Keyboard Hero

CSEE 4840 SPRING 2010 PROJECT PROPOSAL

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I. Abstract

The main goal of our project is to develop a small multimedia system which can play MP3 files on the SD card and display the frequency analyzer on the screen. If time permitted, we will develop a video game "Keyboard Hero", based on MP3 play, music synthesis and video display. This project is based on both the hardware (in VHDL) and software (in C Programming) design.

Keywords: SD card reader, MP3 decoding, frequency analyzer, music synthesis.

II. Introduction

MP3 player is a widespread application and our idea is to build a system on DE2 board which can play MP3 files from the SD card and analyze and show the frequency in real time. Besides that, we hope to develop a music video game "Keyboard Hero" that are similar to "Guitar Hero".

Therefore, the project is a working system consists of a reader for SD card in hardware, an MP3 decoder based on NiosII system, a digital frequency analyzer on screen (implemented by both software and hardware) and hopefully the videogame "Keyboard Hero", which is implemented mostly by software.

The SD card reader should be implemented by some appropriate IP core used on FPGA. And we are doing the MP3 decoder in hardware, which is because we want to turbo the ultimate game software and economizes the computation budget by saving the MP3 software decoding section. In addition, the digital frequency analyzer will be exploited to calculate amplitudes of each frequency in the signal. This frequency computation result will then be projected to screen in forms of histograms, to simulate the effect of the FM radios in the old days.

As for the video game, we expect to extract some specific note at a specific time of a piece of music, store these data in a new file in SD card. This requires us to research into the principle of sound synthesis and develop the tools that will help us to extract and synthesize a specific sound from/to background music. And we consider it as the most important and also the hardest part in the game design. When the new file containing important notes is generated, we can read it out, displaying the notes on the screen in the form of falling color markers in different rows (like "gems" in the "Guitar Hero"). When a marker reach the bottom, which represents a note arrives, player should press the right key on the key board then he can score. If the player misses the

marker or presses the wrong key, he gets no score. When a song is playing or done playing, the total score will be showed on the screen. This requires us to transform data representing notes to falling color markers on screen and showing the score on the screen. Also we should be able to generate sounds by pressing certain keys on the key board. The game should be implemented mostly by software.

III. Actions and Milestones

Action 1/Milestone 1

The very beginning study will be focused on how to let the SD card work. We need to figure out how to get the data from the SD card. After that we have to identify files in MP3 format, read and write the data of one certain file as we want.

Action 2 /Milestone 2

In this stage the MP3 encoding/decoding mechanism will be studied in detail. Then we will implement the MP3 decoder. By finishing MP3 decoding, we should able to play the music out.

Action 3/Milestone 3

The goal of this action is to finish the frequency analyzer. When playing music, the histograms reflecting amplitudes of each frequency should showed on screen.

Action 4/If time permit

In the last action, we should finish music synthesis, VGA displaying and the key board generating sounds part. And then put them together to finally get the game ”Keyboard Hero”.