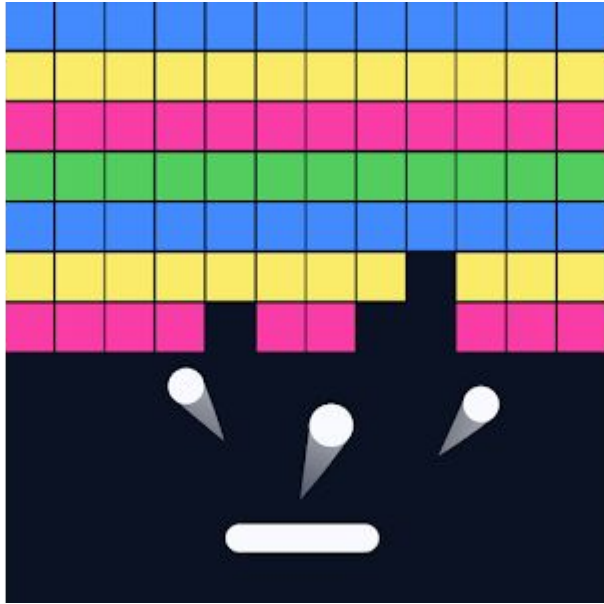


# Final Demo: Brick Breaker

By ECE532 Group 11:  
Marion Jan,  
Natalia Chelmecki,  
Tian Lan



# The Game



1

Control the Bar's Horizontal Movement

2

Avoid the Balls Falling Off the Screen

3

Break the Bricks to Increase Score

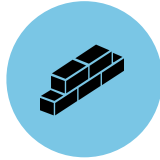
4

Collect Power-Ups

# Initial Goals

## Game

Working like the original Brick Breaker, and with new features.



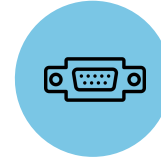
## EEG Sensor

Use an EEG Headset to control the paddle bar.



## Bluetooth and Working Audio

The audio output will include music and will be controlled with Bluetooth.



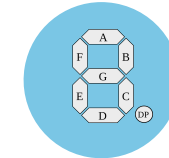
## VGA Display

Display bricks, balls, and the paddle bar properly, with static or moving colors.



## Working Joystick

Buttons control starting and ending the game.



## 7 Segment Disp.

Display the score when the game is running.

# Final Result

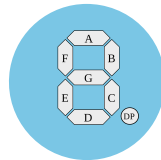
## Game

Working like the original Brick Breaker, and with new features.



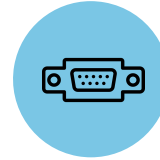
## Bluetooth and Working Audio

The audio output will include music and will be controlled with Bluetooth.



## 7 Segment Display

Display the score when the game is running.



## VGA Display

Display bricks, balls, and the paddle bar properly, with static or moving colors.



## Working Joystick

The bar moves in the direction of the joystick.

# Problems

## EEG Sensor

- No EEG headset
- **Backup Plan:** Bluetooth headphones

## Joystick

- Joystick Pmod IP not working properly
- Had to use hardware IP and AXI

## Bluetooth

- Connection problems when module was a master
- Used module as a slave instead

## Integration

- Modules worked individually but not when connected to Microblaze
- Unfamiliar with AXI protocols



# Problems

## General

- Using different versions of Vivado
- Using VHDL and Verilog together



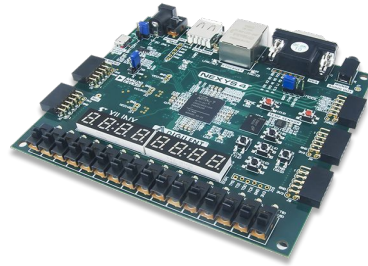
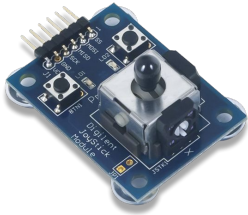
# Changes

