Return of the Jedi

[CSEE 4840 Project Proposal – March 2009]

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1. INTRODUCTION

The main goal of this project is to create special effects on an incoming video and display it in real-time. Specifically, we aim to recognize a sword in the input video and replace it with a light saber (of the Star Wars fame!!).

The technique we intend to use for this effect is similar to the ***Chroma key*** technique. The ends of the sword used will have blue or green markers to find the position of the sword. Once found, the sword is replaced by a light saber with a halo effect.

2. DESIGN

This section describes in brief the design of the Light saber Generator (LSG), components required and a block diagram with description and functionality of each block.

a. COMPONENTS REQUIRED

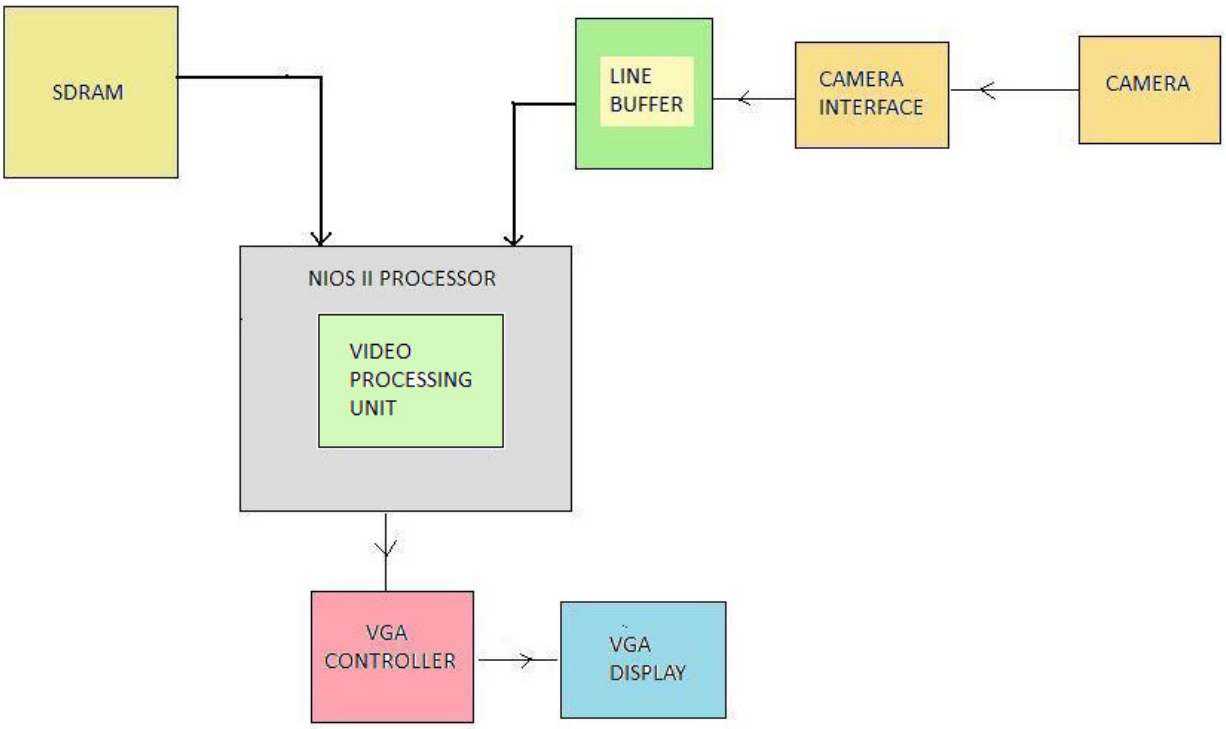
The following components are required for the purpose:

- Altera DE2 Development board
- Digital Camera Module TRDB DC2 (1.3 Mega Pixel)
- Line buffer
- Video Processing Unit
- VGA Display

b. BLOCK DIAGRAM & FUNCTIONAL DESCRIPTION

i. **CAMERA:** The camera can be configured to capture and send images at the required frame rate and resolution. We intend to use a direct video input or the TRDB DC2 supplement kit (in the fast motion capture mode), in order to obtain a real-time input video stream in the form of image frames.

ii. **CAMERA INTERFACE:** The interface communicates the pixel data from the camera to the line buffer. A standard communication protocol must be implemented for this purpose. We need to use additional logic to recognize the end of a frame, the end of a line and then generate the necessary control signals.



iii. **VIDEO PROCESSING UNIT:** The input frames are stored in a line buffer and then sent to the Video Processing Unit (VPU). The VPU processes the incoming frame pixel by pixel and identifies the coordinates of the two ends of the sword. With this information, it calculates the tilt of the sword and pixel information to produce the halo effect.

iv. **VGA CONTROLLER**: The VGA controller takes the pixel information from the VPU and then generates the corresponding blanking and synchronization signals and produces the pixel data in the required format for the VGA display.

3. EXAMPLE

4. RISKS & CHALLENGES

- The algorithm required to generate the halo effect with varying intensity around the sword seems very challenging.
- The quality of the output video is better with higher frame rates; but we anticipate that the pixel processing time will limit the frame rate. Minimizing this processing time to produce a video without noticeable flicker is crucial task.

5. MILESTONES

1. Algorithms – Take an image having a sword (with ends marked) and identify the end coordinates.
2. Halo Effect Generation – Using the coordinates of the ends of the sword, determine the pixel information for producing the halo effect.
3. Camera interfacing – Interface the camera module with the DE2 board and display the video in real-time on the output VGA.
4. Optimization – Reduce the pixel processing time to produce frames at a rate fast enough to generate video.

6. FUTURE GOALS

If we are able to achieve this goal of generating a light saber within time, then our future goals include:

- To superimpose the processed video on a desired background image.
- To add audio effects.