Graphical user interface (GUIDE) and semi-automatic system for the acquisition of anaglyphs

Marco A. Canchola\textsuperscript{a}, Juan A. Arizaga\textsuperscript{b}, Obed Cortés\textsuperscript{b} Eduardo Tecpanecatl\textsuperscript{b} Jose M. Cantero\textsuperscript{b}

\textsuperscript{a}Instituto Nacional de Astrofísica, Óptica y Electrónica, Luis Enrique Erro # 1, Tonantzintla, Puebla, México, C.P. 72840 \textsuperscript{b}Dept. Universidad Politecnica Puebla, México Tercer Carril del Ejido "Serrano" s/n San Mateo Cuanalá. Juan C. Bonilla, Puebla, Pue.

ABSTRACT

Diverse educational experiences have shown greater acceptance of children to ideas related to science, compared with adults. That fact and showing great curiosity are factors to consider to undertake scientific outreach efforts for children, with prospects of success. Moreover now 3D digital images have become a topic that has gained importance in various areas, entertainment, film and video games mainly, but also in areas such as medical practice transcendental in disease detection. This article presents a system model for 3D images for educational purposes that allows students of various grade levels, school and college, have an approach to image processing, explaining the use of filters for stereoscopic images that give brain impression of depth. The system is based on one of two hardware elements, centered on an Arduino board, and a software based on Matlab. The paper presents the design and construction of each of the elements, also presents information on the images obtained and finally how users can interact with the device.

Keywords: anaglyphs, image processing, GUI, Arduino.

1. INTRODUCTION

Begin Nowadays, 3D digital images are a hot topic in diverse areas, such as entertainment but also in medical practice, like cancer detection and other research.

Anaglyph images or anaglyphs are images of two dimensional that can cause tridimensional effect, is based on the phenomenon of binocular vision synthesis and was patented by Louis Ducos du Hauron in 1891. anaglyph images are composed of two layers color overlapping but slightly displaced relative to one another to produce the depth effect. Proposal

The system presented in this paper is based on elements one hardware element, centered on an Arduino board, and a software element based on Matlab. The paper presents the design and construction of each of the elements, also presents information on the images obtained and finally how users can interact with the device.

This system is developed to be an educational system, design and construction was created in order to give high school students or college students an approach to electronic design, programming and 3D images. by the foregoing, system's elements, Arduino, motor, webcam, Matlab, were selected because their fast development skills, as seen next in this paper.
2. BINOCULAR VISION

Is vision in which both eyes are used together. Having two eyes confers at least four advantages over having one. First, it gives a creature a spare eye in case one is damaged. Second, it gives a wider field of view. It can give stereopsis in which binocular disparity (or parallax) provided by the two eyes' different positions on the head give precise depth perception.[1]

![Figure 1.- Stereoscopic Vision](image1)

2.1 Color’s Channels

The color images are formed by channels. When an image for example say it is RGB, we are referring to the colors of the channels that form the image. In this case, mean RGB: Red, Green, Blue. A combination of the values of these three colors results in all of the colors contained in that image.

When all three channels are eliminated, we get a black image. If all three channels are at their maximum values, we get a white image [2]. This is what is behind a color image. When creating anaglyph relief images, look for colors that are totally opposite to each other, the colors are so far in their chromatic characteristics is much more difficult to interfere with each other. One of the most common colors in these techniques is red, with a combination of blue and green, get the cyan, which is its complement.

![Figure 2. Color’s channels](image2)

2.2 Anaglyph 3D

Is the name given to the stereoscopic 3D effect achieved by means of encoding each eye's image using filters of different colors, typically red and blue. Anaglyph 3D images contain two differently filtered colored images, one for each eye. To create an anaglyph is paramount to have two photos, taken at the same time to maintain the same conditions of light and scenery, the pictures should focus the same object, moving laterally the camera about 3 cm for the second picture. A withdrawal the first picture is blue and green layers, while the second picture only removes the layer is red by digital image processing images eventually join our anaglyph resulting.

2.3 Glasses

The glasses red-cyan colors let through all RGB space components, allowing you to see a much more realistic. When viewed through the glasses 3D, will reveal a three dimensional image. The visual cortex of the brain fuses this into perception of a scene with depth Fig 3.
3. DESIGNED SYSTEM

3.1 Hardware

As seen in Figure 4, CPU module interacts with all modules, CPU is based on Arduino Uno board [3]. Arduino is an open Hardware/Software platform, The Arduino Uno is a microcontroller board based on the ATmega328. As described in [4] [5] [6] Arduino becomes a very fast development platform even for those who aren't into electronics’ world.

