6.111 Design Project

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Project Overview

- Goal: Recreate the classic 1980's arcade game Donkey Kong
- Project Components
  - Game Logic
    - Game FSM
    - DK, Mario, Barrel, Collision Detector Logic
  - Display Logic
    - DK, Mario, Barrel, Princess, Background Modules
    - ZBT RAM Implementation of a Frame Buffer
- Possible Further Explorations
  - Video Detection Driven Motion

History

- Developed by Nintendo
- Designed by the legendary Shigeru Miyamoto
- Released in America in 1981
- Instant hit
- Considered by many to be one of the greatest games of all time
- Spawned spin-off games and became entrenched in American popular culture

http://en.wikipedia.org/wiki/Donkey_Kong_%28Arcade_Game%29

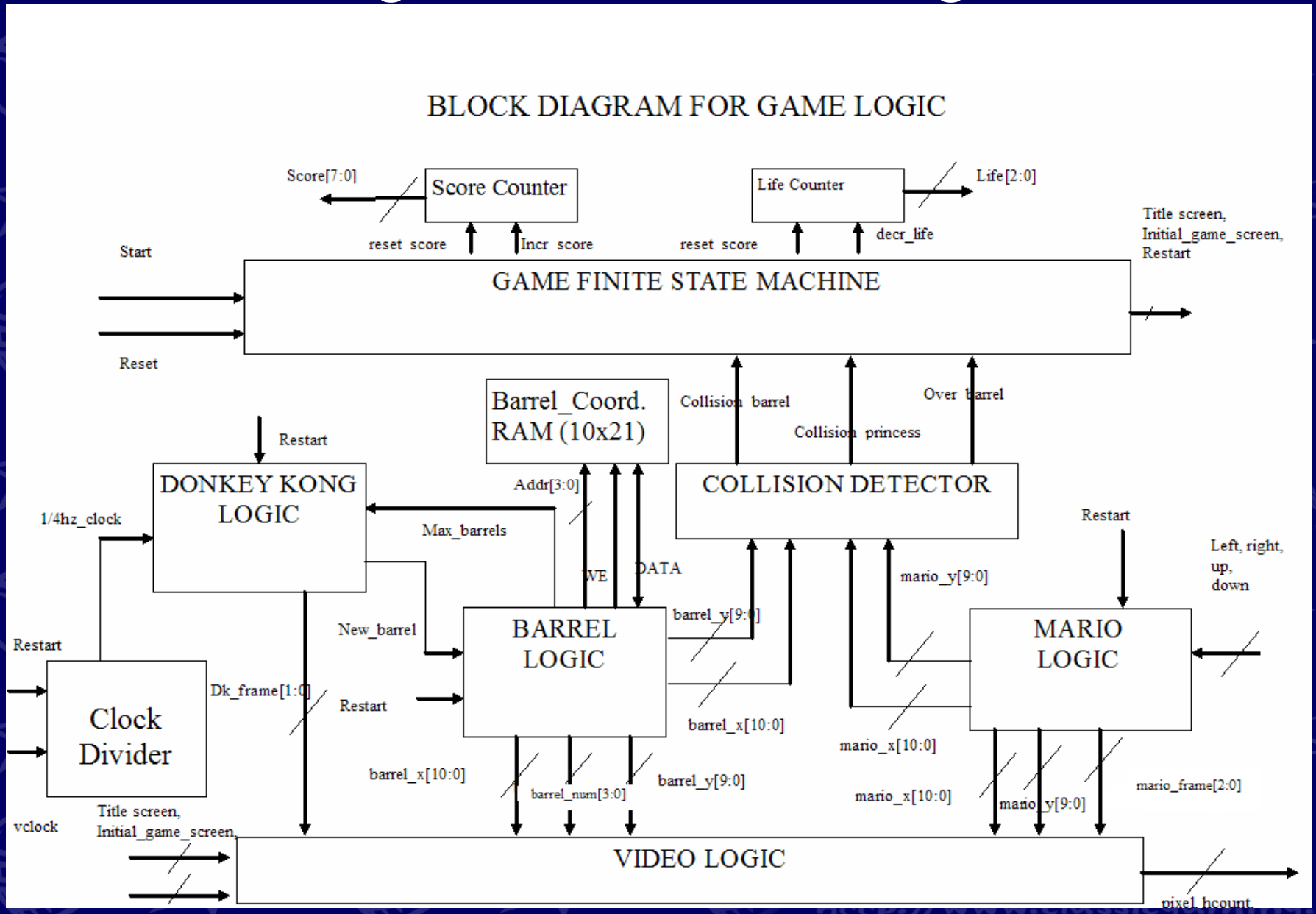
http://www.lacoctelera.com/myfiles/frikiplanet/donkey_kong_arcade.jpg

