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CULTURAL INTERACTIVE PANORAMA (CULTURAMA)

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Abstract (EN)

CULTURAMA, Cultural Panorama, is an innovative harmonized mix between a wealth of cultural and natural heritage information, very informative and attractive multimedia program and latest display technology. It has been developed by the Egyptian Center for Documentation of Cultural and Natural Heritage (CULTNAT). The hardware part contains a huge 180 degrees panoramic interactive computer screen with a diameter of 10 meters that consists of nine separate flat screens arranged in a semicircular shape and nine video projectors controlled by a single computer. An Interactive multimedia software was especially developed by our team in order to display on the panoramic screen.

CULTURAMA has proved to be an excellent tool for delivering information to all age groups: children and adults. CULTURAMA also enabled us to display information that could have never been displayed clearly using regular computer display systems.

In this paper, the concept of CULTURAMA will be presented and its development steps, as well as, the technical aspects used for developing CULTURAMA.

KEY WORDS: Panoramic display, multi-display, multimedia, cultural and natural heritage, interactive

Résumé (FR)

Culturama, comme l'indique son nom, est un panorama culturel, méthode innovatrice s'appuyant sur des technologies de pointe pour représenter des informations riches et diverses sur le patrimoine culturel et naturel égyptien. Elle a été mise au point par le 'Centre égyptien pour la documentation du patrimoine culturel et naturel'.

L'équipement de Culturama comprend 9 projecteurs et 9 écrans plats disposés en demi-cercle et formant ainsi un angle de 180°, le résultat étant un écran géant, informatisé, interactif et panoramique contrôlé par un seul ordinateur grâce à un logiciel multimédia spécialement développé pour ce type de projection.

Excellent outil de visualisation qui plaît à tous les âges, Culturama permet d'afficher clairement l'information, ce qui n'aurait pas été possible d'accomplir à l'aide d'ordinateurs ordinaires.

Dans cet article sont présentés le principe de base de Culturama, les étapes de son développement, ainsi que les aspects techniques du dispositif.

Mots clés: Patrimoine Culturel et Naturel, Panoramique interactif, Ecrans multiples.

Zusammenfassung (DE)

CULTURAMA, kulturelles Panorama, ist eine innovative harmonisierte Mischung aus reichen Kultur- und Naturerbeinformationen, einem sehr informativen attraktiven multimedialen Programm und der modernsten Display-Technologie. Es wurde vom ägyptischen Zentrum für Dokumentation des Kultur- und Naturerbes (Egyptian Center for Documentation of Cultural and Natural Heritage, CULTNAT) entwickelt. Die Hardware besteht aus einem riesigen 180 Grad, interaktiven Bildschirm mit einem Durchmesser von zehn Metern, der aus neun separaten Flachbildschirmen besteht, die in Form eines Halbkreises angeordnet sind und aus neun Videoprojektoren, die von einem einzigen Computer gesteuert werden. Eine interaktive Multimedia-Software für diesen Panoramabildschirm wurde speziell von unserem Team entwickelt.

CULTURAMA ist ein ausgezeichnetes Informations-Tool für alle Altersgruppen, für Kinder wie für Erwachsene. CULTURAMA macht es uns möglich Informationen zu zeigen, die mit regulären Computerdisplay-Systemen nicht deutlich gezeigt hätten werden können.

In diesem Beitrag werden das Konzept von CULTURAMA und seine Entwicklungsschritte präsentiert sowie die technischen Aspekte vorgestellt.

Schlüsselwörter: Panorama-Display, Multi-Display, Multimedia, Kultur- und Naturerbe, interaktiv.

I. INTRODUCTION

Egypt's heritage is of worldwide interest and importance due to its continuity over a period of more than five thousand years. It encompasses various aspects of human civilization, monitors the development of human heritage, and represents cultural as well as natural heritage of national and international value.

This wealth in archeological sites, architecture, arts, folklore and natural beauty needs to be accurately and purposefully documented. Hence, the establishment of the Center for Documentation of Cultural and Natural Heritage, CULTNAT, which is affiliated with Bibliotheca Alexandrina and supported by the Ministry of Communication and Information Technology.

The Center's mandate is to document Egypt's cultural heritage as well as its natural heritage, to increase public awareness of Egypt's heritage using all available modern technology and to build capacities of professionals in the fields of conservation and documentation of cultural and natural heritage.

An important target for CULTNAT is the dissemination of cultural information and the raise of public awareness to the Egyptian heritage. Consequently, CULTNAT was concerned with carrying out research for developing different methods of delivering information using state-of-the-art-technologies. As a result of this research, CULTURAMA was produced as one elaborate and attractive method for illustration of cultural information.

