PROTOTYPING TO DESIGN AN ANAGLYPH 3D IMAGE BASED ON WATERFALL MODEL

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Abstract

In this paper, a discussion of the principles of stereoscopy is presented, and the phases of 3D image production of which is based on the Waterfall model. Also, the results are based on one of the 3D technology which is Anaglyph and it's known to be of two colors (red and cyan).

A 3D anaglyph image and visualization technologies will appear as a three-dimensional by using a classes (red/cyan) as considered part of other technologies used and implemented for production of 3D videos (movies). And by using model to produce a software to process anaglyph video, comes very important; for that, our proposed work is implemented an anaglyph in Waterfall model to produced a 3D image which extracted from a video.

Keywords: anaglyph image, Waterfall model, stereoscopy.

نموذج لتصميم نقش صورة ثلاثية الابعاد على اساس نموذج الشلال

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الخلاصة

في هذا البحث سوف تناقش مبادئ التجسيم (Stereoscopy) ثم ننتقل الى مراحل الانتاج للصورة الثلاثية الابعاد (3D) بواسطة تحويل صورة (الصورة مأخوذة من شريط فيديوي) على أساس مراحل نموذج الشلال وهو مهم جداً في الوقت الحاضر في مجال إدارة المشاريع وانتاج البرمجيات، أن احدى نتائج استخدام التقنيات الثلاثية الابعاد (3D) هي الـ (Anaglyph) والتي تعرف أيضاً باستعمالها للونين (الاحمر والأزرق السماوي) وبأخذ العديد من الصور المختلفة والعمل على التفاصيل المختلفة الموجودة في هذه الصور.

وان التقنيات المرئية والصور (Anaglyph) ذات الابعاد الثلاثية تظهر بشكل ثلاثي الابعاد عند استخدام النظارات (الاحمر/الازرق) وهي تقنية مستخدمة من تقنيات اخرى توظف لانتاج الصور المتحركة الفيديوية. وباستخدام موديل لانتاج هكذا نوع من الصور المتحركة الفيديوية تأتي اهمية هذه التقنية (الانجلف ذات الابعاد الثلاثية)؛ ولهذا اعتمدنا في عملنا هذا اتبعنا خطوات الموديل "الشلال" لتحويل الصور المستخلصة من الصور المتحركة وتحويلها الى شكل ثلاثي الابعاد.

1. Introduction

The earliest form of 3D video is stereoscopy. Stereoscopy is based on capture and delivery of two simultaneous conventional 2D videos. The basis of stereoscopy lies in the fact that the human visual system has two eyes. Due to the different positions of our eyes, while observing the environment, two slightly different 2D images of the 3D scene fall onto the retina of each eye. The human visual system is based on (a) capturing light via our pupils and (b) processing it via the lens and the variable size of the pupil before receiving a focused color image on the retina [1].

The visual stimuli on both retinas are then sensed and carried to the brain where they are interpreted as the seen environment. The lens and the pupil size adaptively interact with the observed scene, as do the directions of the two eyeballs, which are slightly different due to triangularization while focusing on a nearby object. Therefore, if the two 2D images that would fall onto the retinas of the two eyes are simultaneously captured from a scene and then somehow presented separately but simultaneously to the two eyes such that the retina images are replicas of the originals, the brain should see the same 3D scene[1].

Stereoscopy is based on the capture of those two slightly different 2D images that mimic the images naturally obtained by two eyes at slightly different positions, followed by the simultaneous delivery of each image to the corresponding eye. Different modes of separation techniques have been used. The capture is usually accomplished by two parallel cameras. Ideally the two cameras should physically be the same, and the alignment should be perfect [6].