Gameplay

http://en.wikipedia.org/wiki/Image:Donkey_Kong_flier.jpg

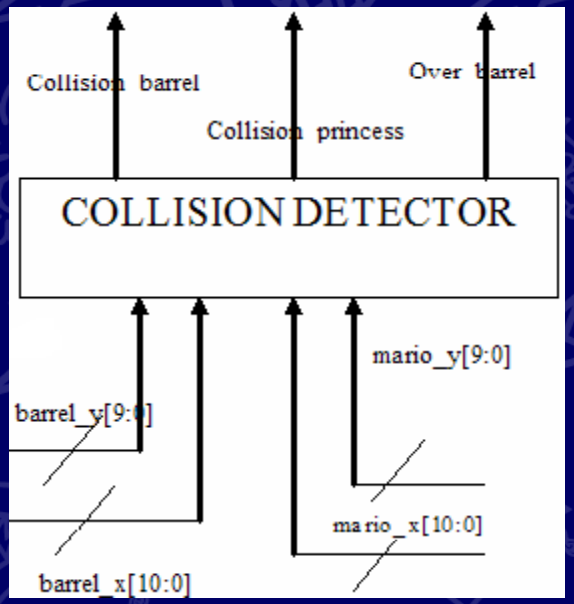
- The user controls Mario with keyboard controls (the up, down, right, left arrows, and the space bar)
  - If time permits, we will implement motion control
- Mario starts at the lowest platform
- Pauline is trapped at the highest platform
- Mario (Jumpman) has to climb up a series of platforms to save Pauline, while Donkey Kong (who is at the top platform) throws barrels to impede Mario's progression
- Mario can jump over barrels and climb ladders to get to the next highest platform
- Once Mario loses all of his lives, the game is over
- When Mario reaches the Princess, the player wins the level

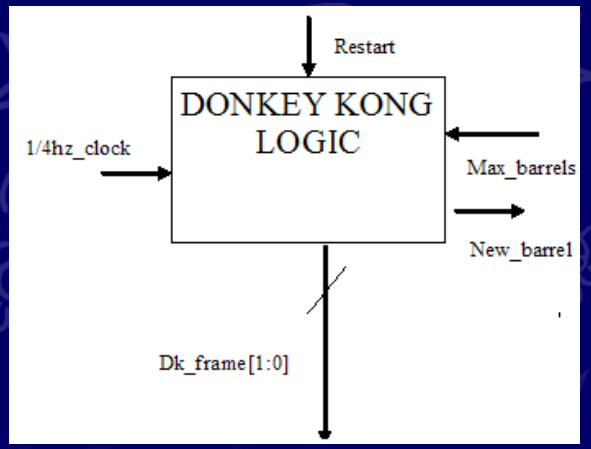
Block Diagram – Game Logic



Game Logic- Details

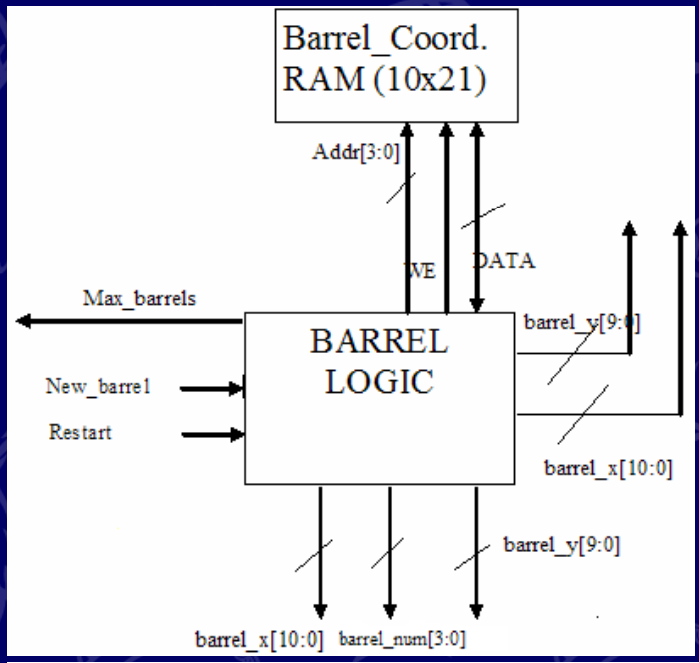
- Collision Detector
  - Determines whether Mario collides with a barrel, jumps over a barrel, or reaches Pauline
- Donkey Kong Logic
  - Uses the ¼ Hz clock to determine when to try to throw another barrel (if max_barrels is not one)