The next section will cover CULTURAMA's start and development, while section three will present hardware and software of CULTURAMA; in section four the new features will be discussed. As for section five the development methodology will be presented; afterwards, related work, future work and conclusion will be briefly discussed.

II. CULTURAMA: Its start and development

In 2001, video walls technology was our main target for delivering information in an interesting way to different categories of audience. Unfortunately, we faced the following problems while studying such a solution: high cost, huge size of equipments, importability of the solution and limited resolution output.

Afterwards, we came up with the idea of simulating the video wall by using regular PC together with multiple plasma screens, arranged in an array. We targeted an array of 2x2 screens, each is 61". The main problem we had to solve was how to make the screens display a continuous image without loosing resolution in which each screen displays 800 x 600 pixels rather than dividing the computer output by 4. We started by investigating the availability of a commercial hardware that can take the computer display output and divide it into multiple outlets during which the total resolution is not limited to standard output resolution. Regrettably, such a solution was not applicable, thus we approached a second methodology. The main essence of this methodology was using different computers. Each computer is running a separate program and attached to one plasma. In fact, the key issue investigated was how to synchronize between the four computers so that the output would seem to be one image rather than being scattered between different computers. As a result, we connected the four computers with a LAN by which the four programs would be able to handshake to synchronize their output together. This approach would have worked fine except for two problems.

First, we intended to produce high-end multimedia display that requires a high level of animation. Meanwhile, this solution would result in having slight delay for handshake which cannot be eliminated which is considered unacceptable for impressive animations. The second problem was the complexity of the software development. Looking for solutions to these problems, a feature in MS Windows was discovered that solved all our problems, which is the ability of Windows to deal with multiple display outputs. MS Windows 2000 can support up to ten different display outputs; moreover, one can arrange these outputs to arbitrarily extend windows desktop. Based on this feature, we equipped a PC with four PCI VGA cards and arranged them to form a 2 x 2 array. Each output is 800 x 600 pixels, which means that the total resolution of the display is 1600 x 1200. Afterwards, we developed a single multimedia program with window size 1600 x 1200. Applying this method, we succeeded in having a video-wall like computer display making use of the full resolution of each display unit. In addition, developing a single program with the total resolution of the array enabled us to produce high end multimedia program with animations and effects which was applied to the four screens as a single display unit achieving an accurate synchronization between them.

We presented this display unit on April 2002 at the soft launch ceremony of Bibliotheca Alexandrina. The show displayed was a 10 minutes multimedia presentation that introduced

different CULTNAT documentation projects together with sample information from each project. (See figure: 1)

Fig:1 Video wall like computer display

The next stage of development started with the idea of achieving a real virtual visit to some ancient Egyptian tombs. These tombs usually consist of one or more small rooms (2m x 2m on the average). The walls of each room contain different Pharaonic inscriptions. These tombs are scattered all over Egypt and many of them are not open for public. Consequently, simulating a real visit to these tombs would give people the opportunity to see these tombs. Our objective was to simulate the rooms using computer screens instead of the walls, electronic cave. [1]We investigated ready made cave systems, but the main disadvantage was the limitation of using the special software for the cave system. Meanwhile, in our solution we use any development tool just taking into consideration the resolution of the output program. The use of such tools enables us to develop any type of application together with high programming capabilities. In order to achieve the cave we had to set up the screens in a rectangular shape with an open side to enable the audience to get in. The audience will view a computer generated image of the tomb walls around them in which one can navigate from one room to another. Moreover, extra levels of information would be added to the visit; for example, an English translation of the hieroglyphic text written on the walls. Using the methodology described above, it became very easy for us to develop this idea.

Starting the development of the cave, we noticed that the use of plasma screens will not be suitable for the new requirements. Basically, because of its small display area compared to

tomb walls, high cost of using an array of plasmas for each wall, exceeding number of outputs supported by Windows and the unrealistic view of the wall that the borders of the plasmas give. As a result, we studied using video projectors instead which was considered an evolutionary point in the development of CULTURAMA because it added a lot of features and new ideas for development. The most important feature was the big display area that the project or can provide especially with the advancement in the projection technology that resulted in good quality image and small projector size. Furthermore, we used three regular projection screens arranged in U shape. Unfortunately, we faced another problem which was the limited area provided for audience, although we targeted large number of audience per show. This problem was solved thinking of different screens setup. We installed regular projector screens with angles of 135 degrees instead of 90 degrees (figure 2). Although this did not stimulate being in tombs, it was useful in displaying the walls of the tombs. During the development of the software we noticed that this setup can be used in displaying many types of information in an attractive way other than just simulating monuments walls.

