PROJET DE SOC: PONG WITH JOYSTICKS

CS-309: Projet de Systems on Chip

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PROJECT GOAL

- Implement a PONG game using the ncurses library.

- Compile a run the game on the Cyclone V HPS running on Linux.

- Make use of the board's Joysticks to handle the user input.

OUTLINE

- Overview of the project structure.
- Look at what elements were needed.
- Overview of the application's structure.
- How is the input handled?

PROJECT OVERVIEW

```
#
#
#
#
#
```

```
*
```

```
#
#
#
#
#
```

```
Score:

                    3                    -                    4
```

CHOICE OF THE PROJECT

- Only peripheral that was functioning was the joysticks.

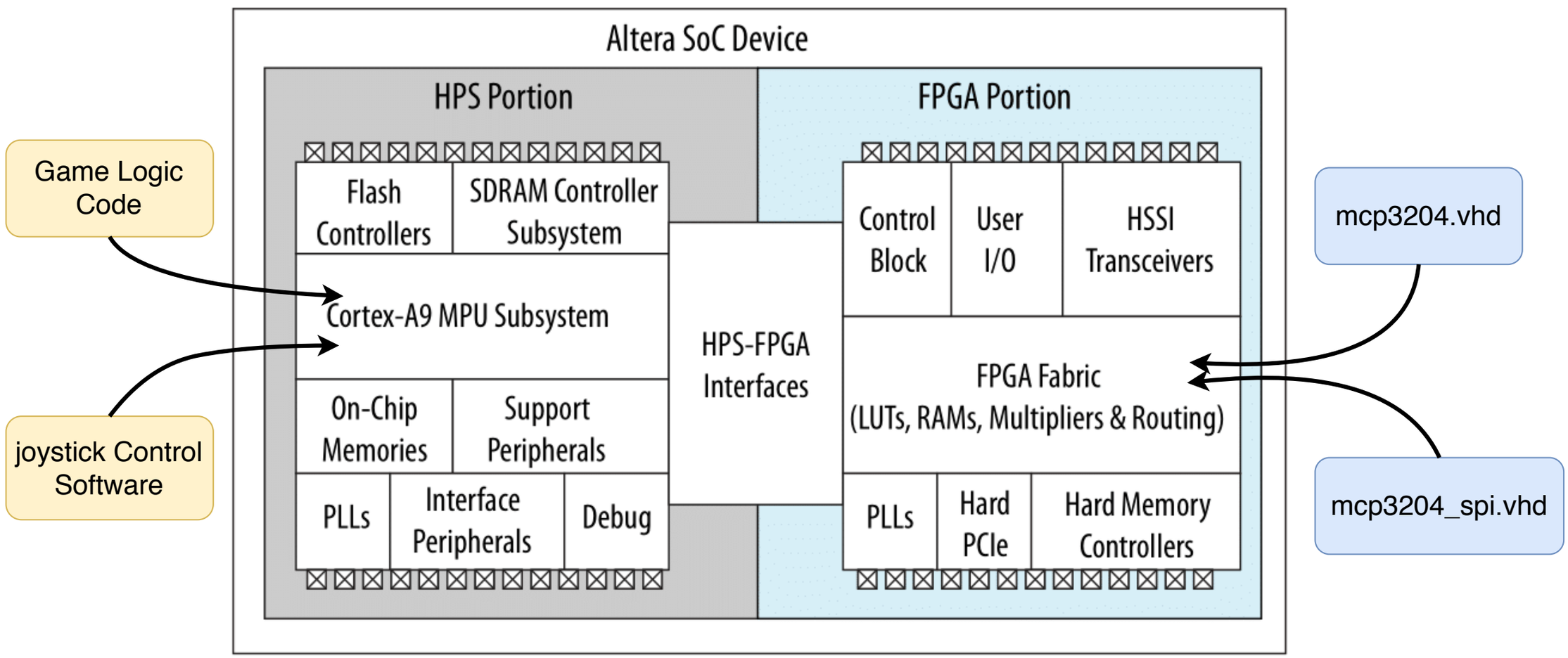
- Why PONG :
  - Simple UI, easily doable with ncurses.
  - Makes sense to use joysticks.
  - Very common game, rules are well known.