## Audio

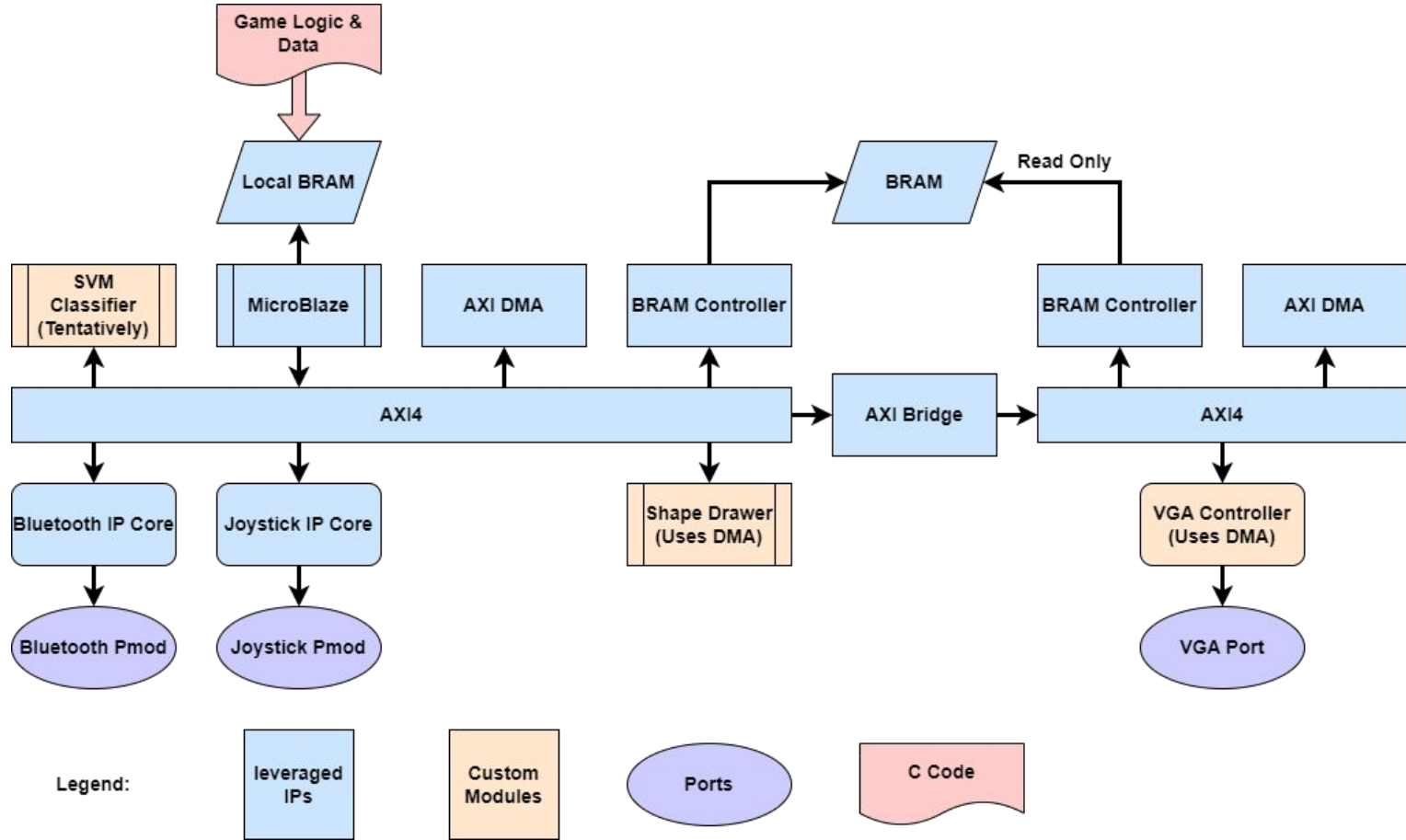
→ Use Audio Port instead of Bluetooth headphones

