

## ***Virtual Drum Set***

Checklist:

### ***Video Module:***

Hand Detection Module: (Luis)

- Correctly recognizes the pixels of a specified color corresponding to the users hands (red or yellow).
- Input is HSV bit stream. Outputs are coordinates for the color-matched pixels.

Center of Mass Module: (Luis)

- Computes the center of mass of all the pixels determined to be part of the user's hand.
- Computes change of position (velocity) of the center of mass through time.
- Input is the output from the Hand Detection Module. Outputs are the coordinates for the center of mass and its corresponding velocity.

Collision Engine: (Rishi)

- Is a FSM that determines whether the user has a hit on a specific drum, based on the movement of the center of mass of the user's hand.
- Inputs are the coordinates and velocity of the center of mass of the user's hands
- Outputs are a set of control signals that specify which drum has been hit and the corresponding gain of the hit.

Display Module: (Rishi)

- Generates the images to be presented to the user while playing the game, which include two drums and a cymbal on the screen.
- Displays animation for a hit on the drum.
- Has an option to show image from camera, controlled by a switch.
- Inputs are the control signals from the collision engine.
- Outputs are VGA signals to display.

## ***Audio Module***

### Game Audio Module: (Rishi)

- Responsible for playing back specific drum sounds corresponding to the users drum hits.
- Drum stored in BRAM.
- Combines game sounds and music for final playback.
- Inputs are control signals from collision engine and music bit stream from Music Audio Module.
- Outputs control signals for AC97

### Music Audio Module: (Luis)

- MATLAB + Python scripts to write to transform song to bits and write to compact flash
- Responsible for reading song information from compact flash and passing it on to Game Audio Module
- Output is music bit stream.

### ***Time permitting extras:***

#### Game feature

- Something similar to Guitar Hero, where drum will be falling on the drum images on screen, which is supposed to hit.
- Hitting the drum at right time will increase your points

#### Learning mode

- In this also we will have drums falling on the drum images on screen, but the falling of drums will create a rhythmic sound.
- We can feed the drum pattern in flash card.
- A switch will control the learning mode and game feature mode.

#### Multiplayer

- Tracking for more than 2 hands, so that more people can play at same time.
- Having the 'Virtual Drum set' at two different computers which are connected, such that one can send the pattern for drum beats and the other have to repeat that same pattern.
- Can also have multiple systems connected where a teacher uses one system and students who want to learn use other systems. Teacher will send drum beta pattern that will reflect on student screen, and all the student have to do is follow the pattern.

#### More Drum Elements

- Having more drum elements to create better user experience.