PROJECT STRUCTURE

- Application runs on the embedded Linux system:
  - Step 1: Install Linux on the board
  - Step 2: Install GCC on the board
  - Step 3: Transfer the game onto the board
  - Step 4: Compile the game on the board
  - Step 5: Play the game

PROJECT STRUCTURE

- Running the game on the board:



INTERFACING HW-SW

- The Joysticks were used by polling the MCP3204 SPI.
- The joysticks control Software had to be updated to use the HPS read instructions rather than the NIOS_II ones.
- The Joysticks were then initialised in the application:

```
#include "hw_headers/soc_system.h"
//...
//Initialize hardware
joysticks_dev joysticks = joysticks_inst((void *) HPS_0_ARM_A9_0_MCP3204_0_BASE);
joysticks_init(&joysticks);
```

USING THE JOYSTICKS

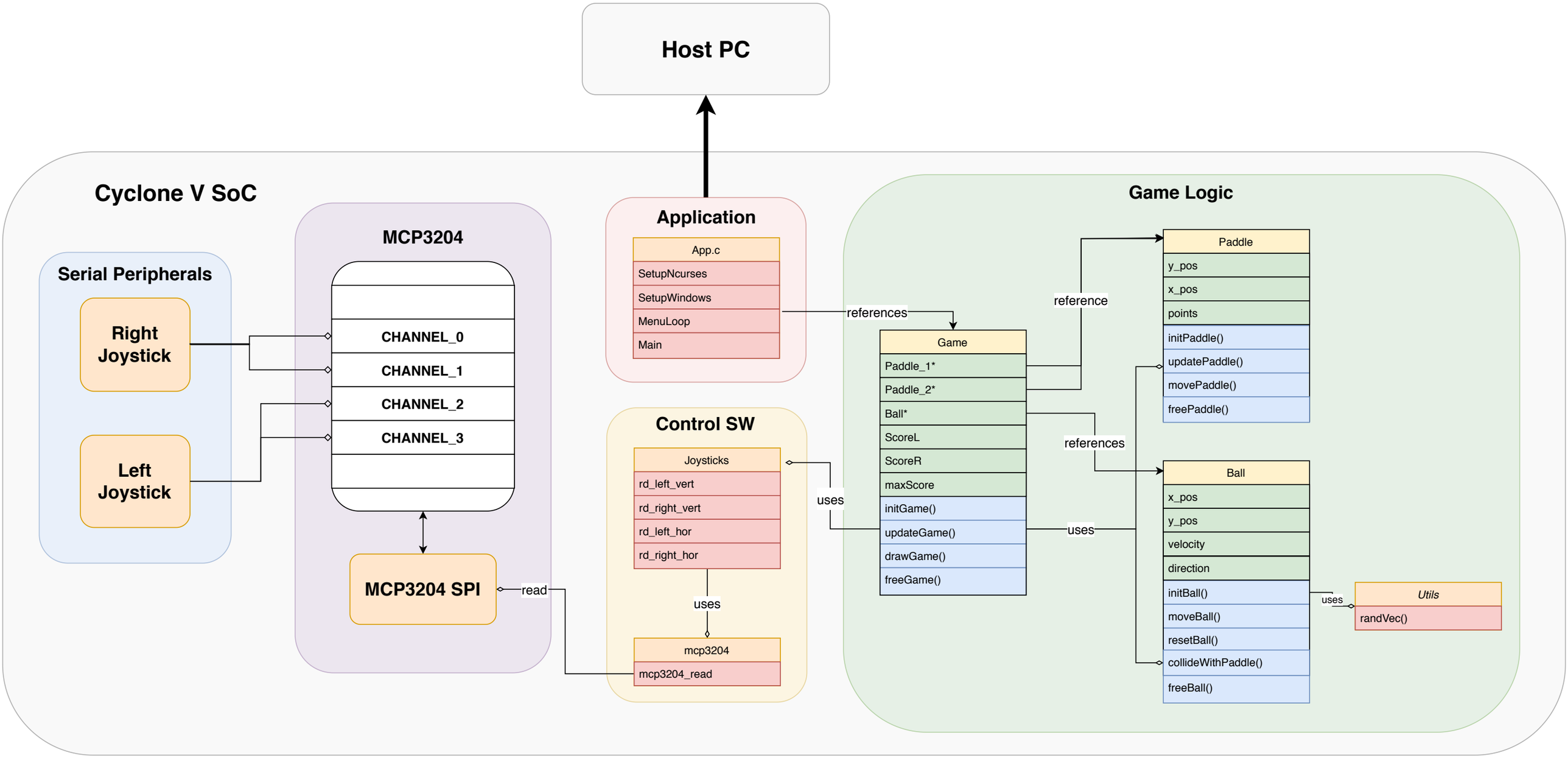
- Using the joysticks was done simply using the control functions implemented in LAB_1:

```
//Get user input
uint32_t jstck_val_l = joysticks_read_left_vertical(joysticks);
uint32_t jstck_val_r = joysticks_read_right_vertical(joysticks);

//Left joystick is all the way up
if(jstck_val_l == JOYSTICKS_MAX_VALUE) {
    highlight = highlight == 0 ? 0 : --highlight;
}
//Left joystick is all the way down
else if(jstck_val_l == JOYSTICKS_MIN_VALUE)
    highlight = (highlight == N_MENU_OPTIONS - 1) ? highlight : ++highlight;
}

//Check for selection confirmation
if(jstck_val_r == JOYSTICKS_MAX_VALUE) {
    return highlight % N_MEU_OPTIONS;
}
```

