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Virtual Campus

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Abstract
A menu driven general purpose software package was developed to present a virtual university campus by using web based software techniques. 360 degree panoramic views are generated by image stitching and inclusion of hot spots. Virtual campus tour was formed with QuickTime movies and also in the web by using Adobe Dreamweaver. Visitors had the flexibility to start from anywhere in the campus and go to any destination by using keys on the keyboard.

Keywords: Virtual, Virtual Tour, hot spots, panoramic view, image stitching, QuickTime movie

INTRODUCTION

Virtual presentations are very popular software tools in recent years. People would like to see the places and locations without actually going there .The aim of this study is to present a typical university campus where students can have virtual walks in the campus area through its web site. In the university there are many faculties and departments with many buildings, facilities and laboratories. The virtual visitors can have a virtual tour of all these premises by starting anywhere indoor or outdoor in the campus.

Virtual tour is a computer presentation of a place and it shows the geometrical properties of that area. This 360-degree panoramic application provides people to look in any direction, see a full circle of the area and walk around by clicking on the hotspots. Adding links to the images to pass the other images of the place makes possible to use the window as a navigation tool. Providing a floor plan helps users to navigate through the environment. Virtual tours improve the visual presentation and spatial understanding of the place being visited. In today's world, the interactive 3D graphics at the web such as web-based virtual tours are getting more popular and day by day providing such tours is becoming crucial for the websites which present the places with visual importance.

WORK PLAN

The generation of the web based virtual University Campus are carried out in various steps. Each step was carefully considered and related to others.

1- Planning and photographing

A geographical plan was generated and 44 points in outdoor area and 131 points in inside the buildings were marked in the plan to produce the transitions between panoramas. Thirty-two standard photographs of any target were taken to make a panorama.

2- Stitching Images

Once the photographing session was completed the photographic images were stitched for creating panoramas by using *REALVIZ Stitcher Unlimited 5.6*. To stitch the images two of thirty-two captured images were considered and markers were placed on them. These markers were located in the other images for exact stitching.

3- Creating Panorama

After stitching the images successfully, a high-resolution 360 degree panorama was created.

4- Converting Panoramas

Once the panoramic view is completed, an external image editor was used to edit these panoramas. *Jasc Paint Shop Pro 9* is used for this purpose. The already edited 360 x 180 panorama is a JPEG format (*.jpg) file. To ensure the visitors to walk around in the area, the file format was converted from jpeg to QuickTime movie (*.mov).

5- Working with Hotspots

The transition from one location to another location in the movie is identified as hot spots. The visitor clicks on a hotspot to go from one location to another one. All panoramas are linked to each other by using hotspots. A panorama has multiple hotspots for several different locations. The hotspots to a panorama or movie file can be added by using REALVIZ Stitcher Unlimited 5.6.

6- Creating *.html Files

Virtual campus tour, formed with QuickTime, was later generated as a web page. *Adobe Dreamweaver CS3* is used for creating the web-site. Creating web-based virtual tour was obtained by linking panoramas to an html file that contains the relevant movie.

After the execution of these steps, a web-based virtual tour of the university campus was ready for the virtual visitors.

PROCEDURE

Virtual campus tour is the digital tour of a particular location composed of a varying degree of panoramic views. It comprises 2D panoramic images and a sequence of hyperlinked stills or video images. These panoramas are connected with each other by a series of hotspots.

The Virtual Campus tour consists of an outdoor area of 1kmx1km and 10 major buildings. A plan of campus outdoor area is shown in Figure 1.

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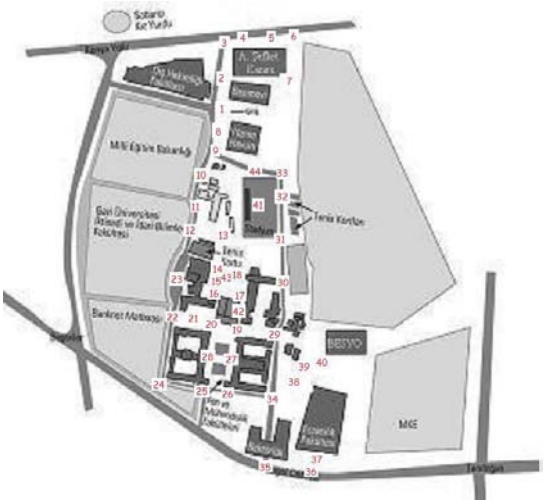

Figure 1 : Plan of the campus outdoor area

The study is divided into two parts. First part supplies the virtual tour with QuickTime movie and the second part supplies through the web site. The visitor can start anywhere in the tour randomly in both parts.

