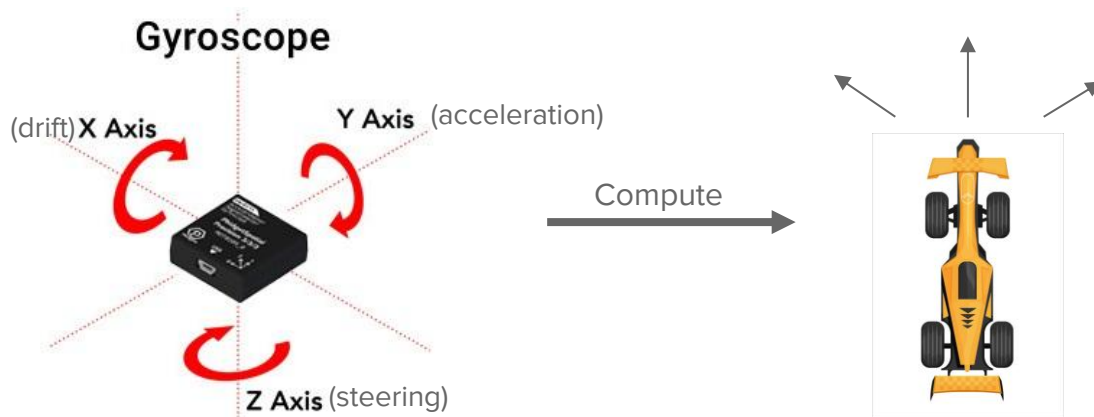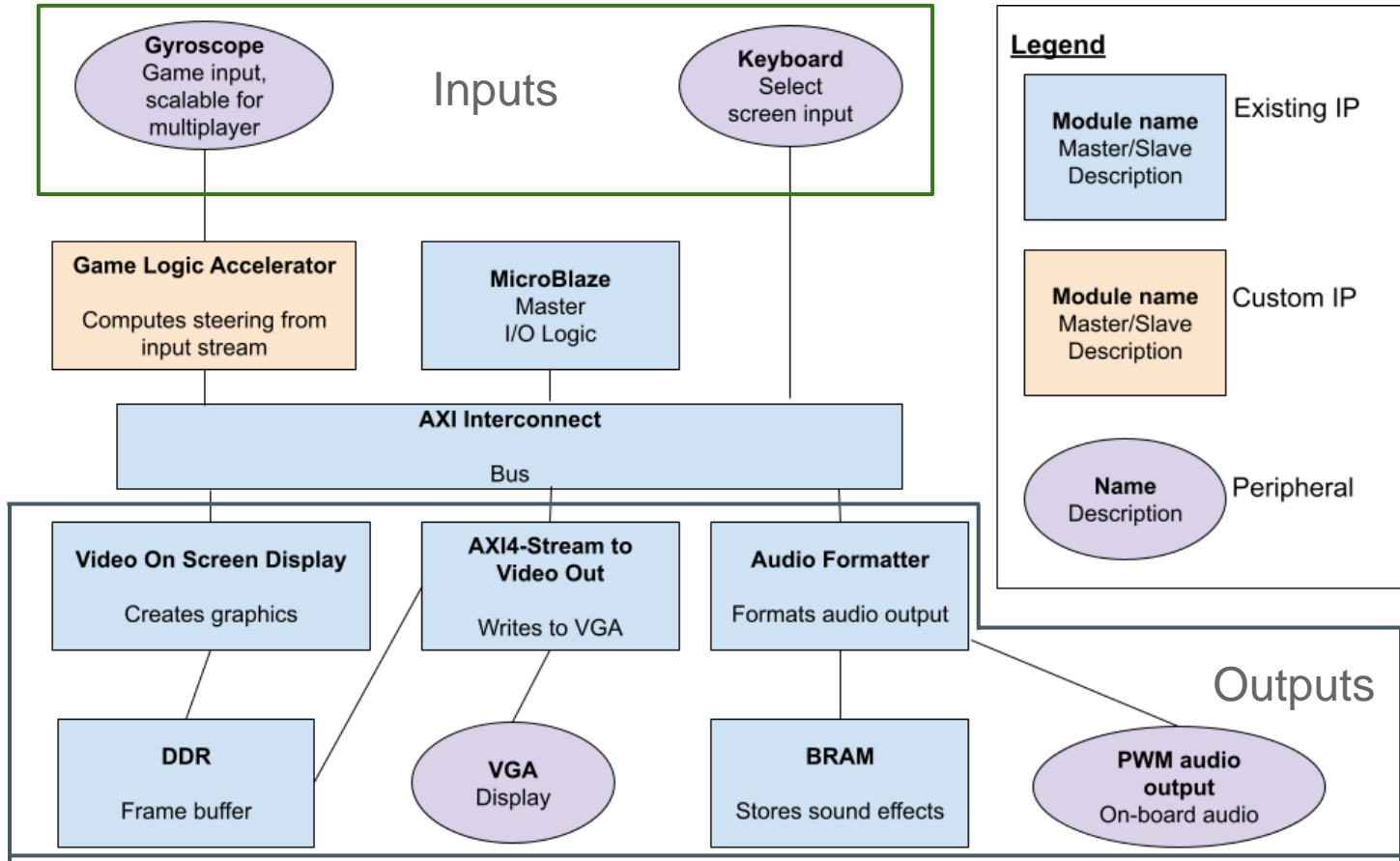# Gyro-Racer