APPLICATION OVERVIEW



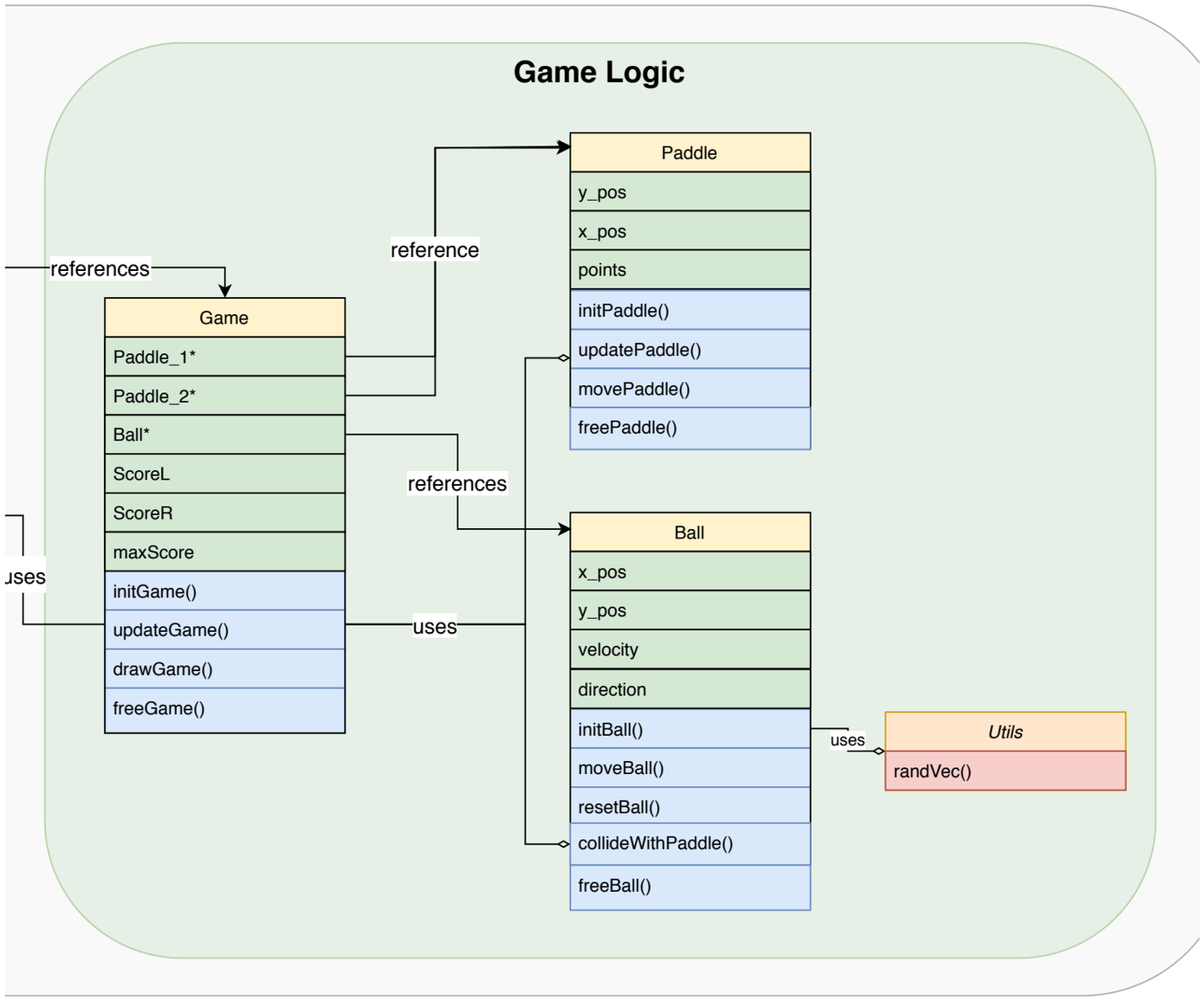
PROGRAMMING WITH NCURSES

- The code is organised in **windows**:
  - Each **window** needs to be drawn on and refreshed independently.
  - There are two windows in our *PONG* game: one for the **main** screen and one the the **scoreboard** and **menu**.