Realviz Stitcher Unlimited 5.6 enables the simple creation of high-quality panoramas for virtual tours and spherical cubic and flat panoramas for the Web presentations. The steps which were defined in Outline section will be explained in detail.

1. Planning and photographing

Initially a plan of the campus was generated to decide how many 3-D panoramas, or nodes, would be enough for the virtual tour (See Figure 1). The locations of these nodes were also carefully decided so that a node where a picture was taken must be linked at least to another node.

Photographs were taken by a high-resolution Nikon D70 digital camera. A tripod and a panoramic pan head for capturing panoramas were used whenever possible. This usage prevented parallax and also ensured sufficient overlap between images.

To capture a full 360° × 180° view of the scene one needed to capture the images in a row in horizontal plane. Additionally, rows of images were also captured with the camera tilted up and down with tilt angles ± 45 degree. The operation is as follows:

a) Camera was tilted +45°up from the horizontal plane and an image was captured. Pan head was rotated by 36° and another image was captured. The images were captured at 36º increments until the row is completed.

b) Camera was leveled to 0° pitch and an image was captured. Pan head was rotated by 36°steps and image capturing was repeated as in (a).

c) Camera was tilted down by –45° from the horizontal plane. Image capturing was repeated in 36° steps as in (a).

See Figure 2.

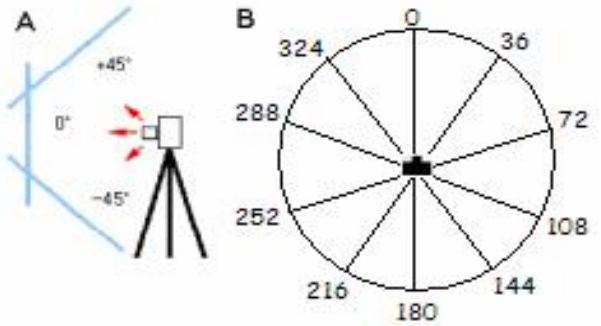

Figure 2 : Techniques of capturing images a) image planes and the camera b) 10 images per 360^0.

In addition to image taking at 0^0, $+45^0$ and -45^0 planes; an image at +90° (straight up) and another image at –90° (straight down) were also taken to ensure that the upper and lower regions of the panorama blends well with the images taken previously. These $\pm 90^0$ pictures will guarantee that the panorama does not end up with a hole (black space) at the zenith. See Figure 3.

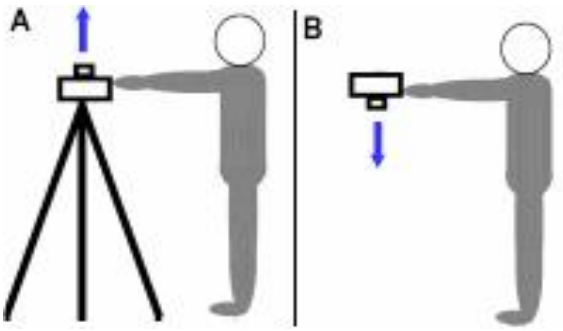

Figure 3 : Techniques of capturing images a) straight up b) straight down

According to the plan in Figure 1, For each target node thirty-two standard photographs are captured under these circumstances. Walking people, cars, sun light, focusing problems, air conditions, shadows, tripod problems etc… can cause retaking of these pictures.

2. Stitching Images

To stitch images for creating panoramas, images must be loaded into the Stitching Window. For exact stitching 2 stitching techniques are used. First technique tries to stitch images automatically by using a powerful pattern matching algorithm. This technique works well in most cases with an exception of scene changes in the panorama (See in Figure 4) For example, if the panorama was shot in open air where the clouds were moving from shot to shot, the automatic stitcher would get confused to align the moving clouds. Sometimes the scene simply lacks enough details for the pattern matching algorithm to get an

accurate match. i.e.: an indoor scene with lots of plain, brightly lit, white walls.