Team 35
Fiona Kuang, Nicholas Furlan, Yushun Tang, Junze Cao
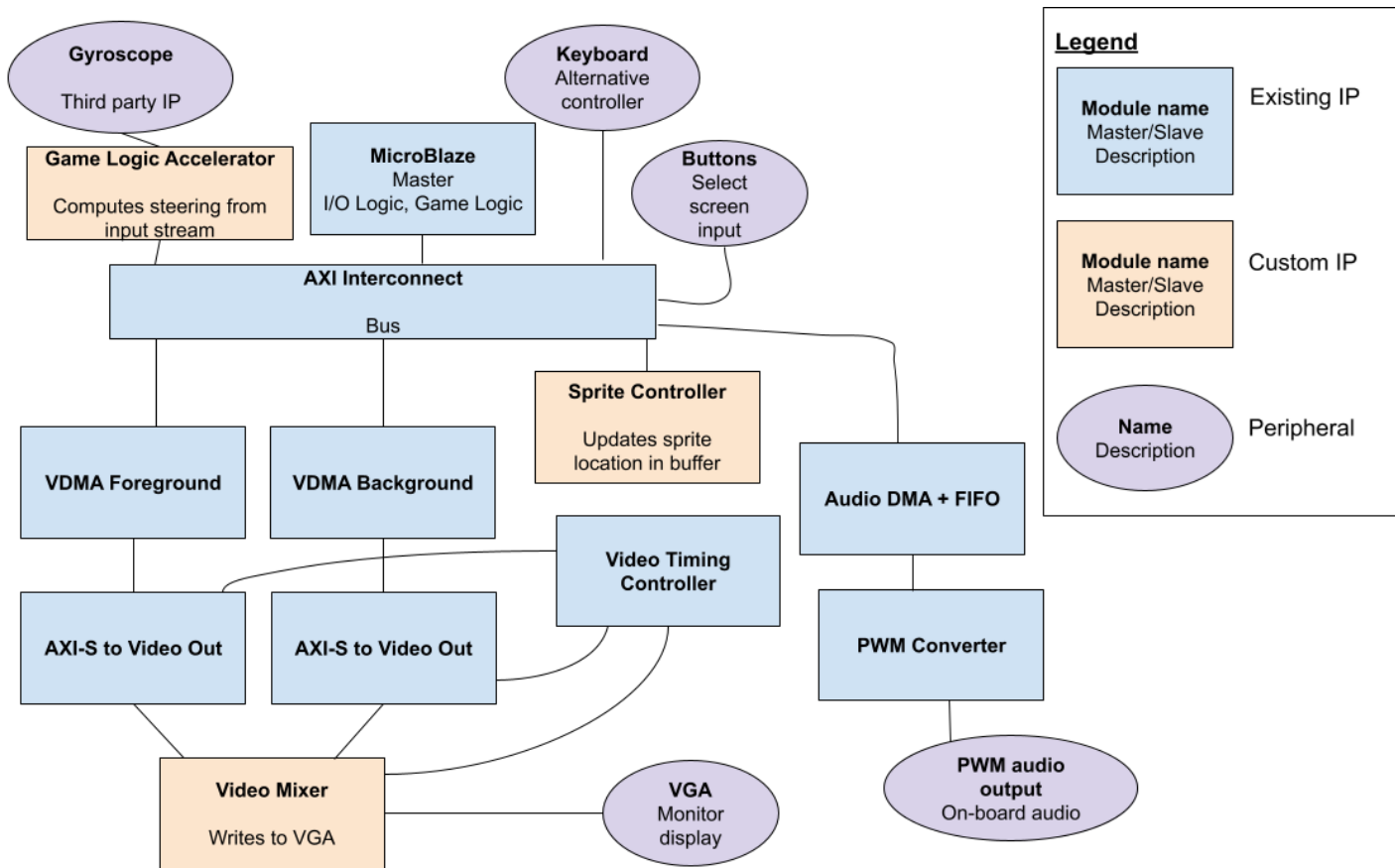
Overview

- Racing game with unconventional controller
  - Gyroscope
- Custom hardware block to interpret player's movements in real time
  - Computed from continuous stream of data from gyroscope