APPLICATION STRUCTURE – GAME_LOGIC

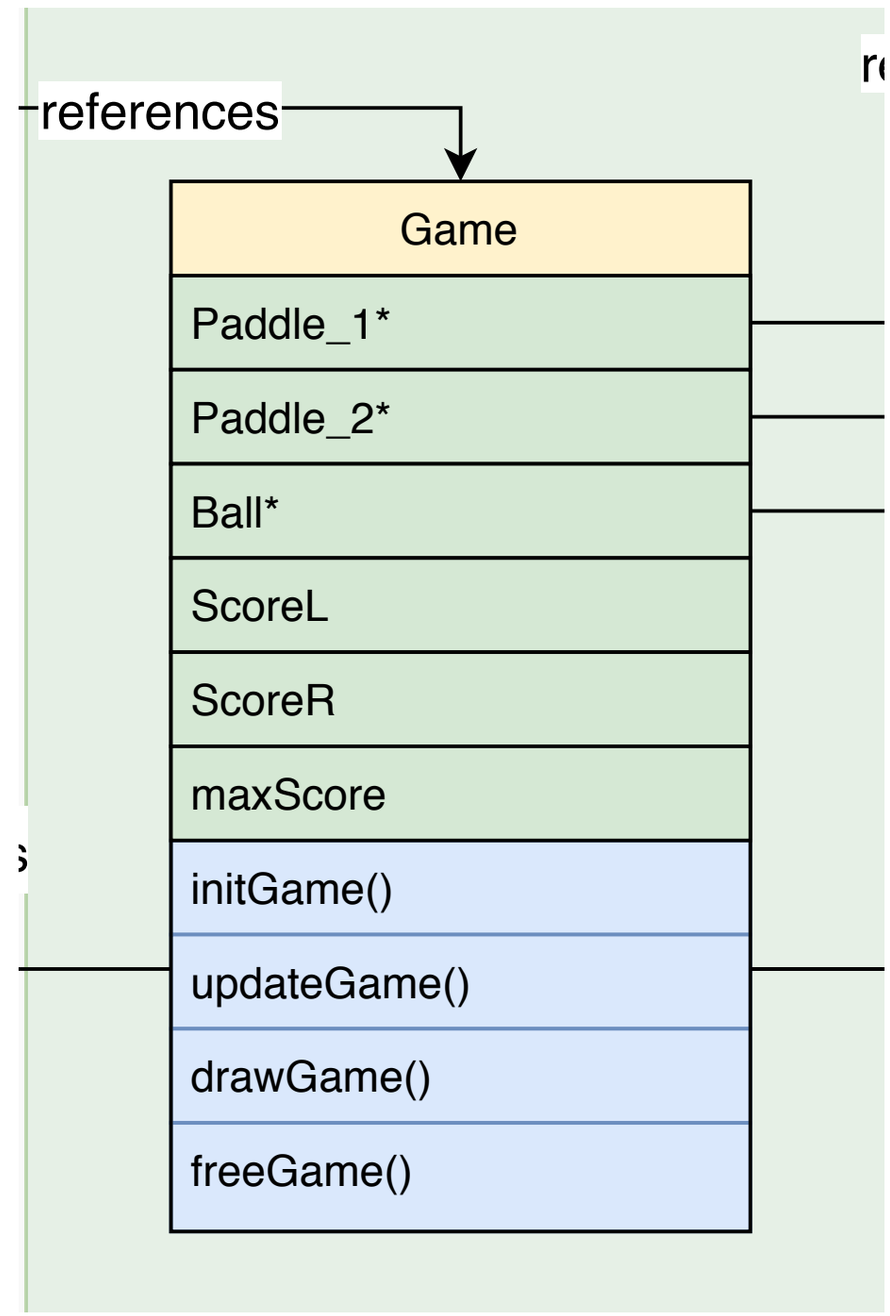
The game logic is separated into 3 parts:

- the **game**: models a round of PONG
- a **ball**: models the ball
- a **paddle**: models one of the players