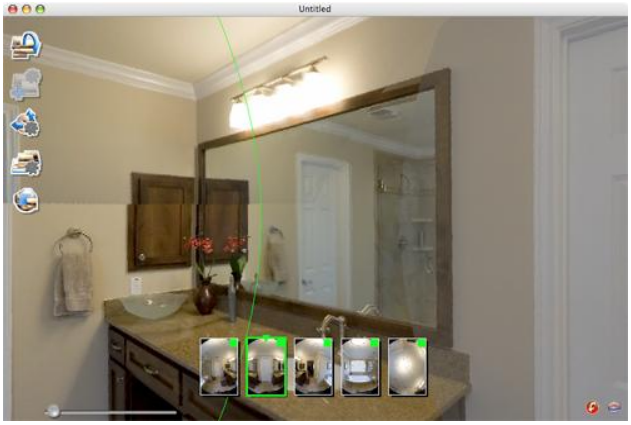

Figure 4 : Example of failed automatic stitching algorithm

Second stitching technique is called manual stitching and it is employed when automatic stitching fails. Manual stitching mode allows to set control points in the images to stitch them together (See Figure 5). In this mode, two images are selected which have similar control points and at least one of them is already stitched to a third image. These two images can be stitched using markers that are produced by the Stitcher software. A marker was placed in the first image by a mouse click (Figure 6) and another marker was placed by another mouse click on a similar point in the second image (Figure 7). These two images were stitched by using the Stitch function of *REALVIZ Stitcher software* by simply pressing the stitch button (Figure 8).

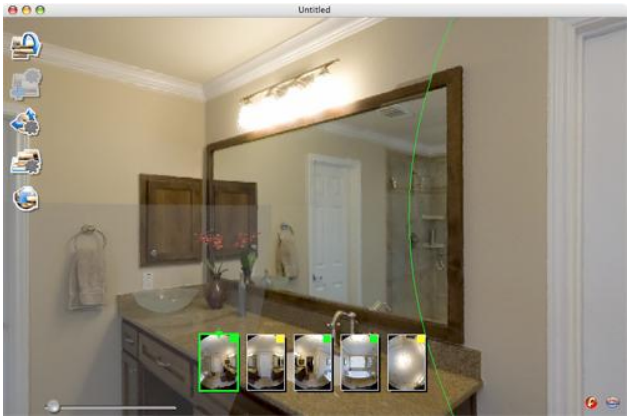

Figure 5 : Example of manual stitching

3. Creating Panorama

When stitching of the images is completed, *REALVIZ Stitcher* provides a render facility to render these stitched images to generate the panoramas as shown in Figure 9 for different file formats such as *.jpg , *.mov, *.tiff , *.iff , *.psd , *.png , *.ppm , *.sgi , *.pic , *tga)

