Full Motion Dance Machine

Final Project Presentation

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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
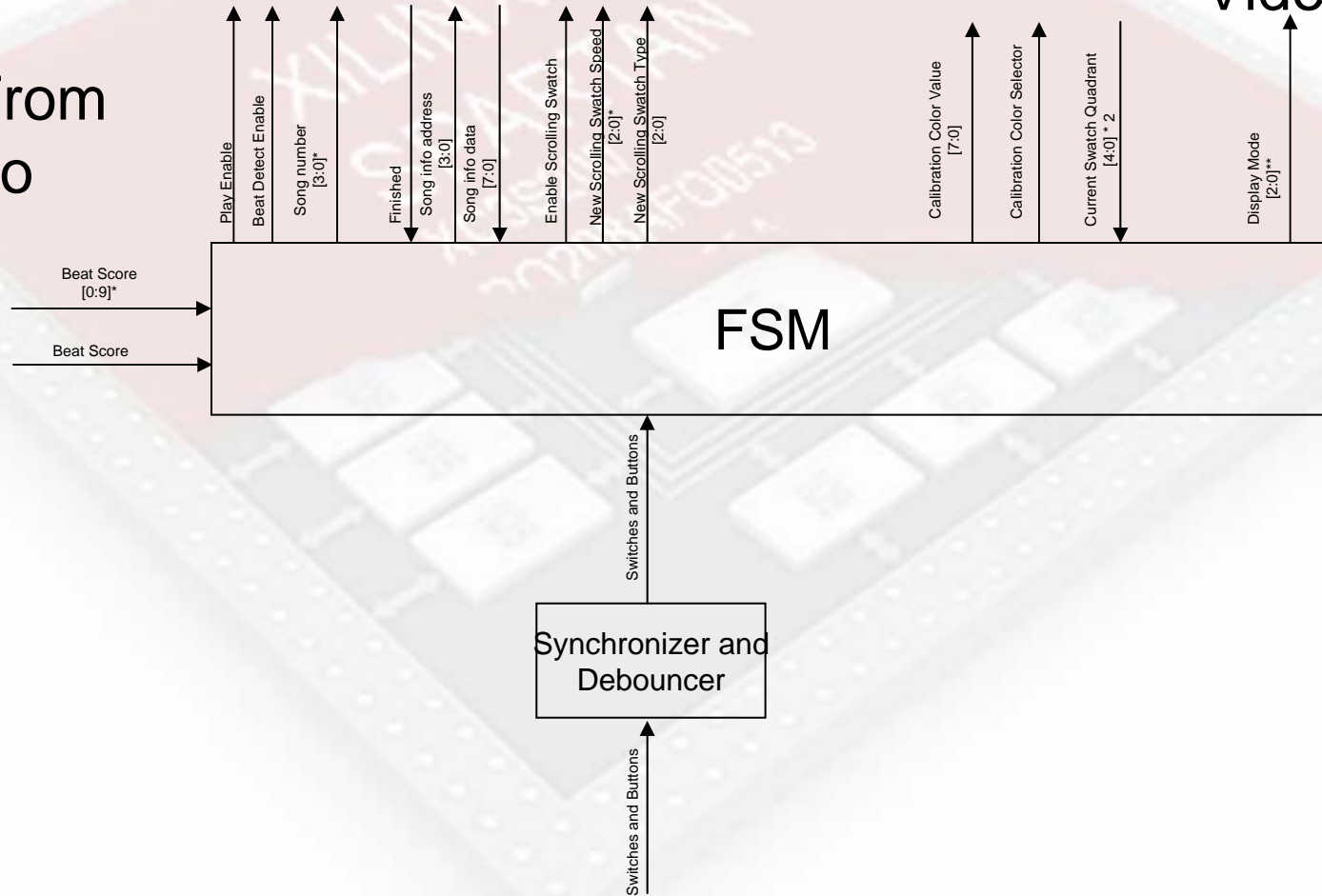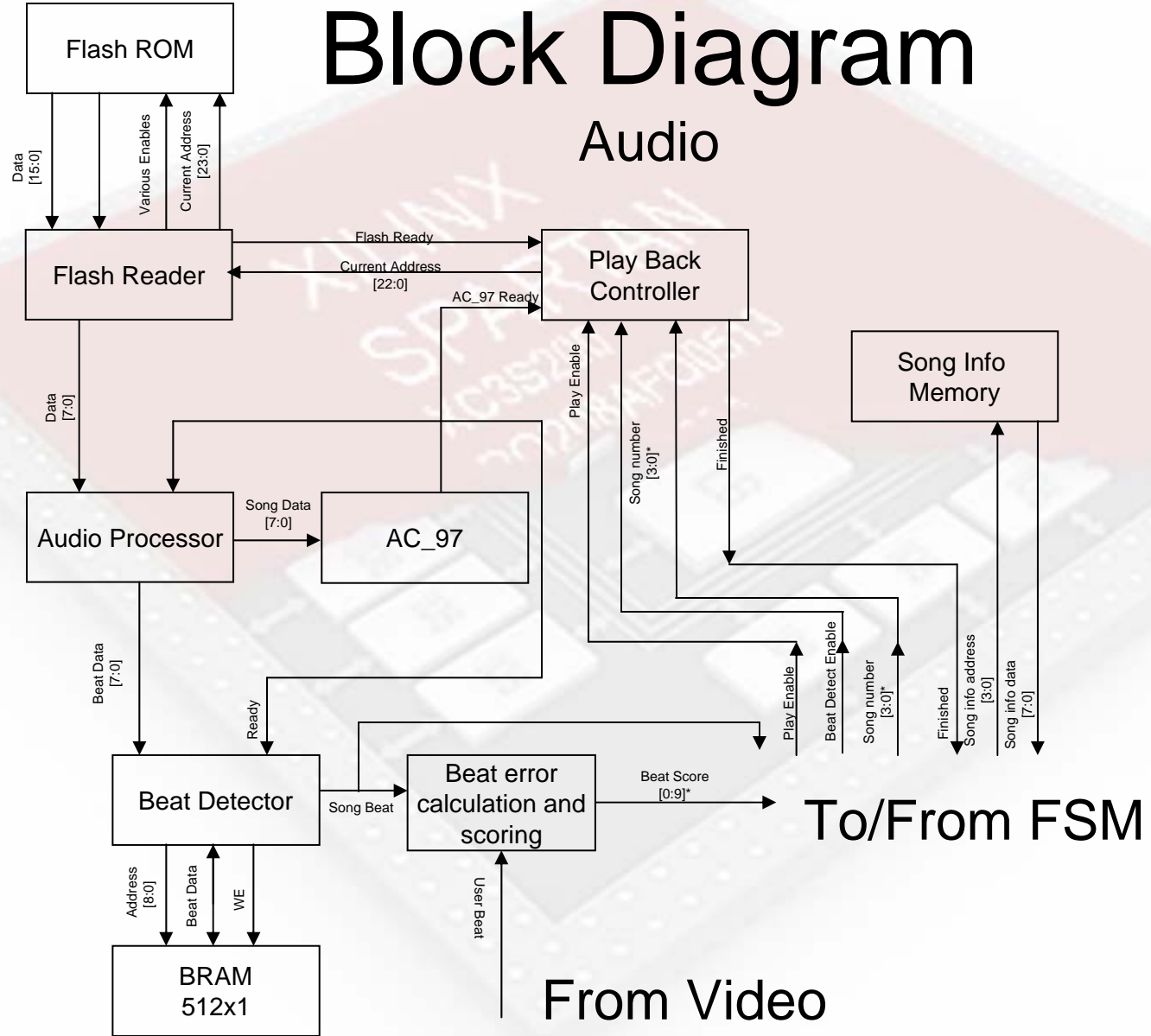
Block Diagram