![System`s Block Diagram](image)

Arduiono Uno board, as presented in Figure 5, is connected Via USB direct to PC over an RS232 protocol using an interface translators, the FTDI Chip. There exist a MATLAB Support Package for Arduino, this package allows communication with an Arduino Uno or Duemilanove over a serial port. It consists of a MATLAB API on the host computer and a server program that runs on the Arduino.

Together, they allows to access Arduino analog I/O, digital I/O, operate servo motors, read encoders, and even handle dc and stepper motors using the adafruit motor shield, all from the MATLAB command line [7].

![Arduino Uno Board](image)

Arduino programming is based in Sketches, pieces of Software based on C++ Language. Diverse Libraries could be found in Arduino IDE in order to improve Programming Software. The Matlab - Arduino link is based on a sketch programmed to interact with the Matlab IO Arduino Package however, it can be used with any terminal using simple commands.

Webcam is attached to a mechanism driven by the servo. Servo, as seen in Figure 6 is controlled by Arduino. This device was obtained from an old printer in order to keep the price low.
Establishing connection with USB or internal Webcams Matlab is able to generate Realtime Video processing. IEEE 1394 (FireWire) and generic Windows video acquisition devices that use Windows Driver Model (WDM) or Video for Windows (VFW) device drivers typically require less setup[8]. To connect to an image acquisition device from within MATLAB, a video input object must be created first.

All information about the Webcam, names, formats and others, is stored in the video object; after creating and configure properties, using Matlab commands user can start and stop frame acquisition. Using this and Arduino connection stenographic images can be generated using only a m-file. Figure 7 shows all m-file hardware-software integration.

4. GRAPHICAL USER INTERFACE (GUI).

Initially anaglyph creation process was conducted manually as follows:

- Take the right photo
- Move camera 3 or 4cm and take the left photo
- Manually download the images in a specific folder
- Run the Program
- Enter the name of the right image between single quotes and its extension e.g. : 'DSCN1672.jpg'
- Enter the name of the left image between single quotes and its extension e.g. : 'DSCN1673.jpg'
- Enter the name of the anaglyph image created between single quotes and its extension e.g. : 'Prueba.jpg'

This process took about 5 minutes and required that the person necessarily should have programming skills basic since as mentioned above had to insert the s command lines in the program for execution. All this led to the implementation of a graphical user interface (GUI) to make the process of creating anaglyphs in a more friendly and efficient interface for any user that is explained below.
The GUI is a visual programming environment available in MATLAB ® designed to create GUIs (Graphical User Interfaces) easily and quickly. A GUIDE application consists of two files:.m and .fig. The. M is the code that contains the correspondences of the control buttons of the interface and the. Fig contains graphic elements [9].

The interface developed Fig.8 consists of a viewing window where you will display the video image having as objective that the user has the ability to monitor in real time the image acquired by the camera, and by taking the picture button right. doing so will enable two buttons "Left" and "Right" with which the user can control the movement of the camera to acquire the image then want da. These images are pre displayed on the right side of the GUI and the user agrees to the jacks only have to press the button to create anaglyph, once created must press the "Save anaglyph" and may place it in the folder that you want.

![GUI Implementation](image)

*Figure 8. - Illustration of the implemented GUI*

### 5. EXPERIMENTAL RESULTS

Below are some of the anaglyphs created with our system in the workshops that have been held by the Student Chapter SPIE-INAOE high schools in different elementary schools and mass events as well as in popular science in our country Fig 9.

![Anaglyph Examples](image)

*Fig.9.- Anaglyphs created*
6. CONCLUSIONS

We planned and executed a semiautomatic system for creating anaglyphs using MATLAB. Was designed and constructed a webcam positioning system controlled by using a GUI programmed in MATLAB. By implementing this system was obtained improvement in process efficiency up to 80%.

ACKNOWLEDGMENTS

The authors would like to thank to the Council of Science and Technology of Puebla (COCYTEP), in Mexico, to the Universidad Politécnica de Puebla for their support given to make this project.

7. REFERENCES

[6] Che-Yuan Tu; Wen-Chieh Kuo; Wei-Hua Teng; Yao-Tsung Wang; Shiau, S.; A Power-Aware Cloud Architecture with Smart Metering. 39th International Conference on Parallel Processing Workshops (ICPPW) 2010 Page(s): 497 - 503