Usually, special glasses are needed for separating the two images. Early versions of these glasses were based on anaglyphs, which are two intensity images, each having a different color whose color spectra do not overlap. Each of the two images is printed (photography), or projected (cinema), or electronically displayed (TV) by overlapping them properly. Eyewear consists of different color filters on each eye that filter, and thus separate, these overlapped images. The color filters should match the spectrum of the displayed images so that each eye receives only its single 2D intensity image. This technique is still used in printed stereoscopic photography. Due to the restrictions on the color, full-color anaglyph-based stereogram's are impossible. However, more sophisticated means of filtering are adopted for cinema and TV [7].

2. Anaglyphic Process

A frame-compatible stereogram where the left- and right-eye images are color-coded and combined into a single image [3].

When the combined image is viewed through glasses with lenses of the corresponding colors, a three-dimensional image is perceived. Different complementary color combinations have been used over the years, but the most common are red and cyan, a shade of blue-green. Anaglyphs may be projected, displayed on a monitor, or produced in print. As can seen, the concept behind a stereo picture is to present slightly offset views of the scene to each eye to trick it into seeing depth. In the real world, we do this with two eyes viewing the scene from slightly different angles. To make a stereo picture, the challenge is not only to display the two different views on the same screen, but also to show just one of those views to each eye. It turns out that this is hard to do. One of the earliest workable methods was the anaglyph process, using the familiar red and cyan glasses [3].

Figure 1 shows a stylish pair of anaglyph glasses and Figure 2 shows a typical anaglyph picture. If you have a pair of red and cyan anaglyph glasses lying around, you can try them out on this picture. The anaglyph process merges the two offset views into a single image, with one view colored cyan and the other view color red. The red and cyan lenses of the anaglyph glasses then allow each eye to see its intended view while blocking the other eye [3].

The problems with anaglyph are ghosting, color degradation, and retinal rivalry (different brightness to each eye). It's just not a very good way to present separate views to each eye. In movie theatres, high-tech polarizing display systems and glasses are used for their much better quality and low cost for a mass audience. However, in a production studio active shutter systems are most common. An active shutter system has rapidly blinking LCD glasses synchronized to a display that is rapidly flicking between the left and right eye views[3].

Figure 1, Anaglyph glass

Figure 2, Anaglyph picture

3. Stereoscopic Image Processing for 3D Monitoring

Once again, let's refer back to our color analogy. There are three levels of color monitoring: basic control is watching lowlights and highlights, making sure your images are not burned out; intermediate color control just requires an all purpose monitor; and advanced color control requires a color-calibrated monitor, light-controlled environment, or the trained eyes of an expert colorist or DP. Otherwise, reference patterns and a vector scope would do the job, even with a colorblind technician. Beyond this, onset LUT management will allow the crew to make sure the tweaked image will match the desired artistic effect [5].

4. Basic 3d Monitoring

Basic stereoscopic control can be done with a 50% mix on a regular 2D monitor. Vertical disparities should be unnoticeable on a small field monitor; otherwise they'll be uncomfortable on full-size screens [8].

Side-by-side and over/under modes can also be used, but they are less efficient in detecting horizontal or vertical disparities and rotations. Anaglyphic 3D is often preferred for previews and is best enjoyed without glasses. The red and blue fringes act as disparity enhancers on the display [8].

5. Intermediate 3d Monitoring

Intermediate level quality control is done using a difference view that clearly shows the disparities and makes them much more noticeable, even measurable.

Basic and average controls can be supplemented with markers showing reference parallaxes on the monitor. One can use simple Post-its or tape applied on the screen. Some professional displays can electronically insert visual helpers, like gridlines, bars, or checkerboards. If you are shooting with no target screen size, 1% and 2% of the screen width are the regular landmarks. If you are shooting for a defined screen size, the size of the reference grid unit can be the equivalent of one or two human inter-optical distances. On a feature, the reference maximum positive parallax will be chosen during the preproduction[2].

Obviously, specific parallax references for FX shots will be enforced with even more caution.

