EE-334
Digital System Design

Custom Digital Circuits

Project Information

Andreas Burg

The PONG Project

- PONG game with a Mandelbrot background computed by a custom datapath

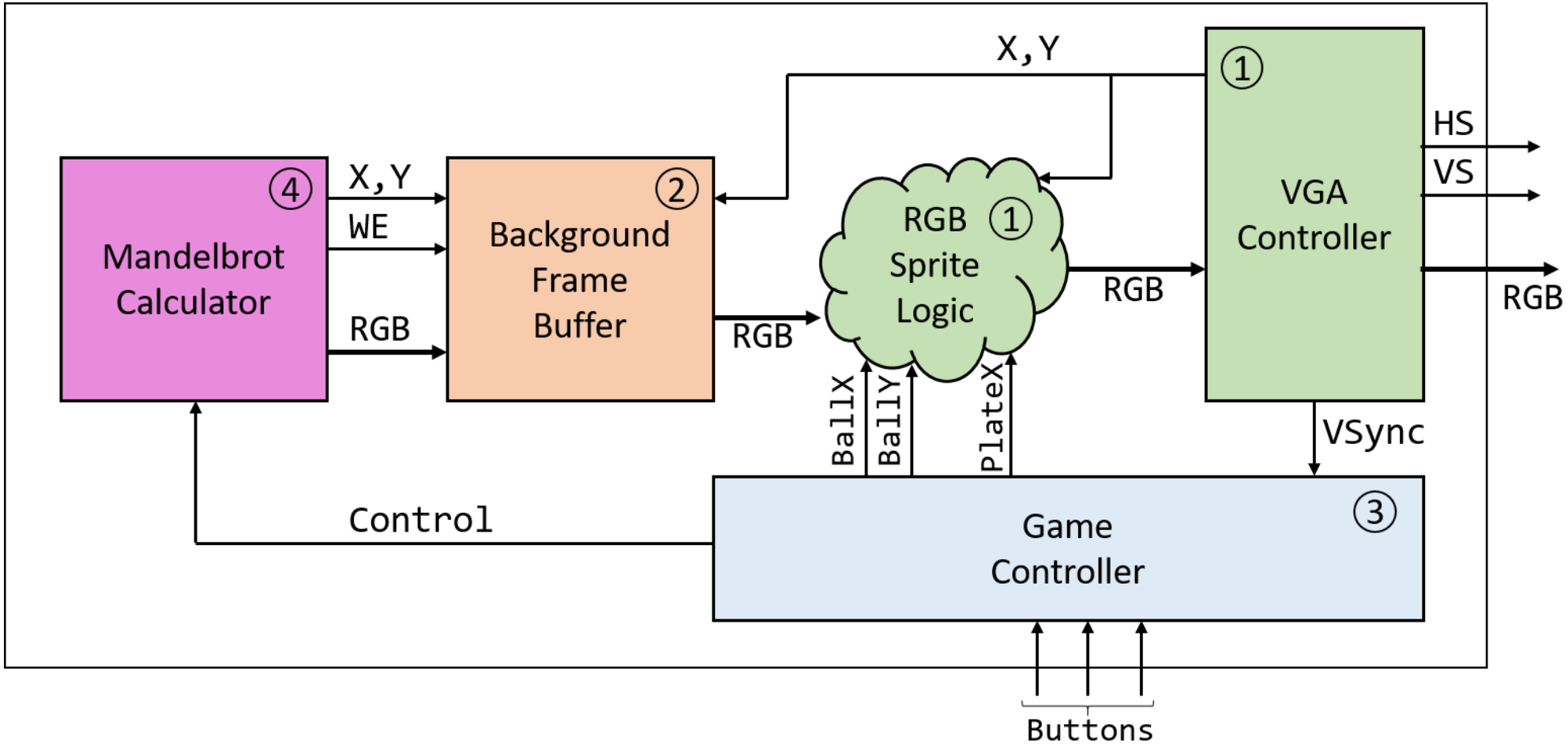
Project Outline

- The **project is partitioned into five stages**:
  1. Output basic graphics on a screen (using a self-made VGA interface)
  2. A basic PONG game with simple graphics generated online by logic
  3. Adding a fixed background to the PONG game
  4. Computing a Mandelbrot fractal online on the FPGA as background (and updating it)
  5. ADDING YOUR OWN IDEAS to arrive at a unique flavour of the game

- **Each step yields a functional** version of the **design**

Project Structure (Guided Part)

- **The project is built to add more and more components in each step**
- The **final** high-level **block diagram** shows the components of the individual steps



Project Organization

- More **information** on the individual steps **will be provided during the project**
  - Note that **you are not expected to progress at the pace at which new steps are introduced**

- **Steps build on each other**
  - For each step you can re-use your previous design
  - We recommend to start a new project for each step and import the code from the last step

- Finally, you add more features, but we recommend to first proceed to the end of the project and only add in the end to be sure to have a working design

Grading

- The project accounts for 50% of your final grade.

- **You do not need to complete all steps to pass the class**
- **Grades are based on your report and the quality of your code**

- **The achievable grade range depends on how far you progress in the project:**

	Maximum Grade
VGA Controller / Test Image	4.0 / 4.25
Pong Game	4.75
Pong Game & Background	5.0
Pong Game & Mandelbrot	5.5
Pong Game, Mandelbrot & Extras	up to 6

Ideas for Extras

- Use sprites for the ball and/or plate
- Additional sprites/balls flying around on the screen for distracting attention
- Steering the ball depending on where it hits the plate
- Sprites can be animated
- Tile based objects can be spread around the screen
- Collision with objects on the screen
- Objects can change their location
- Re-calculation of the Mandelbrot with different zoom/coordinates

Deliverables

- At the end of the project, you need to deliver the following:
  - An archive of **your final XILINX project**
  - **A bit file** that can be downloaded to the FPGA and is functional
  - **A ZIP file** that contains all your code.
  - **An 8 min. video** that presents your design (showing the result AND describing the architecture)
  - **The slides** you use in your presentation video

- Due date: the deliverables are due on December 22nd , 20h00 CET
  - No delays will be granted beyond this deadline
  - Groups must submit a single presentation/set of files.