GAME STRUCTURE – GAME

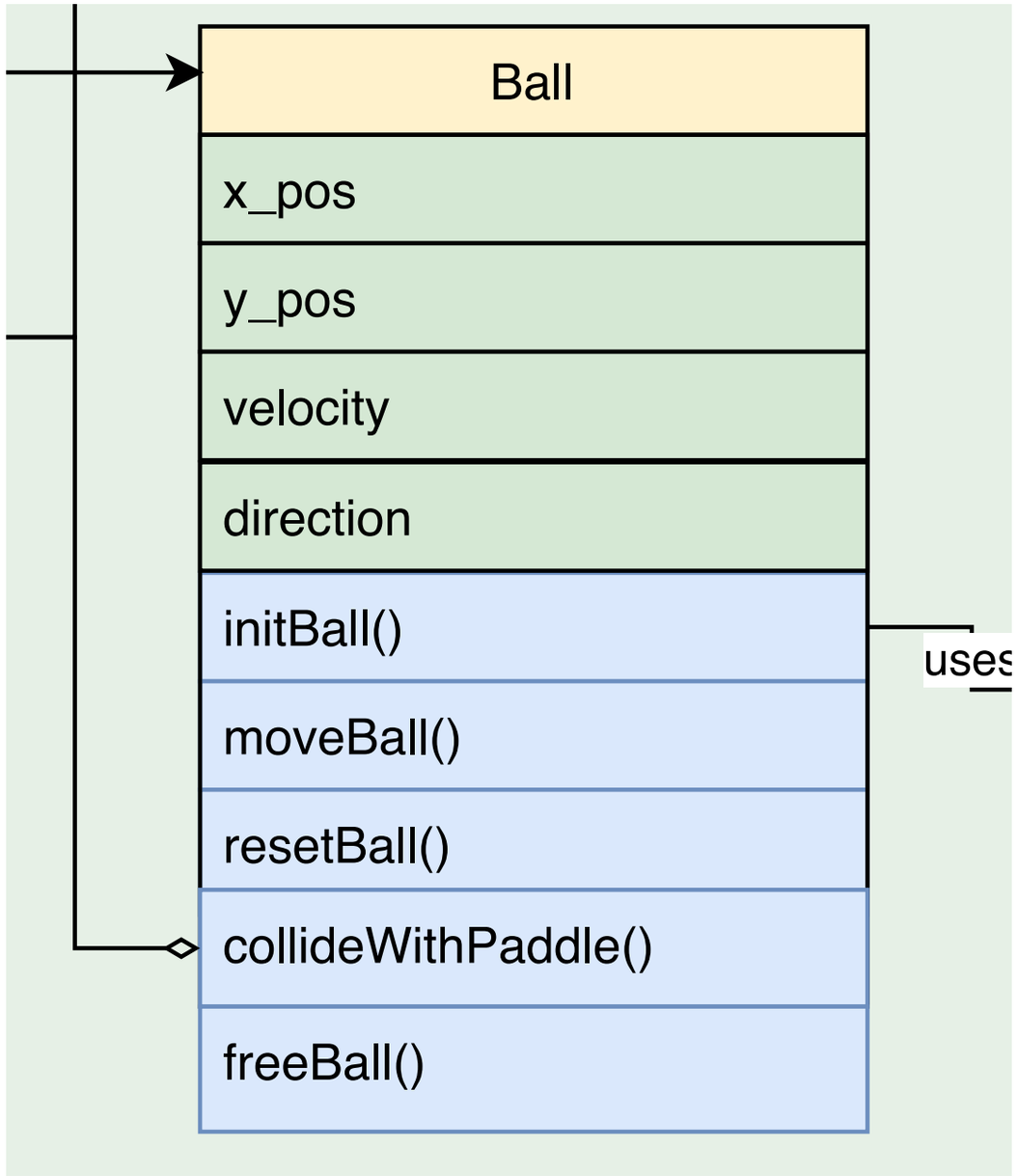
- Contains references to the two paddles and the ball.
- Maintains the scores that are displayed on the lower window.
- Handles the creation, updating and drawing of all of the elements in the game.