6. Waterfall Model Processes

A successful software project is the one that satisfies the expectations on all the three goals of cost, schedule, and quality. Consequently, when planning and executing a software project, the decisions are mostly taken with a view to ultimately reduce the cost or the cycle time, or for improving the quality. Software projects utilize a process to organize the execution of tasks to achieve the goals on the cost, schedule, and quality fronts [4].

A project's process specification defines the tasks the project should perform, and the order in which they should be done. The actual process exists when the project is actually executed. Although process specification is distinct from the actual process, and will consider the process specification for a project and the actual process of the project as one and the same, and will use the term process to refer to both of them. It should, however, be mentioned that although should assuming that there is no difficulty in a project following a specified process, in reality it is not as simple. Often the actual process being followed in the project may be very different from the project's process specification. Reasons for this divergence vary from laziness to lack of appreciation of importance of process to "old habits die hard." Ensuring that the project is following the process it planned for itself is an important issue for organizations in the business of executing projects, and there are different ways to deal with it[4].

The simplest process model is the waterfall model, which states that the phases are organized in a linear order. The model was originally proposed by Royce, though variations of the model have evolved depending on the nature of activities and the flow of control between them. In this model, a project begins with feasibility analysis. Upon successfully demonstrating the feasibility of a project, the requirements analysis and project planning begins. The design starts after the requirements analysis is complete, and coding begins after the design is complete. Once the programming is completed, the code is integrated and testing is done. Upon successful completion of testing, the system is installed. After this, the regular operation and maintenance of the system takes place [10]. The model is shown in Figure 3.

