture the Left and Right Image. These captured images are used for conversion and processing. The cameras should have frame rate of 30 per second otherwise there will be a mismatch in getting the images. The two cameras should be of same type and size and may be from the same manufacturer.

Fig. 3: Web Cameras

C. USB Hub:

USB Hubs are optional requirement for this system they are used when interfacing the Cameras with Interfacing Instruments like NI-MYRIO. These are widely used for Real time applications. For our system, a USB Hub with minimum of two ports is needed since two cameras are used.

Fig. 4: USB Hub

IV. LAB VIEW 3D PROGRAMMING

As mentioned earlier, LabVIEW VI has three major components, they are: Front Panel, Block Diagram, Connector Panel. LabVIEW creates the user interface with the help of Front panel of the software. Front panel consists of Controls and Indicators. Block Diagram consists of Programming functions and Blocks (such as interfacing blocks, mathematical-trigonometrical functions, Digital Processing system interfaces).

A. Block Diagram:

Block Diagram part consists of several Functional Blocks. These blocks include Imaging systems which are necessary for 3D programming [5]. The Block Diagram of the system is as shown in Figure 5.

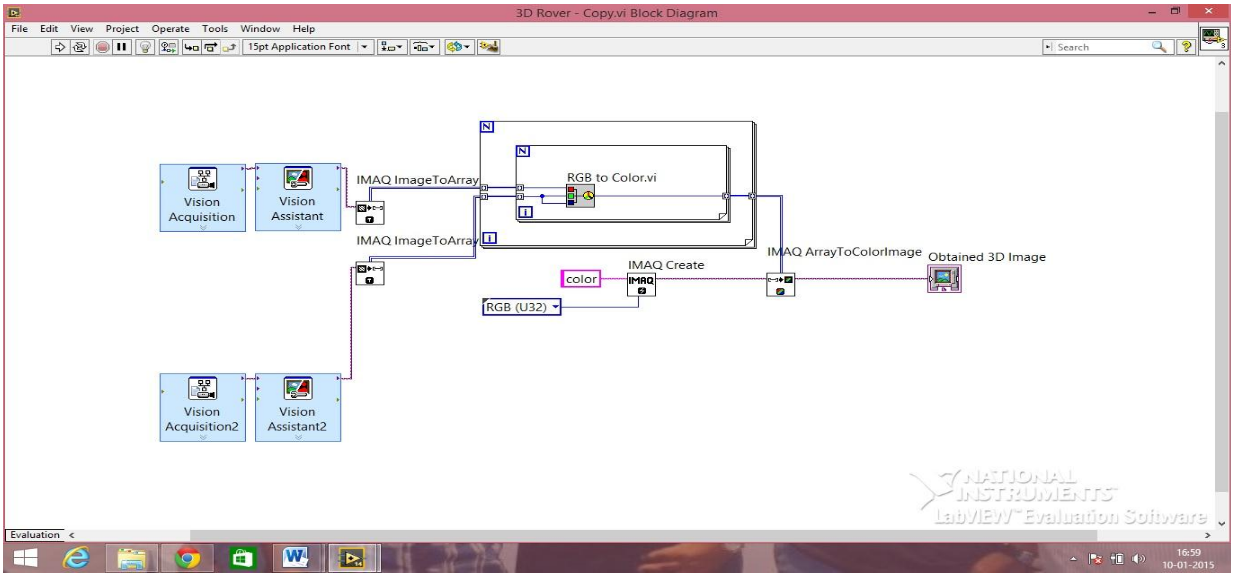

Fig. 5: Block Diagram of 3D Image VI

The Block Diagram consists of following blocks.

1) *Vision Acquisition:*

In Vision Acquisition block, the images from the Cameras are obtained. This is done by selecting the appropriate hardware camera by double clicking the block.

2) *Vision Assistant:*

Vision Assistant Systems help to convert, filter and morph images. The process of converting the RBG Image (Left and Right) to Grayscale and extracting Red-Blue-Green Components are done through this block.

3) *IMAQ Image to Array:*

In this Block, the Grayscale images are converted into Array of Pixel Values. These Pixel Values are either Unsigned 16bit, Integer 16bit or Unsigned 32bit etc.

4) *For Loop:*

For Loop with Auto Indexing Enable converts the 2D Array Pixel Values into 1D Array Pixel Values, but two For Loops nested will convert the 2D Array into Single Integer Value.