GAME STRUCTURE – BALL

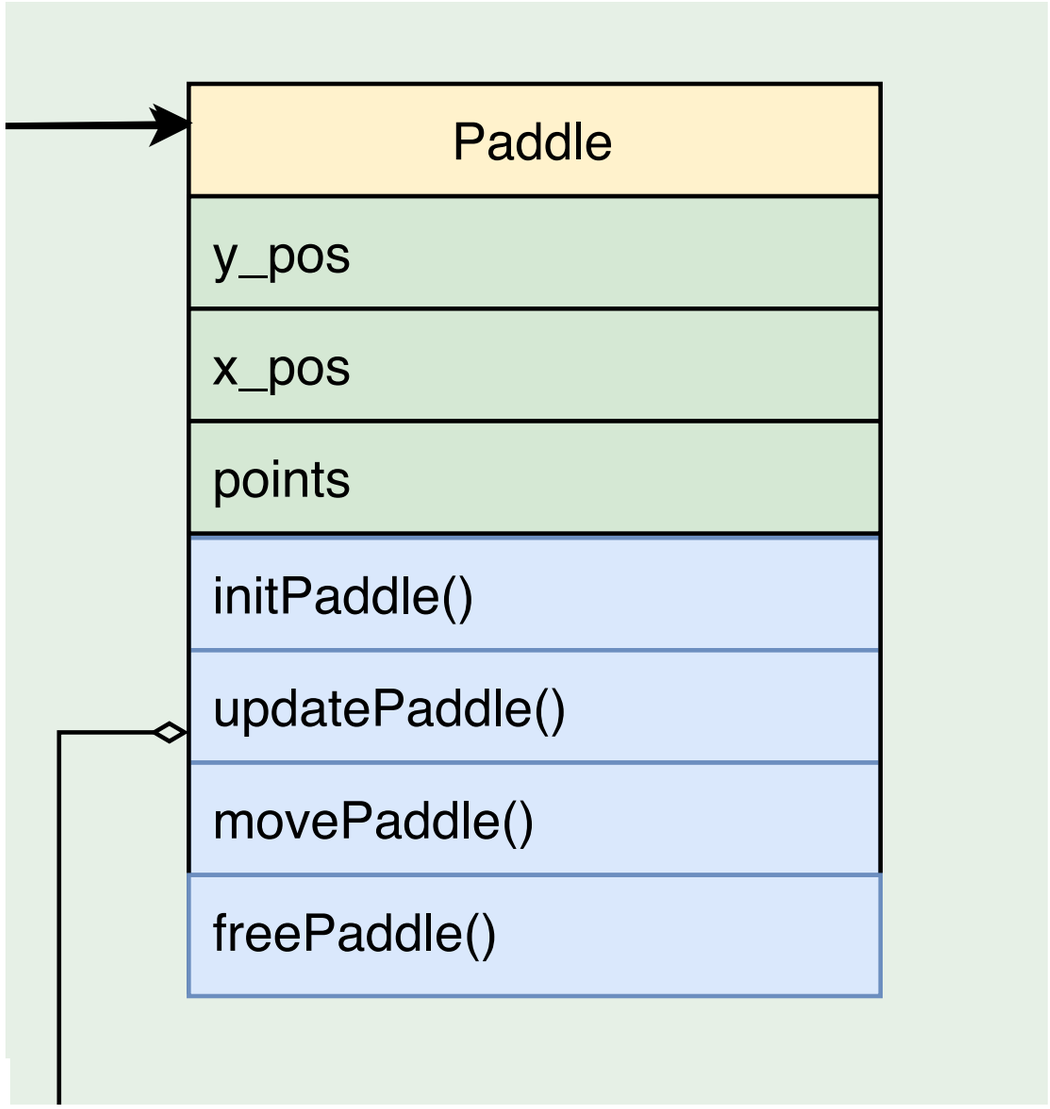
- Contains the position of the ball, its direction and its velocity.

- Handles the ball's movement and collisions with the other elements of the game.



GAME STRUCTURE – PADDLE

- Contains the position of a paddle and the number of points it has gained.
- Handles mostly the player input and moving the paddle.



GAME STRUCTURE – CPU CONTROLLED PADDLE

- Very basic “AI”:
  - Looks one step ahead.
  - Moves towards the ball’s next position.
  - Quite easy to defeat, but can still pose a challenge.

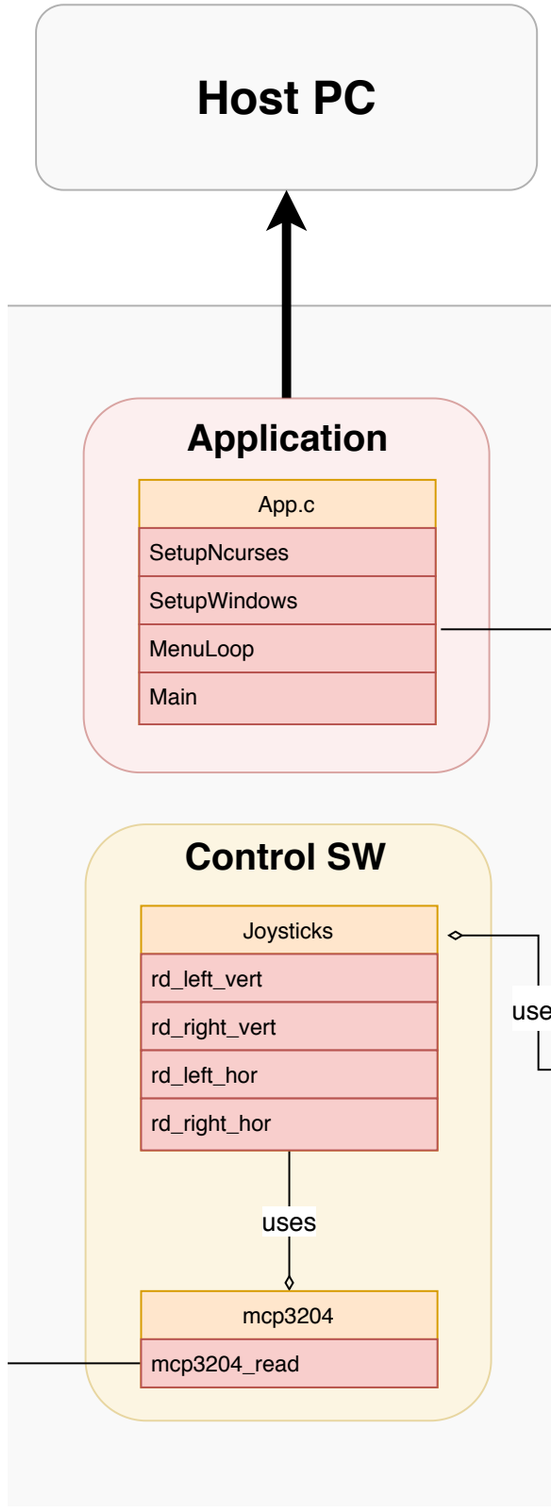
APPLICATION STRUCTURE – APP & CONTROL SW