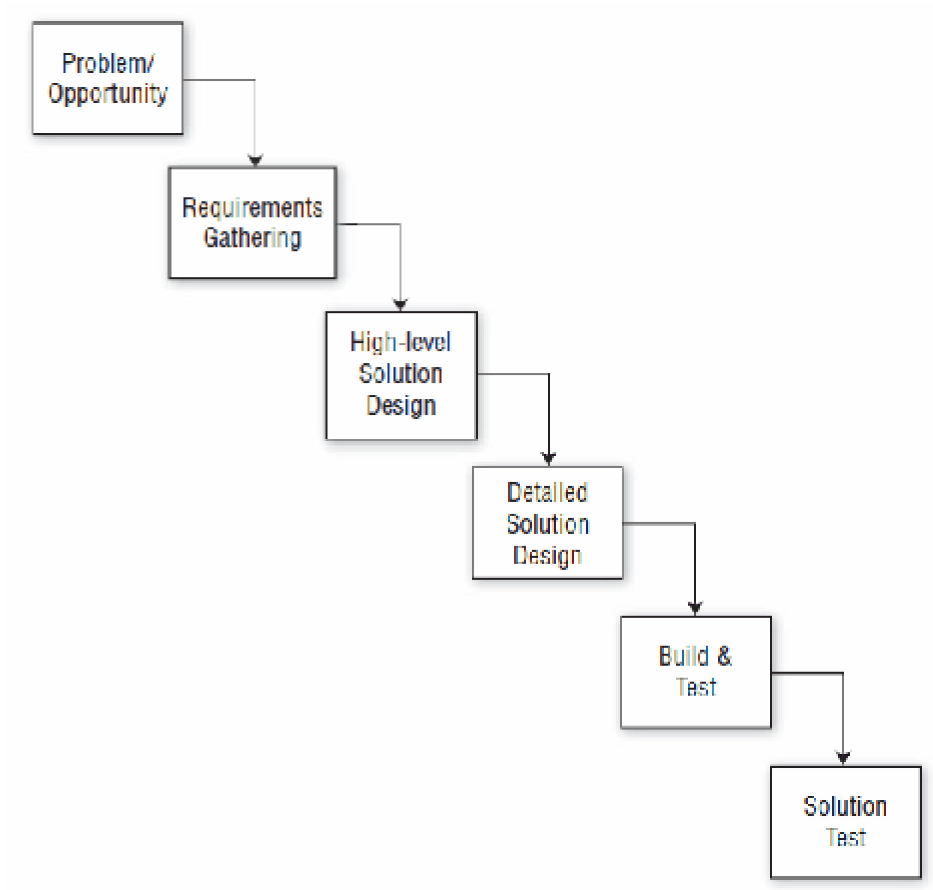

Figure 3, Waterfall Model Phases

The requirements analysis phase is mentioned as "analysis and planning." Planning is a critical activity in software development. A good plan is based on the requirements of the system and should be done before later phases begin. However, in practice, detailed requirements are not necessary for planning. Consequently, planning usually overlaps with the requirements analysis, and a plan is ready before the later phases begin. This plan is an additional input to all the later phases [10].

Linear ordering of activities has some important consequences. First, to clearly identify the end of a phase and the beginning of the next, some certification mechanism has to be employed at the end of each phase. This is usually done by some verification and validation means that will ensure that the output of a phase is consistent with its input (which is the output of the previous phase), and that the output of the phase is consistent with the overall requirements of the system [9].

Though the set of documents that should be produced in a project is dependent on how the process is implemented, the following documents generally form a reasonable set that should be produced in each project [4]:

- Requirements document
- Project plan
- Design documents (architecture, system, detailed)
- Test plan and test reports
- Final code
- Software manuals (e.g., user, installation, etc.)

In addition to these work products, there are various other documents that are produced in a typical project. These include review reports, which are the outcome of reviews conducted for work products, as well as status reports that summarize the status of the project on a regular basis. Many other reports may be produced for improving the execution of the project or project reporting [4].

One of the main advantages of this model is its simplicity. It is conceptually straightforward and divides the large task of building a software system into a series of cleanly divided phases, each phase dealing with a separate logical concern. It is also easy to administer in a contractual setup—as each phase is completed and its work product produced, some amount of money is given by the customer to the developing organization[4].

7. Purposes Work

The waterfall model has been widely adopted because it can be clearly divided into various steps and documents can be defined as the result for each step. This enables management to inspect the development process and assess its progress. Every step is considered to be complete when the documents defined for this step are produced, reviewed and accepted. The waterfall life cycle comprises the following steps:

- Requirements analysis

The purpose of this step is to identify and document the requirements to the software system. Interaction between customers and developers is necessary if the requirements are not clear. In stereoscopic system especially in anaglyph technology, the requirement to design a software to analysis this technology, and before that need to take different images (frames) from a video and then take some of these frames and convert it to 3D anaglyph, these requirement needed by customer. The requirements of this software are graphically shown in figure below.