## EEG Headset

→ Use Joystick instead of EEG Headset

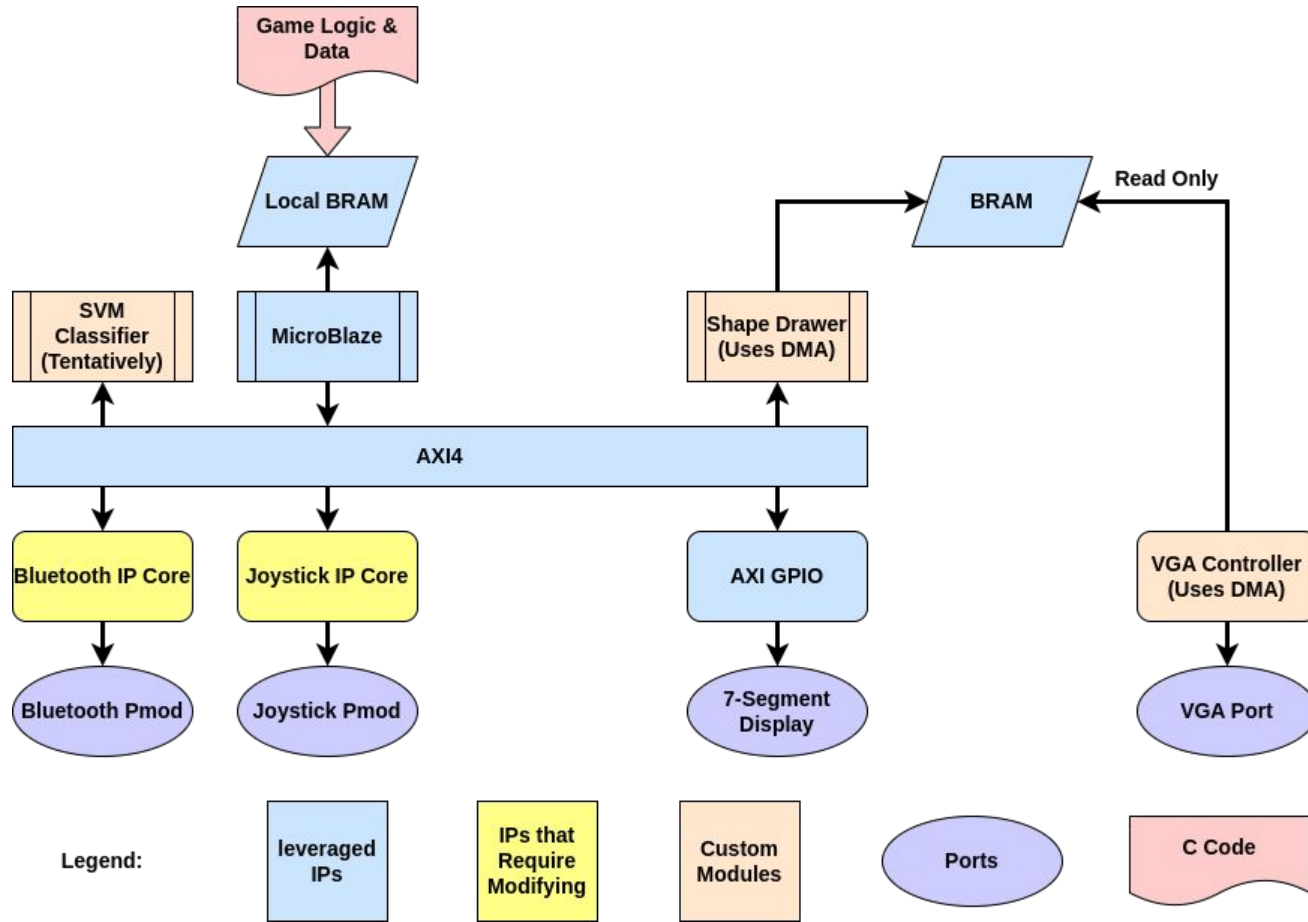


# Initial Block Diagram

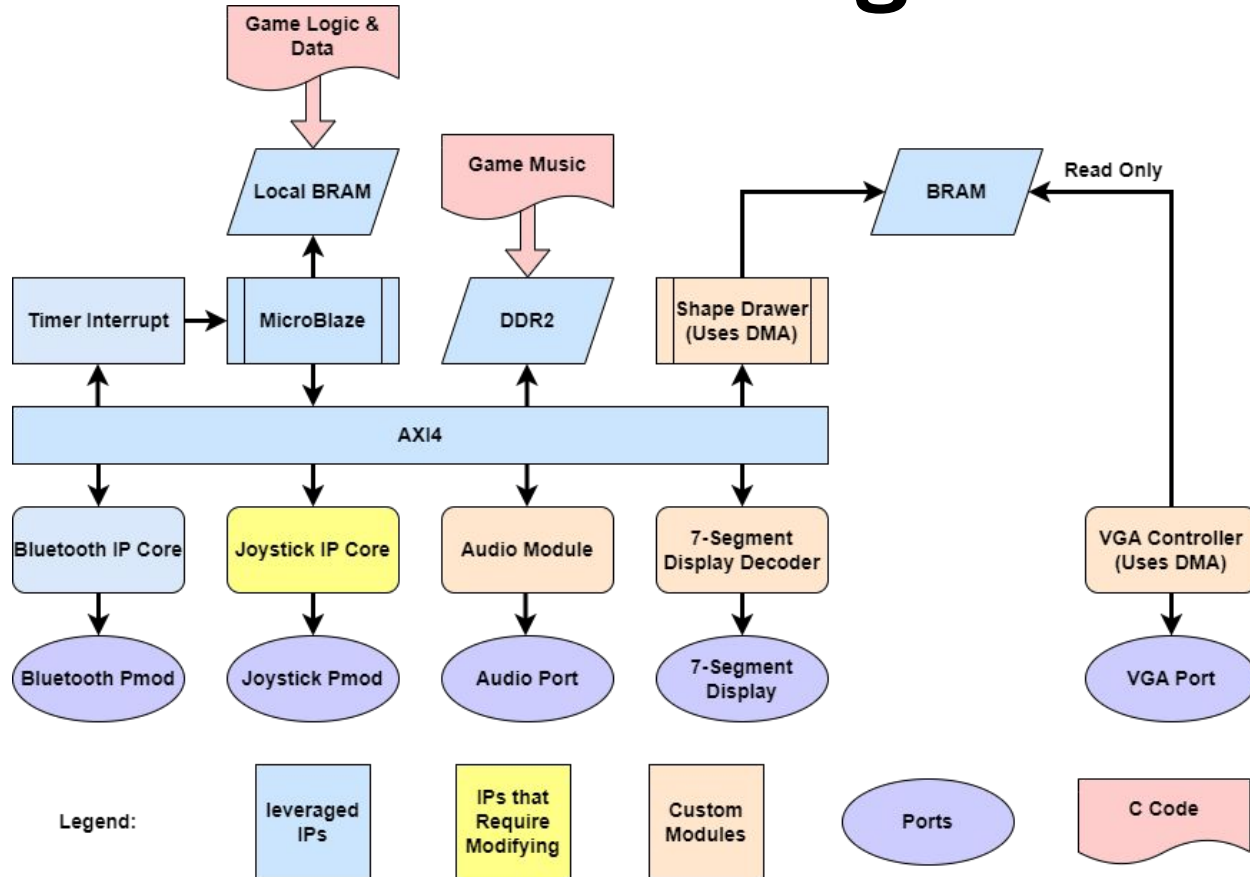




# Midterm Block Diagram



# Final Block Diagram



# Existing IP

- Bluetooth - IP core from Digilent
- Joystick - IP core from Digilent
- PWM IP - Example project online



