**INTRODUCTION**

The goal of the project is to create a device which uses hand movements to perform audio processing effects analogous to a DJ performance i.e., volume control, filtering effects, reverberation, etc. DJ equipment is generally large, cumbersome, and expensive. The proposed device would remove the need for this bulky equipment.

The device will use digital signal processing principles to capture and process image signals, and more relevantly to add effects to audio signals. The algorithms used to create these capabilities will be implemented on the C5515 eZDSP Stick and the Altera DE2-70 FPGA Board. A digital camera will be used to capture images, with the aid of colored gloves.

**PROJECT DETAILS: MOTION DETECTION**

For color detection we changed the captured image frame from RGB to HSV color space; we proceeded to use both RGB and HSV values to set the threshold for each pixel in order to filter the image. The Hue value of HSV color space would detect the target red or green color in addition to the conditions of relations among R, G and B. This would eliminate the negative effects of shadow and reflection.

For motion detection we count the number of data points in each row, and set the row with the maximum count to the vertical location of the glove. In order to achieve more stable location information, we convert the vertical position into 8 different indexes to avoid the effects of shaking.

**FUTURE WORK**

Potential features that may be implemented in the future include:

- **Phase Vocoder:** This would give the user the ability to modify the tempo of the music without changing the pitch and vice versa.
- **Flanging:** This would create a distortion effect by mixing a signal with a delayed version of itself.
- **Wider range of gestures:** More complex gestures to give more parameters of audio control.
- **Object recognition:** Instead of needing to track colors, the camera will be able to track the movement of a specific object (such as the user’s hand).

**CONTRIBUTIONS**

We would like to thank Professor Mark Brebob, Professor Kurt Metzger, and GSI Chao Yuan for their assistance, as well as the University of Michigan Department of Electrical Engineering and Computer Science for their funding. Also, we would like to thank Texas Instruments and Altera for providing us with our project hardware.