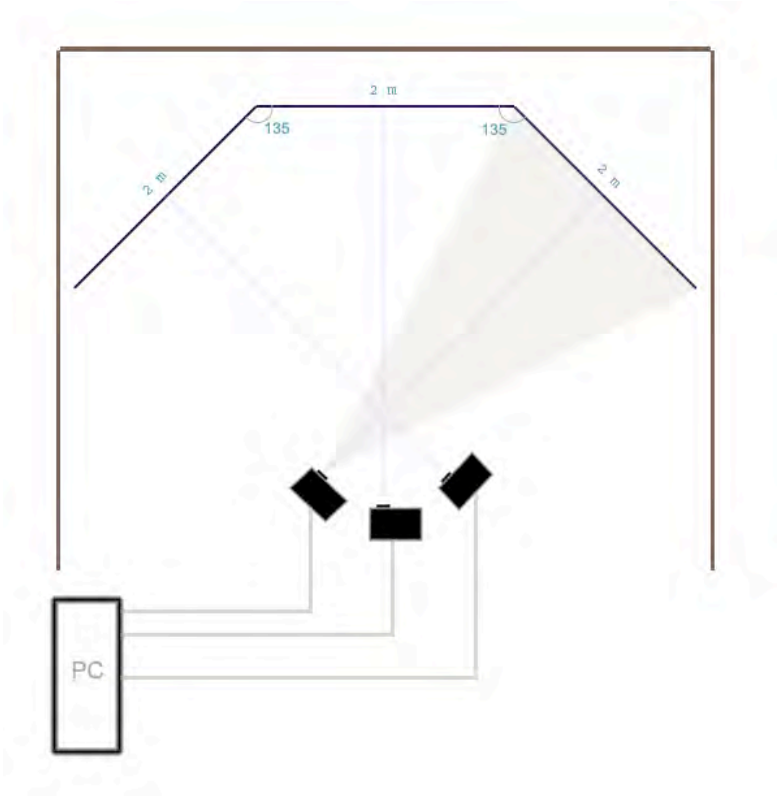

Figure 2: Three screens projection setup

Figure 3: Three screens projection

In April 2002, at the inauguration ceremony of Bibliotheca Alexandrina we introduced this display method to the public for the first time with a 12 minutes cultural multimedia show (figure 3). The great success of this show encouraged us to invest more time and effort for the development of CULTURAMA. As a result, we started to study using five screens instead of three. Lot of issues had to be put into consideration: Multimedia output performance, software development methodology for optimum utilization of the big display area, and hardware setup. We have installed the five screens to form a 90 degrees panorama, with an angle of 157.5 degrees between each two successive screens. The total output resolution was 4000 x 600 pixels. In September 2003, at the inauguration ceremony of the smart village under the auspices of His Highness the President of Egypt, the five screens display was presented (figure 4). This event was considered the last step before our final form for CULTURAMA was introduced in October 2003.

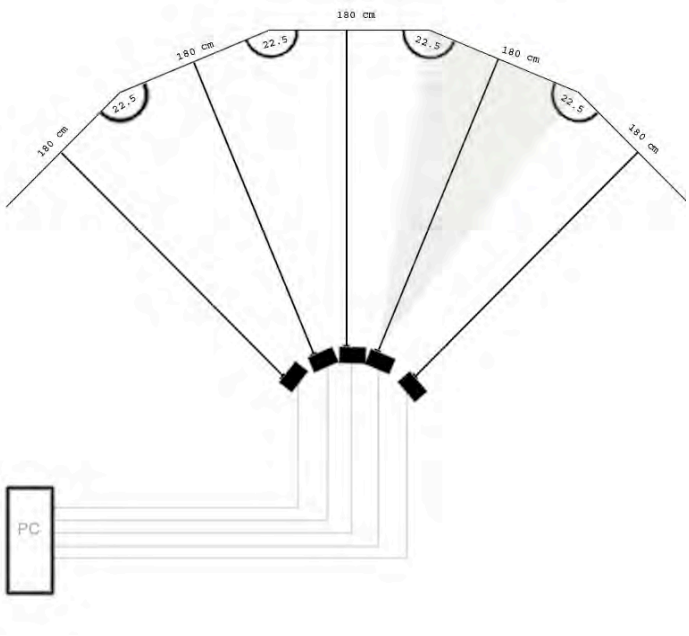

Figure 4: Five screens projection setup

III. CULTURAMA hardware and software

Currently, a permanent hall of 100 m^2 is dedicated for CULTURAMA at CULTNAT building located at the smart village, Egypt. After the three screens and the five screens display previously presented, a nine screens display is currently located at CULTNAT. The screens are arranged in a semicircular shape with a diameter of 10 meters (figure 5). The hall is equipped to hold thirty five persons per show(figure 6).

