Application A8-108

作品名稱

魔鏡

The Magic Mirror

隊伍名稱

科科科科男 KKKK Boys

隊　長

鄭朝鐘 台灣大學電子工程學研究所

隊　員

蔡一民、張靖瑩、王子愷

台灣大學電子工程學研究所

指導教授

陳良基 老師 台灣大學電子工程學研究所

作品摘要

創作動機

當顯示器技術越來越成熟，顯示器也可以不再是顯示器!!如果有個可以「看穿」一切的技術，能看穿牆壁、看穿障礙物，看到阻隔物後面的美景，滿足人們的想像空間那該有多好。藉由晶片設計、視訊影像處理技術和顯示技術的精進，我們能將此「看穿」一切，將物體「透明化」的夢想實現!!

系統簡介

隨著影像技術越來越成熟，我們利用攝影機(Camera)取得顯示器或牆壁後的影像，利用視訊影像處理技術還原人眼看到的真實場景!!。我們整合視訊影像處理技術、運算加速之硬體架構設計和顯示技術成一系統。視訊影像處理技術包含幾個技術：影像擷取(Video Capturing)、視訊影像無縫合成(Video Seamless Warping)、深度估算(Depth Estimation)與視角合成技術(View Interpolation)。

首先藉由影像擷取取得位在顯示器後的二維場景影像，系統中運用至少兩個攝影機(Camera)，因此系統有至少兩個影像輸入(Stereo Input)，模擬多個視角。同時我們藉由使用者觀看顯示器的視角資訊來生成要在該視角顯示的畫面。而為了使得使用者觀看螢幕上的影像時，能感覺此螢幕上影像是和周圍場景無狹縫連接，因此利用視訊影像無縫合成技術(Video Seamless Warping)處理取得影像和真實環境的接觸邊緣。而真實場景和二維畫面最大差異在於深度資訊的取得，系統加入深度估算技術與視角合成技術。

而在硬體方面，要達到即時(Real-time)運算，視訊影像無縫合成技術和深度估算等核心技術所需運算量太大，以CPU並無法負荷，因此我們的系統將利用所設計之ASIC或FPGA來加速運算，至少達到30fps的運算量。整個系統組成包含顯示器、攝影機以及硬體架構部分(Hardware Architecture)。

Abstract

Motivation

Nowadays, display technology has become mature. If there is a technology helping us to see the beautiful things behind barriers, it will be a wonderful dream. With circuit design knowledge, video signal processing technology, we can realize the "see-through" technology and we can make all objects become "transparent"!

System Overview

With video/image signals processing technology, we use cameras to capture video/image signals from the real world. That is, if a viewer stands in front of a monitor or a display, the system uses cameras to capture scenes behind the display and then shows the captured images with proposed "transparent" reconstruction procedure.

Firstly, the system utilizes at least two cameras for capturing. Then the system generates different reconstructed images according to the viewing positions of the viewers. To make viwers feel that the reconstructed images have seamless connection to real surroundings, we then derive "Video Seamless Warping" to handle stitching problems and to find the best matches between the captured images and the real scenes. Besides, for 3D issues, the biggest difference between real scenes and two-dimensional images is depth information; the system also supports 3D videos/images by depth estimation.

For hardware architecture issues, seamless video warping and depth estimation need high computing power, but CPU solution cannot afford such real-time processing. Thus, we design ASIC/FPGA to speed up the calculation and realize the proposed algorithms in real-time, that is, at least 30 fps. Totally speaking, the whole system includes monitors/displays, multiple cameras and the parallel hardware framework with ASIC and a FPGA platform for demonstration.