Figure 6 : Placing the first marker

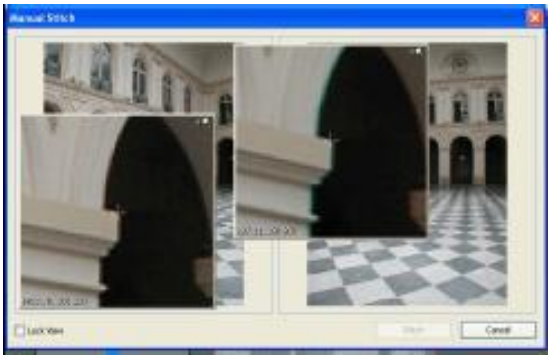

Figure 7 : Placing the second marker

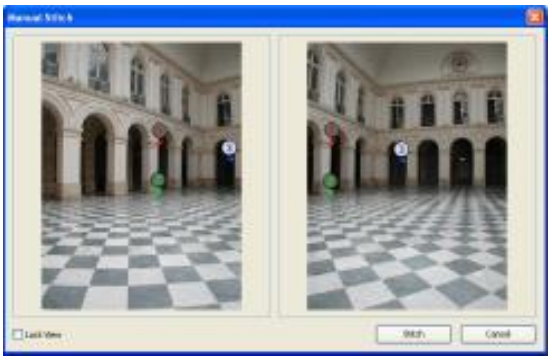

Figure 8 : Stitched images

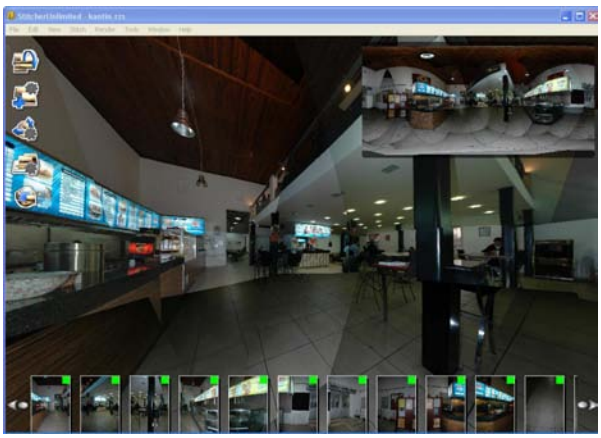

Figure 9 : Example of a panorama generated by rendered stitched images

Rendering stitched images to generate a panorama is carried out in various steps:

a) The images of the Panorama must be completely stitched.
b) The light intensity of Panorama must be equalized to balance the level of brightness in the images.
c) Panoramic view must be aligned so that the final scene must be determined. Alignment was achieved by drawing horizontal and vertical lines in the panoramic area as shown in Figure 10.

Figure 10 : Aligning the panorama

d) A file format must be chosen to convert the Stitched panorama to a spherical panorama (See Figure 11) in order to obtain a 3D effect.

Figure 11 : Example of panoramic image with 3D effect

4. Converting Panoramas

Panorama was generated after rendering in JPEG format and stored in a *.jpeg file. To provide the visual tour effect, the JPEG format file was converted to QuickTime movie (*.mov) format.

Panorama, stored in jpeg file, was edited by using *Jasc Paint Shop Pro 9* to convert a 360^0 x 180^0 panorama into another file format in order to work with Hotspots

5. Working with Hotspots

Hotspots are transition areas of a panorama to launch some actions, such as opening URLs or to link to other panoramas to create a virtual tour effect made from several panoramas. Hotspots are drawn directly in the Stitching Window in the Hotspot mode. After determining where the links must be and which panorama is linked, hotspots are created as polygons in the Hotspot Creation Mode (See Figure 12).

Figure 12 : Example of hot spot

6. Creating *.html Files

Adobe Dreamweaver CS3 software was employed to show the generated quick time movies in a web page. Dreamweaver CS3 offers the choice of a visual layout interface or a streamlined coding environment. Intelligent integration with related Adobe software ensures an efficient workflow across ones favorite tools.

Logic of creating web-based virtual tour depends on linking panoramas to an html file that contains relevant movies. This created web-based virtual campus tour supplies the visitors to start from anywhere in the campus.

RESULTS

In this study QuickTime videos were obtained for each section of the campus. They were linked to each other and the virtual campus tour was generated. The developed virtual campus tour helped the visitors to cruise in the virtual campus as if they were walking in the real campus.

Any interested visitor can enter the virtual campus through the following web site.
http://comp.eng.ankara.edu.tr/proje_html/index.html
The web page is divided into two parts, the map and the panorama window (See Figure 13).

Figure 13: The web page of the virtual tour of the campus

The map acts as a reference guide in the virtual tour for the visitors. The information about the locations is also presented as a stream of text next to the map.
The visitors can use the mouse to navigate, go from one location to another one, enter or exit buildings. They are also able to use the arrow keys for seeing a full circle of the area. Using "Shift" and "Ctrl" keys provide visitors to get closer to and go far away from the particular location.

CONCLUSION

Web-based Virtual Tour of campus generated a real time virtual tour and also provided a realistic 'walk-around' in the campus.
Virtual campus tour was useful for students to go through the campus before coming to the university. The study can be extended to real estate industry, museums and touristic visits and many other areas where visits can be made before going there.

REFERENCES

1. REALVIZ Stitcher Unlimited 5.6 - User_Guide.pdf
2. REALVIZ Stitcher Unlimited 5.6 – Tutorial.pdf
3. REALVIZ Stitcher Unlimited 5.6 – Publishing.pdf
4. URL_1 : http://en.wikipedia.org/wiki/Virtual_tour
5. URL_2 : http://www.adobe.com
6. URL_3 : http://www.dreamweaver.com
7. URL_4 : http://www.realviz.com