The Application file handles:

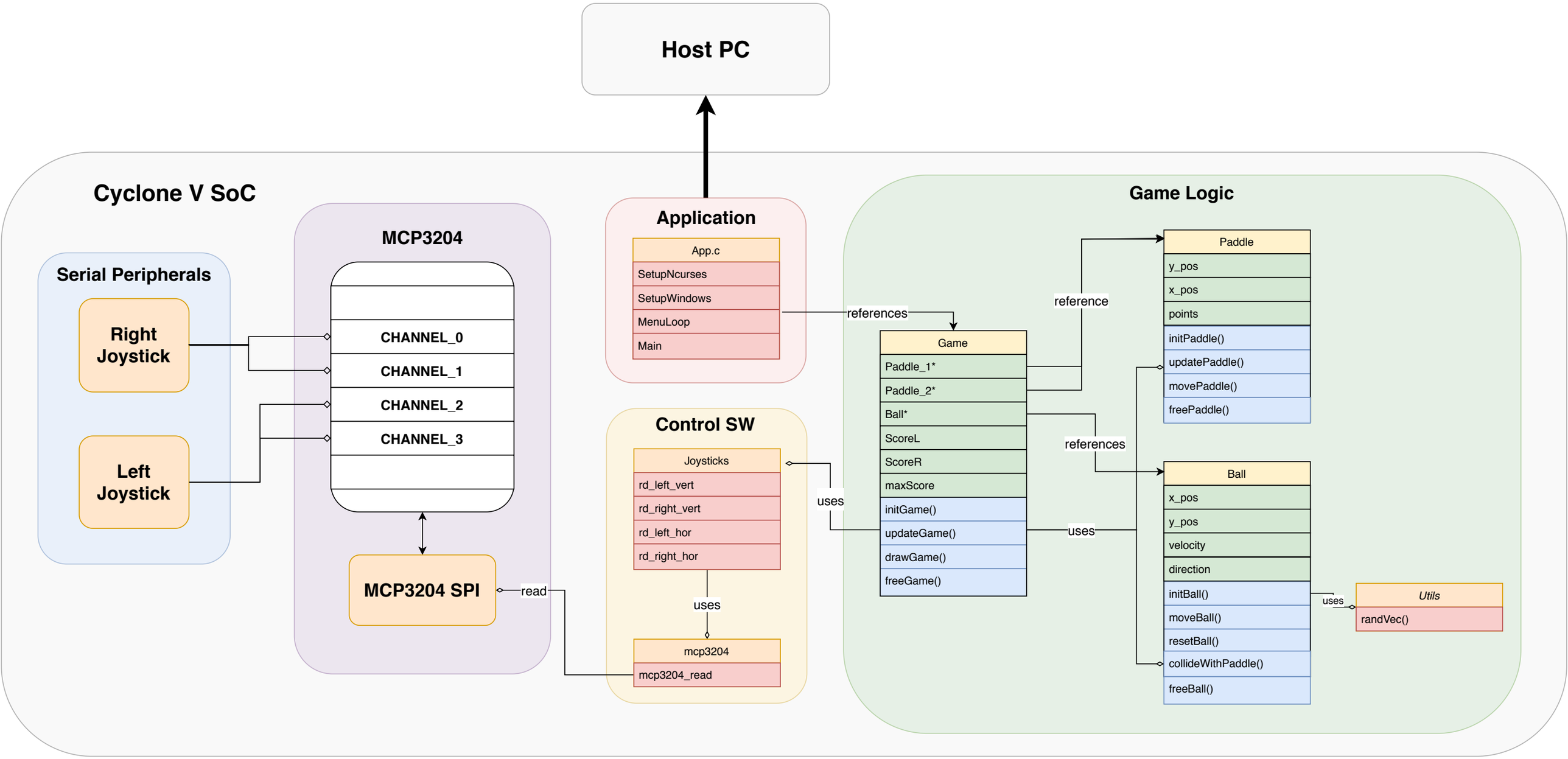
- Initialising **ncurses**
- Creating and refreshing the two windows
- Switching from the menu to the game
- Initialising the game