System Control

To/From Audio

To/From Video

- Play Enable
- Beat Detect Enable
- Song number [3:0]*
- Finished
- Song info address [3:0]
- Song info data [7:0]
- Enable Scrolling Swatch
- New Scrolling Swatch Speed [2:0]*
- New Scrolling Swatch Type [2:0]
- Calibration Color Value [7:0]
- Calibration Color Selector
- Current Swatch Quadrant [4:0] * 2
- Display Mode [2:0]**

Beat Score [0:9]*

Beat Score

FSM

Switches and Buttons

Synchronizer and Debouncer

Switches and Buttons

Block Diagram
Audio

Flash ROM

Data [15:0]

Various Enables

Current Address [23:0]

Flash Reader

Flash Ready

Current Address [22:0]

AC_97 Ready

Play Back Controller

Play Enable

Song number [3:0]*

Finished

Song Info Memory

Data [7:0]

Audio Processor

Song Data [7:0]

AC_97

Beat Data [7:0]

Ready

Play Enable

Beat Detect Enable

Song number [3:0]*

Finished

Song info address [3:0]

Song info data [7:0]

Beat Detector

Song Beat

Beat error calculation and scoring

Beat Score [0:9]*

To/From FSM

Address [8:0]

Beat Data

WE

User Beat

BRAM 512x1

From Video

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Video
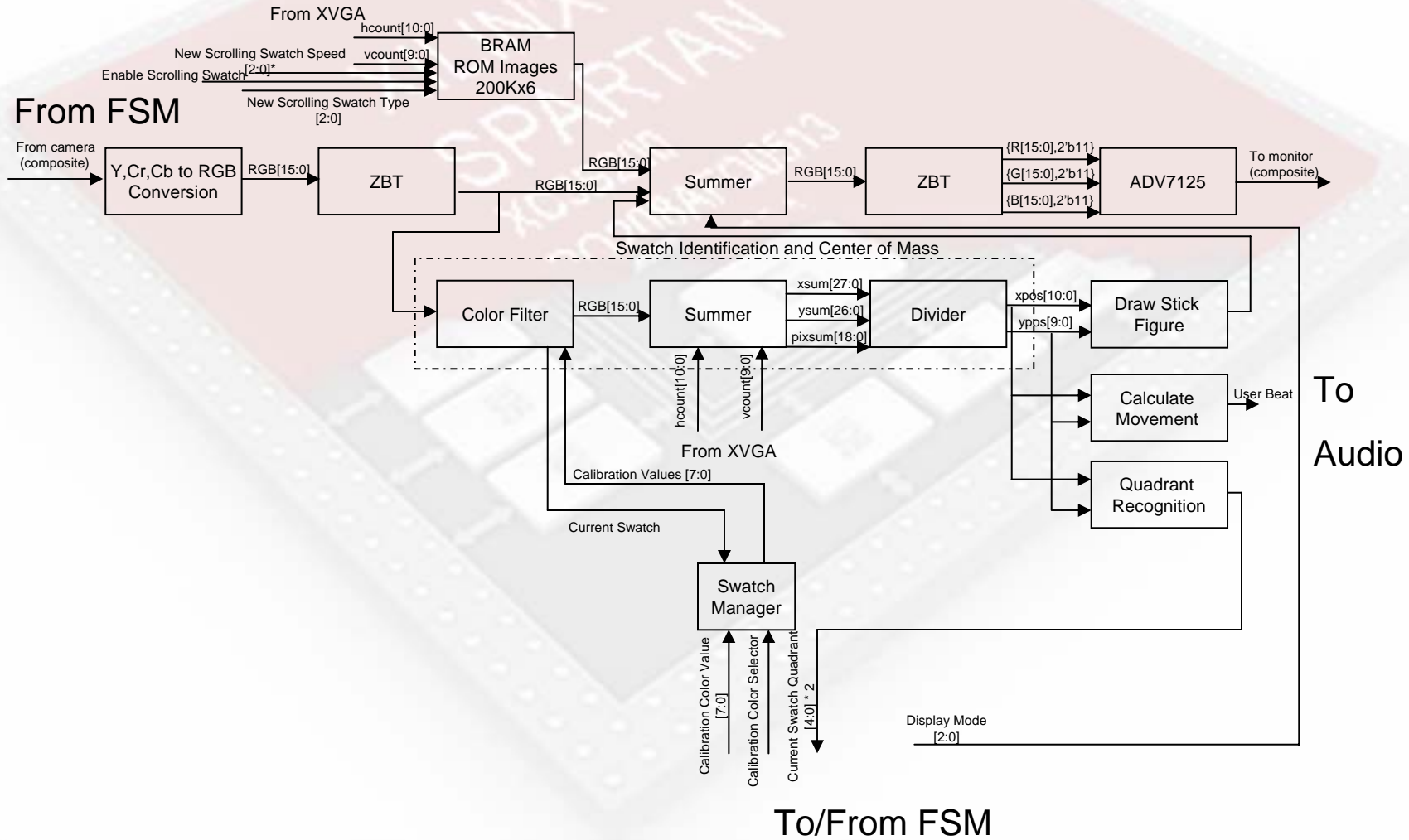
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Memory Allocations