5) *RBG to COLOR:*

This Block provides colors to the Pixel Values, for the Left Image Red Color will be given since Red Component is needed and for the Right Image Blue and Green Colors are given since Blue-Green Components is needed.

6) *IMAQ Create:*

This block is needed to provide the 3D image as it is the one which mentions which type of image is to be obtained for the converted Pixel Values. In above Figure, RBG image is given as a control, mentioning that the output image should be RBG Color Image.

7) *IMAQ Array to Color Image:*

This block converts the 2D Pixels out from the For Loop to 3D IMAGE and the image is obtained in the Image Indicator as shown in Figure 5.

B. Front Panel:

As already mentioned, Front Panel is the User Interface Window in which only Controls, Indicators and also Decorations can be placed. For this 3D Image system, an Image Indicator itself is necessary to View the Obtained Image. There are Different types of Image and Video Displays in LabVIEW.

The Front Panel of the System is as shown in Figure 6.

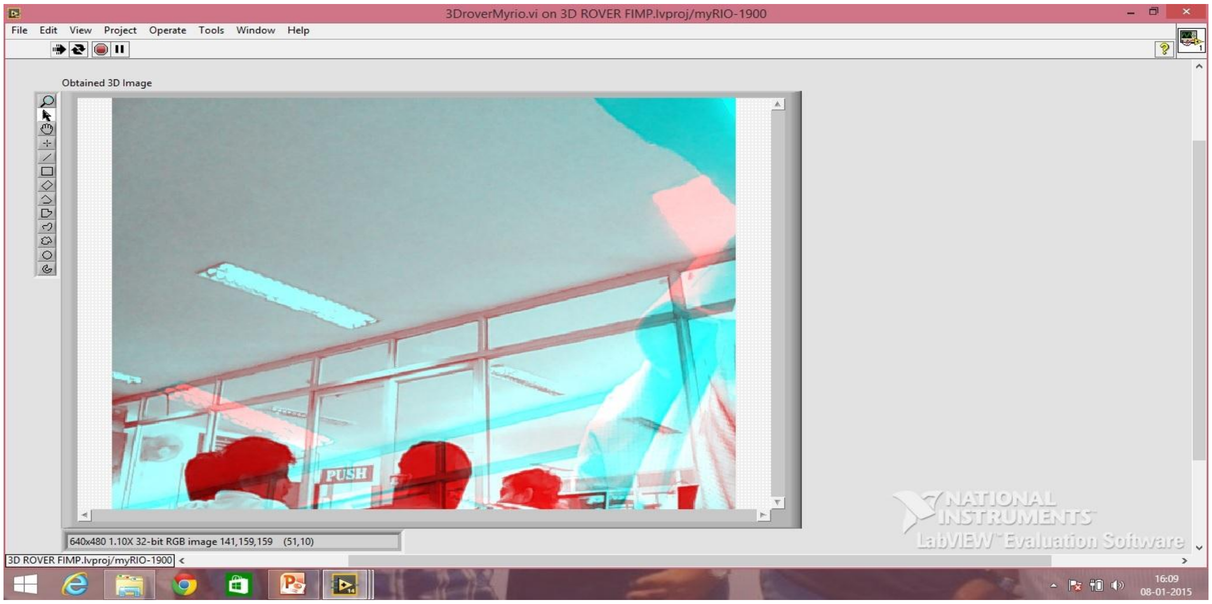

Fig. 6: Front Panel of 3D Image VI

Here Red and Cyan Images are separated with a distance. Hence to visualise the Red and Cyan Images separately, 3D Red-Cyan Glass is needed.

The Red-Cyan Glass will be as shown in Figure 7.

Fig. 7: Anaglyph 3D Red-Cyan Glass

V. Result and Conclusion

3D images will be obtained only if the Lenses of the cameras are separated by some distance (say 5cm). Otherwise there will be a mismatch in the obtained 3D image. Only when the phase of two images of two cameras is at an angle (less than 45∘), the Images will be in correct order. Therefore, Distance and Angle play a vital role in the formation of 3D image.

Hence the 3D image is obtained by taking the Red Component of first Image (Left Camera) and Blue-Green Component of second Image (Right Camera) and merging them with the help of Functional Blocks in the Block Diagram of NI-LabVIEW 2014 software. By using a Red-Cyan 3D Glass, the Resultant 3D Image has been obtained.

References

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