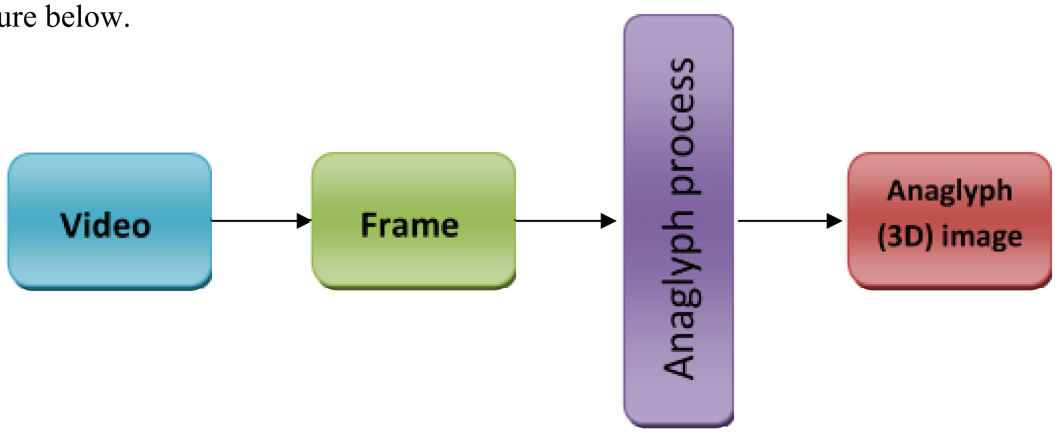

Figure 4, Requirements phases for 3D anaglyph analysis software

- Specification

Once the requirements are clear, software developers write the exact specification of the software system. The specification focuses on the system itself, and all the user requirements have to be considered. The resulting document serves as the base for the subsequent development process. The final system will be said to be correct if it meets the specification. In purposes system, the final image should keep same resolution and size as the one extracted from a video, other specification it's about the anaglyph image, that merge two images and showed in a single one with colored cyan and red, depend on anaglyph technology.

- Design

The design of a software system usually comprises two stages, architectural or high-level design and detailed design. Architectural design establishes the overall structure of the design, e.g., module structure and class organization.

The results of the architectural design are refined by outlining the structure of the modules, classes, functions or controls and this last one in our system used as x and y variation, threshold, left/right color and screen.

- Implementation

In this step the actual code of the software system is produced. Below the code details in design phase.

- Extracting an image(s) from a video file, and this will be done by select a movie and then define the destination location where the image will be save, as seen below.


Image 1


Image 2


Image 3

Figure 5, extracted sequence of images from video vipmosaicking.avi


Image 1


Image 2


Image 3

Figure 6, extracted sequence of images from video rhinos.avi

- **Parameters**
  - Horizontal and vertical used to make a separation between images vertically and horizontally.
  - Threshold to consider an image to have color.
  - Screens, depends on what kind of glasses you're using, in the left screen for cyan color and right screen for red color.
- **Image data**

In this section read image dimension, then extract the dimensions of an image. Need to convert the image to grayscale for threshold purpose. Also, need to create two overlay images for left and right that will be assigned for output image.

There is a condition in this step, its checking if the intensity of an image is below than the threshold or not. If its so, then will leave the current pixel and in same time will generating an overlay images (left and right).

As known in anaglyph 3D, the two layers of an image (red and cyan) be shifted, for that, in our system, we will shift (extend) left and right layer vertically and horizontally. Finally will have an anaglyph image as shown below.

Figure 7, anaglyph image for vipmosaicking_1.jpg

Figure 8, anaglyph image for rhinos_1.jpg

Some cases considered here in this paper about the different glasses color (Red and yellow). Below its figure done for this consideration case.

Figure 9, anaglyph image for rhinos_1.jpg

For other cases, especially in contrast of anaglyph color that could be need to enhancement for one or both colors of anaglyph image as shown below.

Normal anaglyph image More contrast for red color in anaglyph image

Figure 10, results for different contrast in an anaglyph image

- Test

All parts of the software system have to be tested individually. After that, the parts are integrated and the system is tested as a whole. As shown in figures (11 and 13) below will test the original image and final one by calculate intensity of each image by histogram which shows the distributed of data values as shown in figures (12 and 14).

Figure 11, Original Image and Process Image (anaglyph)