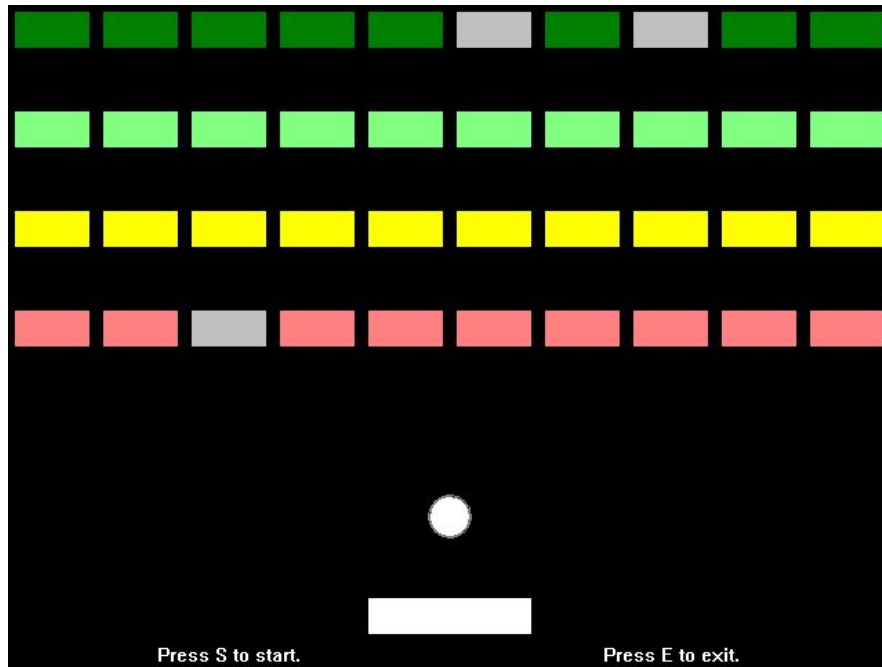
# Custom Blocks

## Hardware

- 7 Segment Display
- VGA Controller
- Shape Drawer

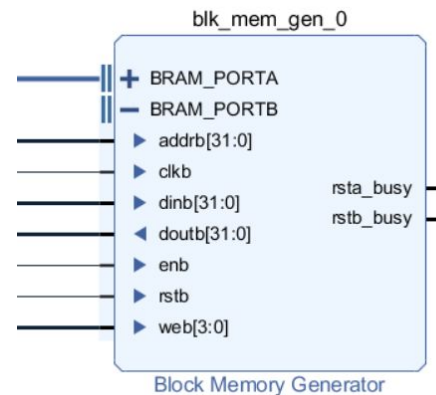
## Code

- Game Logic

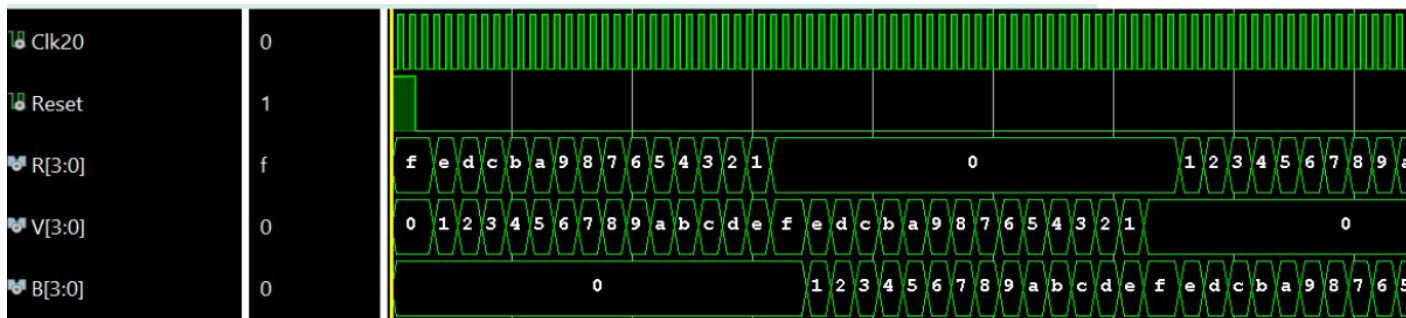
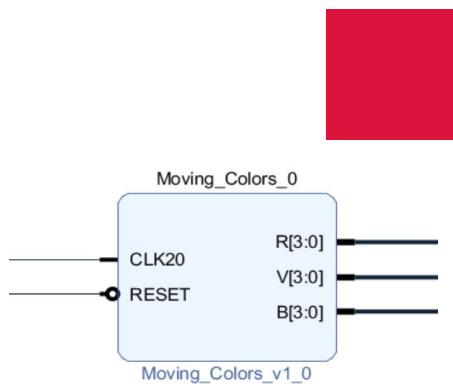


# Custom Blocks - VGA

Address	Data																															
0x00000	R	R	R	R	G	G	G	G	B	B	B	B	X	X	X	X	R	R	R	R	G	G	G	G	B	B	B	B	X	X	X	X
0x00004	R	R	R	R	G	G	G	G	B	B	B	B	X	X	X	X	R	R	R	R	G	G	G	G	B	B	B	B	X	X	X	X
.....	.....																															
0x95FFC	R	R	R	R	G	G	G	G	B	B	B	B	X	X	X	X	R	R	R	R	G	G	G	G	B	B	B	B	X	X	X	X

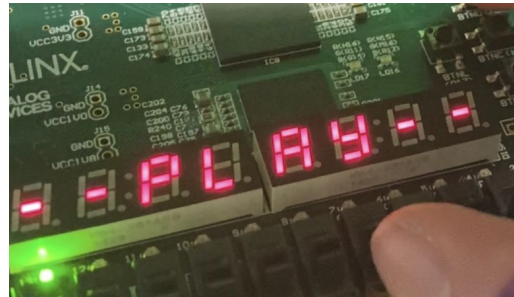


The memory layout we have implemented. Bits marked with **R**, **G** and **B** are 4-bit RGB values, and **X** means **rainbow**.



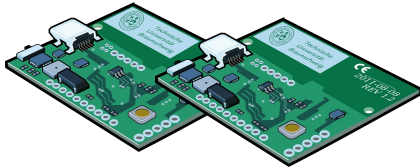
# Design Process

- Ensure modules work before trying to integrate them
- Work was assigned such that no one person could block another's work



# Lessons Learned

- Start early
- Integrate modules together sooner
- Plan milestones so that only two people need to test using the board each week



**~ Demo Time ~**







**Any Questions?**