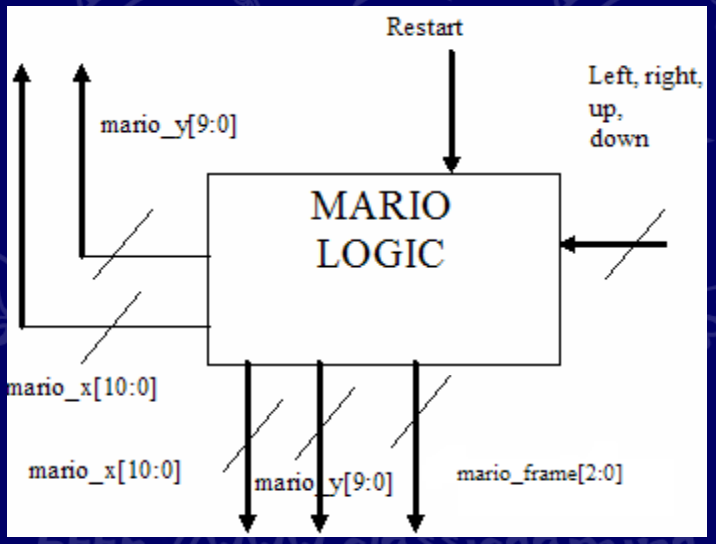




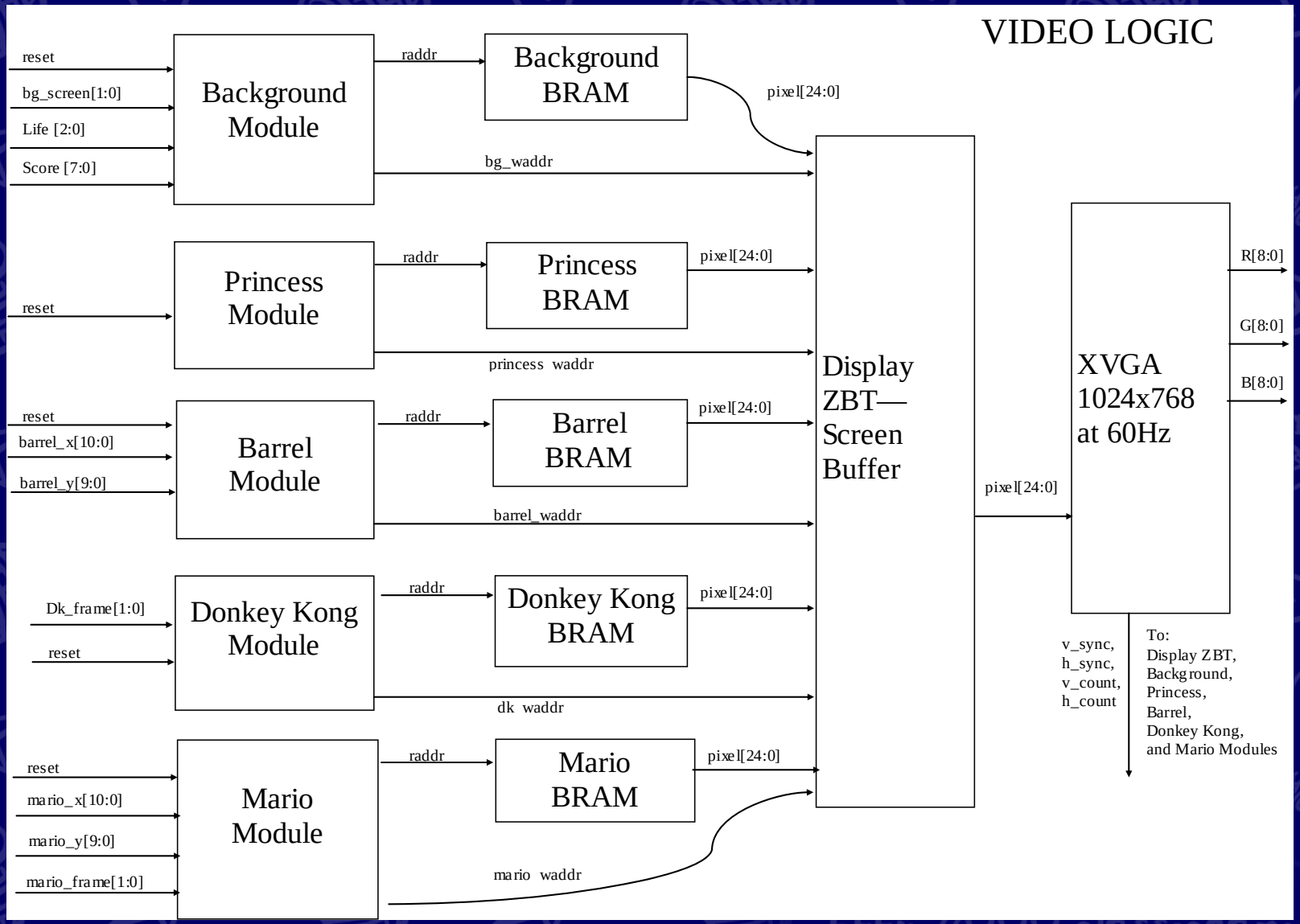
Game Logic- Details

- Barrel Logic
  - Writes/Reads the coordinates of each barrel from a 10x21 RAM
  - Creates a new barrel when told so by Donkey Kong Logic
  - Tells Donkey Kong Logic when there are the maximum number of barrels onscreen
  - Sends the coordinates of each barrel to the Video Logic and the Collision Detector
- Mario Logic
  - Takes the control inputs from the user and gives the Collision Detector and Video Logic the coordinates of Mario
  - Also tells the Video Logic which frame of animation to use for Mario





Block Diagram –Display Logic

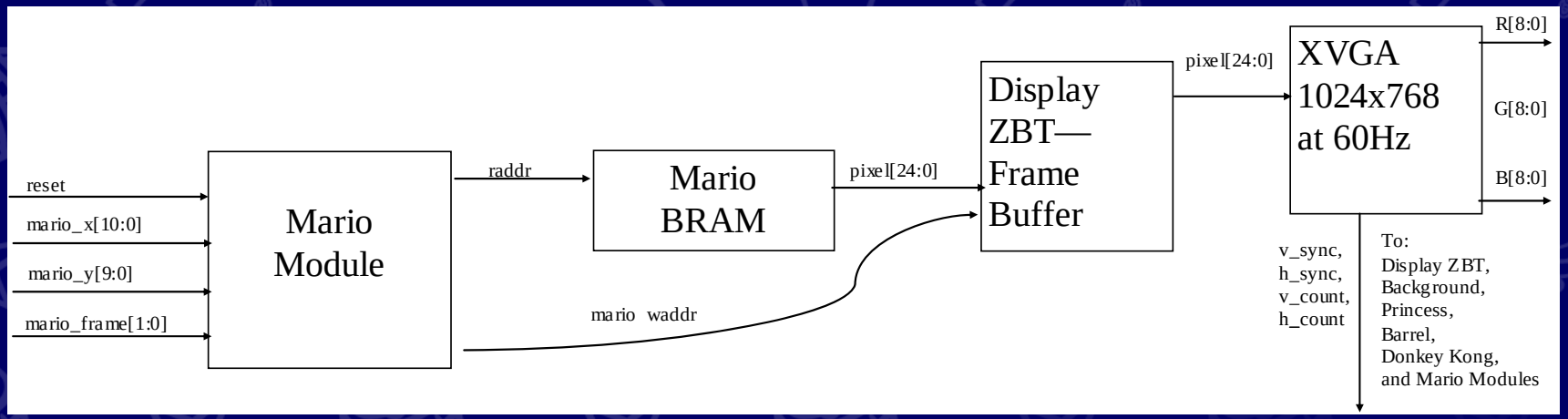


Display Object Specifications

- Donkey Kong
  - 32x64 pixels
  - 3 frames of animation
- Peach
  - 32x64 pixels
  - 2 frames of animation
- Mario
  - 16x32 pixels
  - 4 frames of animation
- Barrels
  - 16x16 pixels
- Background: Platforms, Life & Score Display
  - Spacing between platforms = 64 pixels
  - Each platform height: 32 pixels
  - Each repeating unit: 32x32 pixels

RAM Implementation – Mario Example

- Each of the 4 animation frames stored in a BRAM
- Mario module
  - Inputs: <mario_x>, <mario_y>, <mario_frame>
  - Outputs:
    - <raddr> - which animation frame to load from BRAM
    - <mario_waddr> - where this is placed in the frame buffer
- Frame Buffer – each location maps directly onto a pixel on the monitor



Proposed Timeline

- Game Logic
  - Friday, November 17
    - Finish a basic version of the Mario and Barrel logic
  - Wednesday, November 22
    - Have a completed basic version of all of the main logic modules
- Display Logic
  - Friday, November 17
    - All objects loaded onto ZBT RAM
    - Begin Assembling of Frame Buffer
  - Wednesday, November 22
    - Frame buffer with all 5 objects displayed onto the monitor