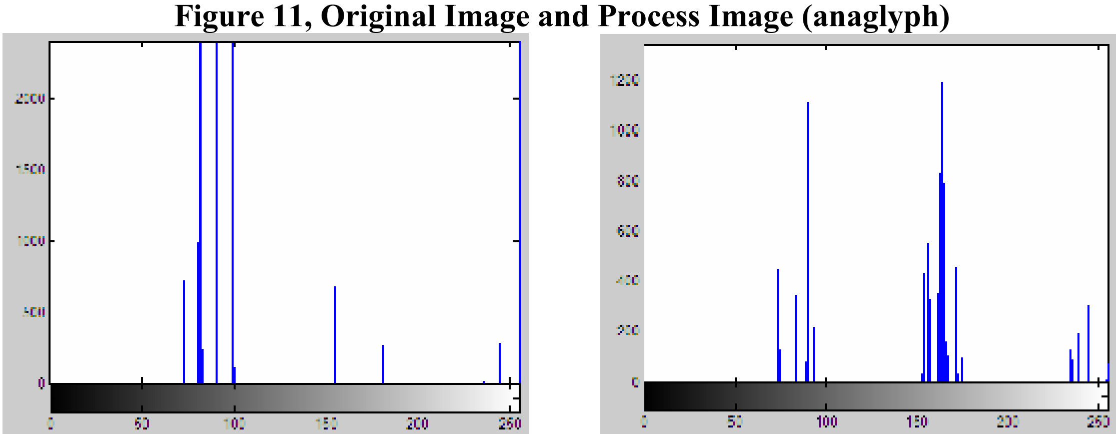

Figure 12, Histogram of an Original Image and Process Image (anaglyph)

Figure 13, Original Image and Process Image (anaglyph)

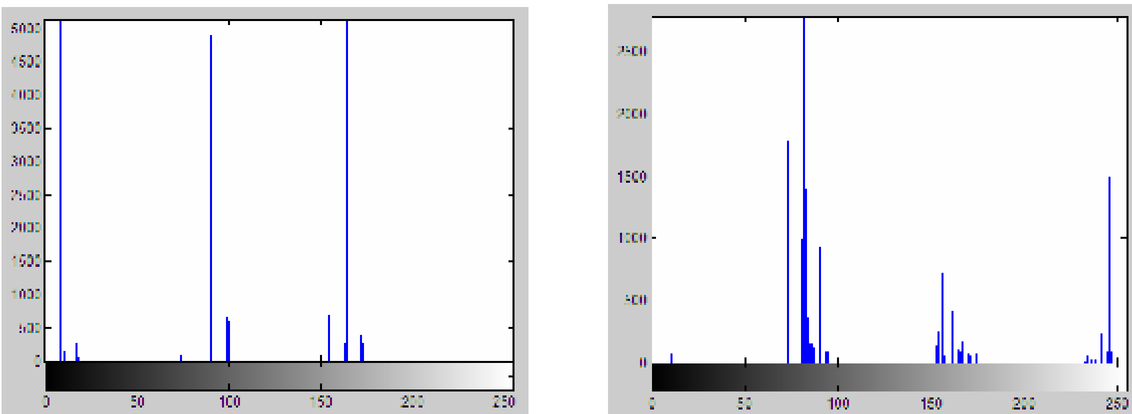

Figure 14, Histogram of an Original Image and Process Image (anaglyph)

- Operation and maintenance

After successful testing that comes by converting a frame of extracted video to three-dimensional anaglyph which should wear an anaglyph class. Then, the system is delivered to the customers. Any modifications after delivery are part of the maintenance phase.

Any step might uncover problems in a previous step and necessitate returning and partly or even completely redoing earlier work. In practice a step might start before the previous has been totally completed. Some activities of the software process are not depicted as separate steps because they span the entire life cycle. These activities encompass documentation, verification and management.

8. Conclusion

Although there are a range of other stereoscopic display technologies available that produce much better 3D image quality than the anaglyph 3D method (e.g. polarized, shutter glasses, and invites), the anaglyph 3d method remains widely used because of its simplicity, low cost, and compatibility with all full-color displays and prints. If anaglyph 3D is to be used, it would be best if it were production flexible and follow some produce software management for best quality and maintenance cases which is one of the purposes of this paper.

This paper has focus on anaglyphic 3-D images can be product mass movie produced in 3D by (Waterfall model) of software life cycle in software management. The study has also revealed that there is considerable variation in the amount of anaglyphic exhibited by different display, different movie, and different anaglyph colors in case if using different glasses color. Compared to works that has only considered red/cyan anaglyph glasses, this paper has extended the work to include red/yellow which are now also in common usage.

9. References

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