The Control Sw handles:

- Wrapping the Joystick polling
- Interfacing with the MCP3204 SPI



APPLICATION STRUCTURE – SUMMARY



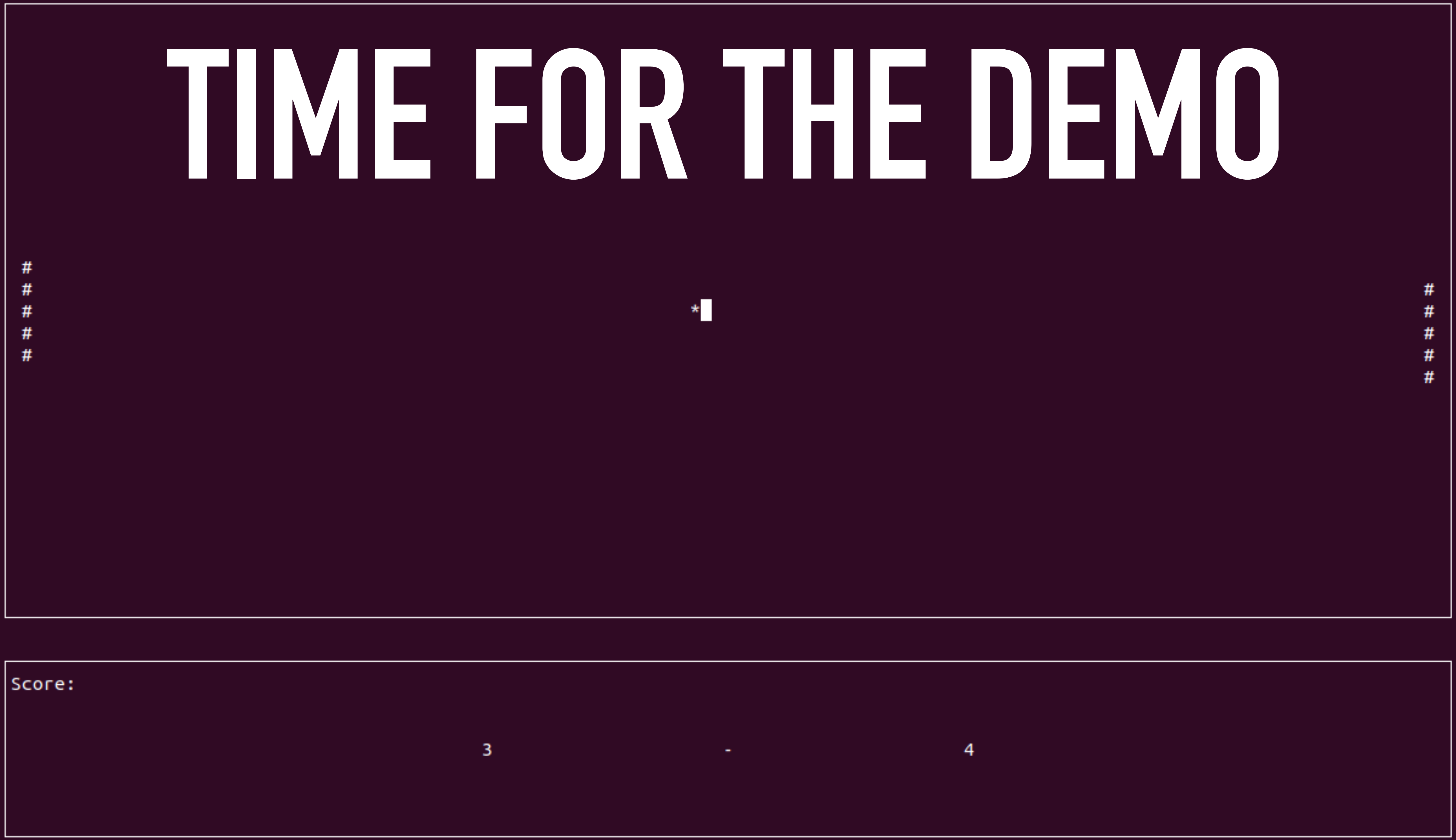
CONCLUSION – PROBLEMS

- The board only works every other time.

- Sometimes it just decides to no longer accept the host-PC's input which leads to Linux having to be reinstalled. (Hopefully the demo will go well…)

- Missing a lot of peripherals, only the joysticks were usable.

TIME FOR THE DEMO



```
#
#                                                              #
#                              *                               #
#                                                              #
#                                                              #
                                                               #
```

```
Score:

                     3          -          4
```