In the previous stages of our multi-screen projection, we used a standard projection screens that had always the problem of having gaps between the screens. This was caused by the rolling mechanism of the screens or by the borders of the screens in case of using non-rolling screens. As a result of this problem, we started to create our custom screens. We experimented different methods to build the nine screens seamlessly. At the end we reached a good implementation that achieved a seamless panoramic screen together with portability and elegant look. We have used two banner stands on which we installed a single sheet of projection material to build a seamless screen with height of 2.65 meters and width of 2 meters. The surface area of the resulting panoramic screen is 2.65 x 18 meters. Meanwhile due to the aspect ratio of the computer output , the projection area is only 1.5 meters height and 18 meters width.

The hardware currently in use consists of a workstation with dual 3.02 GHz Xeon processors, 2GB RAM and equipped with five dual output VGA cards. A set of nine ceiling mounted LCD projectors with luminance of 2200 ANSI.

As for the software, using the multi display support feature in MS Windows, we extended the desktop to 7200 x 600 pixels. This resolution grants 800x600 pixels per screen. We have chosen such a low resolution to achieve the best utilization of memory for the produced multimedia program. A special multimedia program with window size of 7200 x 600 pixels was developed by CULTNAT multimedia team to be displayed in CULTURAMA (figure 7).

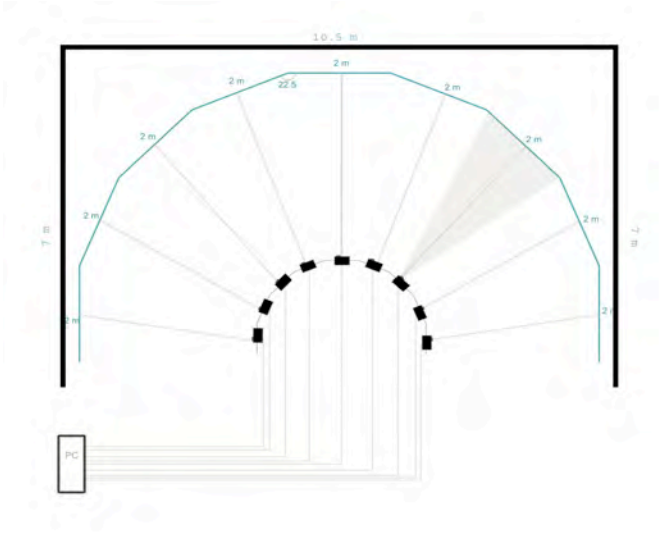

Figure 5: Culturama screens projection setup

Figure 6: Culturama Hall

Figure 7: Culturama in display

IV. New features in CULTURAMA

CULTURAMA is the first fully interactive multimedia program displayed on semicircular nine screens panoramic display for cultural and natural heritage. In addition, we have achieved a huge computer display area with the resolution 7200 x 600 pixels. This area is used to deliver wide range of information that could have never been delivered using standard computer display. Examples of such information are historical time lines, panorama of real scenes and sites, visual comparison between many items and the clear display of large objects. Moreover, we have introduced a new concept of multimedia development to utilize this huge display area. At last but not least, we have made use of regular equipments represented in regular workstations and regular video projectors in addition to implementing the semicircular screen using flat projection screens. The use of those familiar equipments made CULTURAMA: cost effective, easier to maintain, together with flexible and powerful software development. Also the use of flat projection screens facilitated image stitching with no need for special hardware.

V. Development methodology for CULTURAMA

The key factor for CULTURAMA success is the amount and the type of information it contains together with the methodology used to introduce this information. The content of CULTURAMA is a merge of information selected from our database built in the different programs of CULTNAT. This information is introduced to the audience in an interactive multimedia program that has been developed taking into consideration two important aspects

of design. The first aspect is simplicity in delivering information while using multiple and latest multimedia technologies. The different technologies used are harmonized together in a perfect way in order to present cultural wealth in a very simple, impressive, clear and compact manner. On the other hand, the second aspect is the division of information into multiple levels: general and more specific ones.

