Full Motion Dance Machine
Final Project Presentation
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November 14th, 2006

6.111 - Introductory Digital Systems Laboratory
Massachusetts Institute of Technology
Introduction

• The dance machine will use a video camera to find colored swatches on specific body parts of the user.
• Scrolling pictures will instruct the user how to dance. How well the user matches their dance with the instructions will be evaluated by the dance machine and scored.
• The beat of the user will be determined by computing changes in the velocity of certain body parts.
• Beat detection will also be performed on a song. The beat from the user will be compared to that of the song and scored.
System Overview

System Control
Handles mode control, game logic, beat comparison, and user input

Audio
Handles audio storage, audio playback, and beat detection

Video
Handles video input, swatch detection, stick-figure drawing, beat detection, and quadrant recognition
Block Diagram
Memory Allocations

Audio
- Flash ROM
  - up to 16MB of song data
- 512x1 bits of BRAM
- Beat at data at interval

Video
- 2 ZBTs
- Buffers
- 200Kx6 bits of BRAM
- Image Storage

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Implementation Challenges

- Timing for video components
- Timing for arithmetic calculations in stick figure and center of mass calculations
- Storing multiple songs in Flash ROM, serial connection, etc.
- Wide range of camera view
- Environment lighting and calibration
Current Progress

• Video
  – Read camera data and display on screen
  – Calculate center of mass for four different colored swatches on a shirt
  – Draw a stickman using shoulder and arm x,y coordinates and scale it appropriately

• Audio
  – Do song data conversion in Matlab and store into Flash memory
  – Playback song data using AC97 D/A converter
  – Proof of concept of audio beat detection algorithm using Matlab
High Risk Objectives

• Video
  – Display moving reference frame

• Audio
  – Perform tone detection
  – Compare user tone to song tone and score
# Project Timeline

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- **Audio**
  - 14: Load and play back full song
  - 17: Process audio and detect beats
  - 19: Multiple songs
  - 22: Tone Detection (time permitting)

- **Video**
  - 29: Motion tracking
  - 1: Graphical Dance move indicator and beats

- **System control**
  - 1: Basic functionality of all graphics
  - 4: Game scoring and single song game control
  - 8: Multiple songs and more advance UI

- **Integration**
  - 1: Integrate stick man and swatch positions
  - 4: Integrate Audio and video components

- **Debugging**
  - 8: Get all the modules to work together
  - 11: Working system
Questions?