Gyroscope

(drift) X Axis   Y Axis (acceleration)

Compute →

Z Axis (steering)

Proposed Block Diagram

3

Final Block Diagram

Custom IP: Gyro calculations

- Calculations done in hardware
- Packaged as AXI-lite slave module
- On start (or system reset), calibrates noise threshold
- Filters noise from Gyro angular momentum data and converts it to angle value
  - Integrates the values
- Reset button sets all axes angles to 0

Custom IP: Sprite Controller

- Dedicated DMA Device
- AXI4-LITE Slave + AXI4-FULL Master
- When instructed by MicroBlaze:
  - Cache the Sprite Information Table
  - Read From Tile Memory
  - Draw onto specific position of the frame buffer
- Capabilities
  - Draw up to 32 sprites to framebuffer
  - Support up to 128 Tile 16 + 128 Tile 32
  - Support interrupt pin to tell when the work is done

"Draw **32x32** sprite with index = **0** to **(400, 300)**"

"Draw **16x16** sprite with index = **1** to **(100, 100)**"
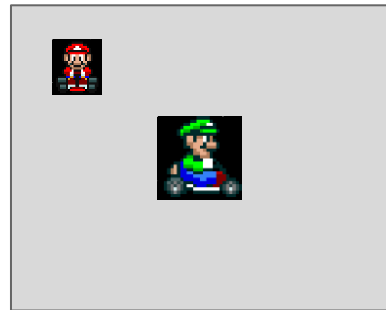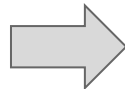
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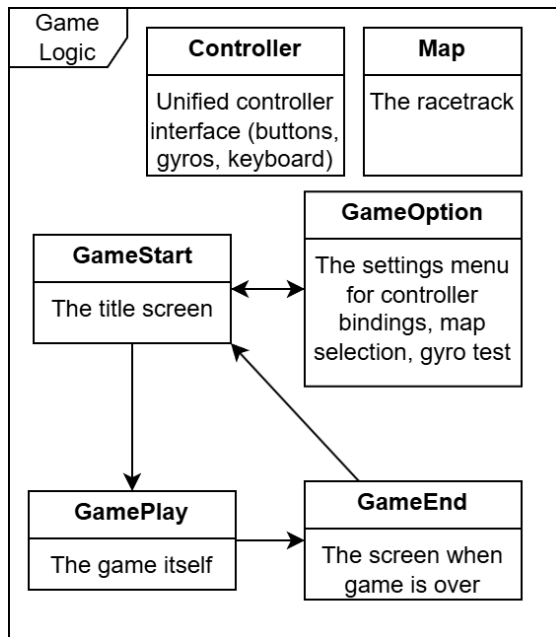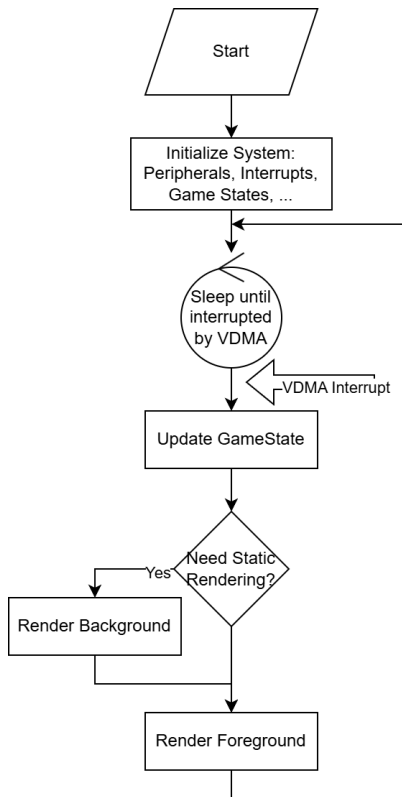Sprite information Table

32x32 Tile Table

16x16 Tile Table

Frame Buffer

Audio

- AXI DMA reads the sample from memory
- Sample sent to FIFO to control audio speed
- Custom IP AXI slave generates a ready signal for the FIFO to send the sample to PWM generator @ 8000Hz
  - Samples are 8000 Hz

Software Flow

Main loop sync with VDMA(800x600@60Hz)

- Ticks every 1/60s

4 Game States

In every tick, the active state runs:

- Update
- Draw static (if needed)
- Draw dynamic

Difficulty Score

Item	Points
VGA Output using MicroBlaze	0.75
Gyroscope PMOD	0.75
Keyboard Input	0.50
Software Algorithm	1.00
Onboard Audio	0.50
Gyro Calculations IP block	0.50
Sprite Controller IP block	0.50
Total:	4.50

Future Improvements

- More sound effects
- More advanced courses:
  - moving obstacles
  - multiple terrain types
- Higher resolution graphics (requires Nexys Video board)
- Store images and audio in SD card

Demo &
Any Questions?