VI. Current programs displayed in CULTURAMA

CULTURAMA has three main sections, which represent three different periods of the Egyptian history. Those sections are Ancient Egyptian Period, Highlights of Islamic Civilization and Modern Egypt. In the first section, we introduce the Ancient Times by displaying the timeline of the Pharonic period starting from 3000 B.C. up till the start of the Gregorian calender. All the well-known kings are presented by a photo in which they are placed in their correct chronological position. Pointing to any of those kings, basic information is displayed, which represents the first level of information (figure 8). Without CULTURAMA screen, one could have never been able to display such a timeline on a single screen. Furthermore, if the user wants to know more stories about specific kings, he can just click on this particular king where the second level of information is displayed. For example, Thotmosis III who built an outstanding room in the Karnak Temple, called the botanical garden. On the walls of this room, he has documented the natural elements known in Egypt at his time. By clicking Thotmosis III, the walls of the botanical garden are displayed giving the audience the chance to see all the animals, birds, and plants inscribed on the walls. Moreover, selecting any of these elements will display more information about it in which a recent photo of the bird or the plant is displayed together with description that is considered the third level of information.

Another section that can be reached from the time line is the Rhind mathematical papyrus (RMP), which is considered one of the most famous mathematical papyri from the time of Pharaohs. The RMP is five meters long and contains 86 different mathematical problems and their solutions. Using CULTURAMA enabled us to display RMP and to magnify it 3 times on one screen. Furthermore, users can interact with the papyrus to zoom into any of the problems in order to see the English translation of the hieroglyphic text (figure 9).
Another key feature of CULTURAMA is the ability to display on it panoramic scenes of some places or sites. This technology is specifically used in the modern Egypt section. In this

section, we currently display a panoramic view of Cairo from the Nile (figure 10) and Alexandria from the sea (figure 11). Users can interact with the panorama to navigate or select some of the components in the view in order to see more information about this component, which is considered the second level of information in this section. For instance, in Cairo panorama you can click on one of the old bridges on the Nile to see a movie clip of that bridge filmed by the brothers Lumiere in 1895.

Figure 8: Pharaonic timeline section

Figure 9: Rhind mathematical papyrus section

Figure 10: Cairo from the Nile section

Figure 11: Alexandria from the sea section

VII. Audience of CULTURAMA

A wide range of audience types visited and watched CULTURAMA starting from children to highly educated people working in different fields with different nationalities. The feedback was amazing, Vinton Cerf, the senior vice-president of technology strategy, MCI, said" The CULTNAT projects may be the most important, historical, educational and technological efforts ever monumental in Egypt. They will cement the importance of Egyptian history and culture into the fabric of world history". Moreover, displaying CULTURAMA to students and teachers, we discovered that it could be used as an attractive educational tool especially by giving children the opportunity to run the program. At the university level, lots of Professors in the fields of Culture and History requested to arrange some sessions in CULTURAMA in which they can bring their students to give them lectures using CULTURAMA. Moreover, cultural experts were impressed by the way the information can be presented on CULTURAMA as they started thinking about the usage of this type of display in their field. Museum design experts and museum managers also consider CULTURAMA as an essential element that should exist in every important museum. In fact, many IT Ministers who visited CULTURAMA from different countries were fascinated. In conclusion, CULTURAMA can be used for a very wide range of audience, and for lots of purposes.

VIII. Related work

In this section we highlight some work achieved by others which is related to our work.
First we would like to mention the existence of other panoramic displays in semicircle [2] and full circle[3], but they are mainly used for video and not computer display. Curved computer

projection displays have been also achieved with the use of special hardware that divide the computer output between two or three projectors and wrap the projected image to the geometry of the screen.[4]

The cave technology that is also based on multi screen technology has been developed during the last few years.[1]

Finally parallel to our development process the use of multi display technology has been developed. Currently, some companies are producing multi-screen; however,[5],[6],[7],[8] none of them has produced an integrated solution like ours in terns of content, development, hardware and software development

IX. Conclusion and Future Work

In conclusion we have achieved an interesting display technique using standard equipment which in turn led to the use of any programming tool for software development. In addition, we introduced a new presentation concept using the large screen that deliver to all types of audience a large amount of information in the field of heritage. It can also be used in many different fields other than heritage.

The success of CULTURAMA encouraged us to assign more effort and resources for further development of the idea. Currently, we are testing the idea of increasing the display area of the screens. Moreover, we are studying the use of stereoscope imaging technology in order to add more dimensions to the audience experience. Finally, we are studying the use of the same equipment to achieve different screen setups like cave etc. Regarding the software development we are continuously adding new modules to the software described earlier.

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