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Chip Implementation of Three-dimensional "Along the River During the Qingming Festival " Generator and Interactive Exhibition System

立體清明上河圖互動展示系統與晶片實現

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作品摘要 Abstract

本系統之架構如圖1所示，第一部分使用二維至三維影像轉換技術，利用清明上河圖的特徵重建深度影像，透過二值化與連通物件標籤的方式，將二維影像分成物件資訊與背景資訊，接著利用Simple Linear Iterative Clustering（SLIC）方式，將物件影像作群聚，配合漸層深度影像，將物件與背景分別填上深度，再使用影像的邊緣資訊修正深度資訊，即可重建相對應的深度影像。

System Architecture

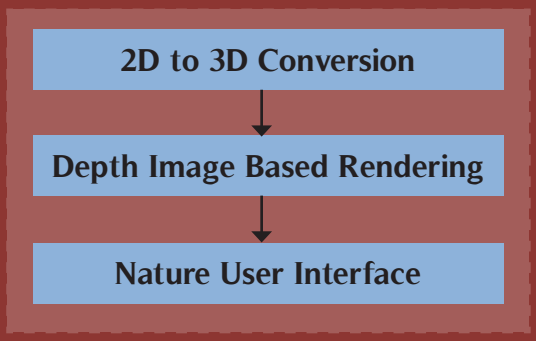

圖1 > 系統架構圖

Depth Image Based Rendering（DIBR）方塊中使用深度圖進行虛擬視角的生成，因為深度圖邊緣變化劇烈的部分會造成虛擬視角中的破洞，並造成使用者觀賞的不適，因此我們採用視差調整的方法來降低過大的破洞，讓破洞的部分重新分割成一像素寬度的小破洞，並使用最鄰近值的方法做填補，填補完破洞的左右虛擬視角即可搭配快門眼鏡於立體電視上產生立體效果。

我們使用七十四吋立體電視來展示成果，若使用滑鼠來操控是很不方便的，因此本系統同時也提出自然使用者介面，可以藉由單手手掌的左右移動來操作清明上河圖的左右捲動，並且可以使用手指來點擊圖形化介面上的按鈕，並可依據雙手擺出特定手勢時，雙手的距離來控制清明上河圖之縮放。

The architecture of our system is shown in figure 1. The technique of 2D-to-3D image conversion was used in the first part of the system which could be divided into the following steps. At first, we used the features of "Along the River During the Qingming Festival" to reconstruct the depth map, and divide the 2D image object and background through thresholding function and image labeling. Then, we used Simple Linear Iterative Clustering (SLIC) algorithm to make the image cluster. Next, we assigned initial depth value for object and background images separately with gradient depth map. Last, we used the edge of the image to correct the depth value and the corresponding part of the depth map could be used by the DIBR of the second part of the study.

As to the "Depth Image Based Rendering" block, reference view and depth map were adopted to generate the virtual view. In the depth regions with sharp depth discontinuities, it resulted in the enormous hole-region in virtual views. Consequently, it would make users uncomfortable when viewing stereoscopic images.

In order to reduce the enormous hole-region, we introduced parallax modification algorithm to divide the enormous hole-region into one-pixel-width hole. After parallax modification, we adopted the nearest interpolation algorithm and Telea inpainting algorithm to fill hole-region. Finally, we interlaced the right and left virtual view sequentially. When users put on the shuttle glasses, they can obtain the 3D effect as well as on the stereo TV.

We showed our results on the 74-inch stereo TV. Due to controlling is unhandy via mouse, so we proposed the "Natural User Interface" to control our system. It could control scrolling of the "Along the River During the Qingming Festival" via movement directions of single hand. Users could click the buttons via finger clicking detection on the graphical interface. The system would detect user's gesture of two hands. If user poised the specific gesture, they could control the zoom of picture via the distance between left hand and right hand.