Video

2 ZBTs

Buffers

200Kx6 bits of BRAM

Image Storage

Audio

Flash ROM

  up to 16MB of song data

512x1 bits of BRAM

  Beat at data at interval
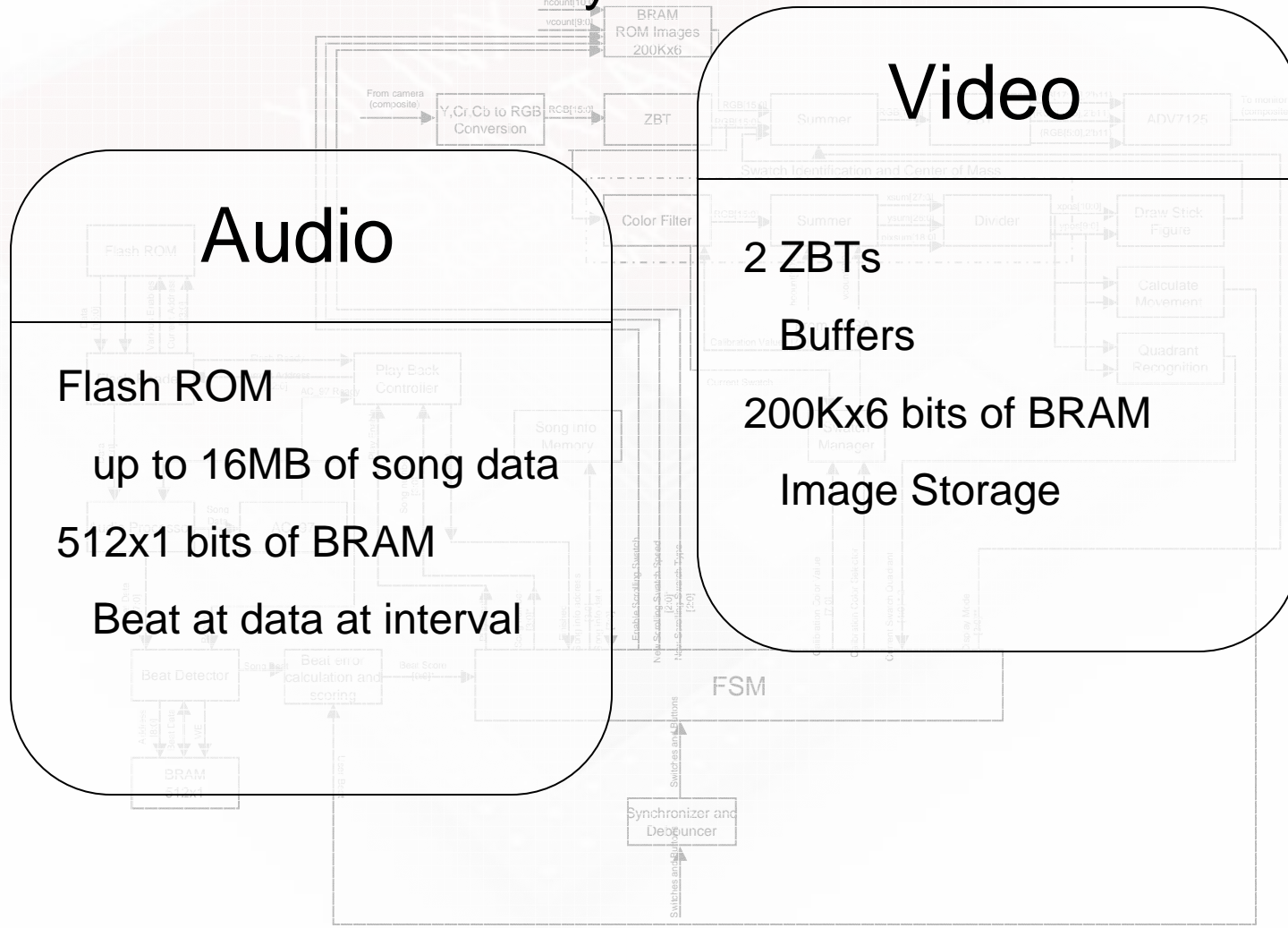
Implementation Challenges

- 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

	NOV					DEC			
	14	17	19	22	29	1	4	8	11
Audio	load and play back full song		Process audio and detect beats		Multiple songs	Tone Detection (time permitting)			
Video	Motion tracking	Graphical Dance move indicator and beats		Basic functionality of all graphics					
System control				Game scoring and single song game control		Multiple songs and more advance UI			
Integration		Integrate stick man and swatch positions		Integrate Audio and video components					
Debugging						Get all the modules to work together			Working system

Questions?