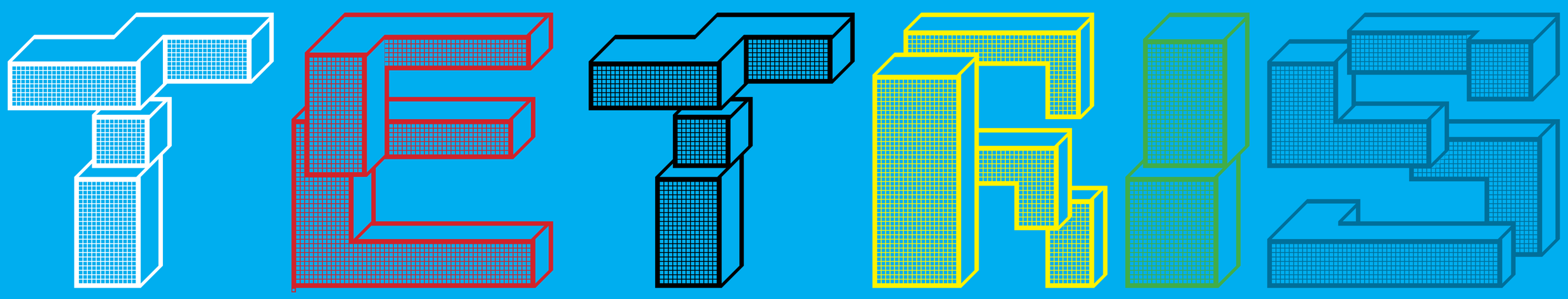
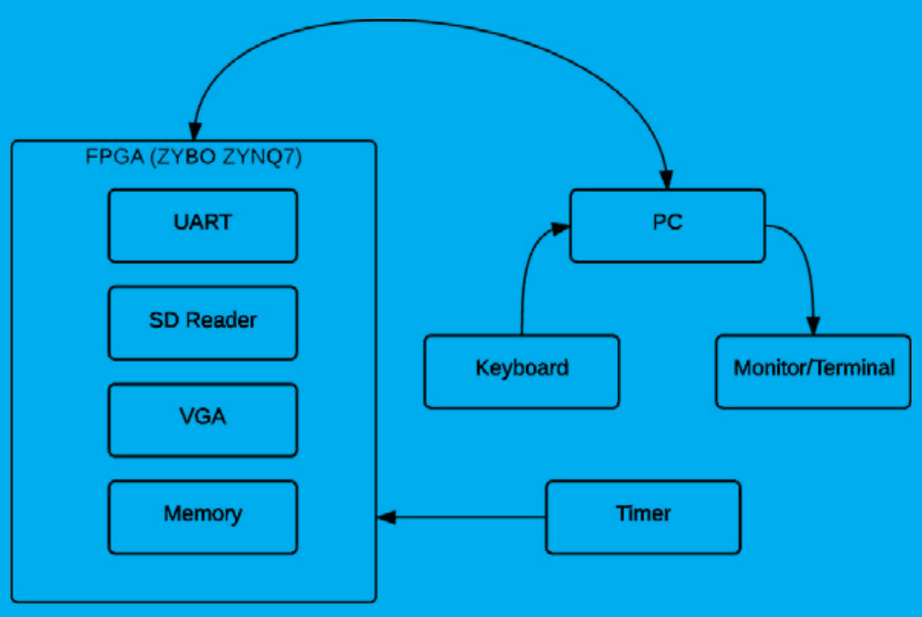


BUILDING THE GAME OF TETRIS FROM SCRATCH

by Anwar Choukair & Kristin Hansen

This poster describes the final project in the course HW/SW Programming. It is a project in which a game of Tetris was supposed to be developed for an FPGA board using Vivado (HW), and further implementing the game logic in C (SW).

Designing and describing the hardware and its behaviour



Initially we have to create a "computer" that can run Tetris - but not the kind of computer you'd know from your daily life, but a more simple one that only has a single task: to run the game and include the exact components required to execute all of the game's functions. Such a system is also called an "embedded system". To be able to accomplish such a task, we use an FPGA board, which is short for "Field-Programmable Gate Array".

An FPGA board is a chip which include several programmable components, such as USB, HDMI and many more. It is our job to decide which components we need and program the hardware in such a way that we can use those components when we write our SW implementation.

You can think of it like you're in a kitchen, where you want to cook a nice meal and you have a lot of groceries; you first pick all the groceries you need (program the FPGA), and then cook the meal (write the software code).

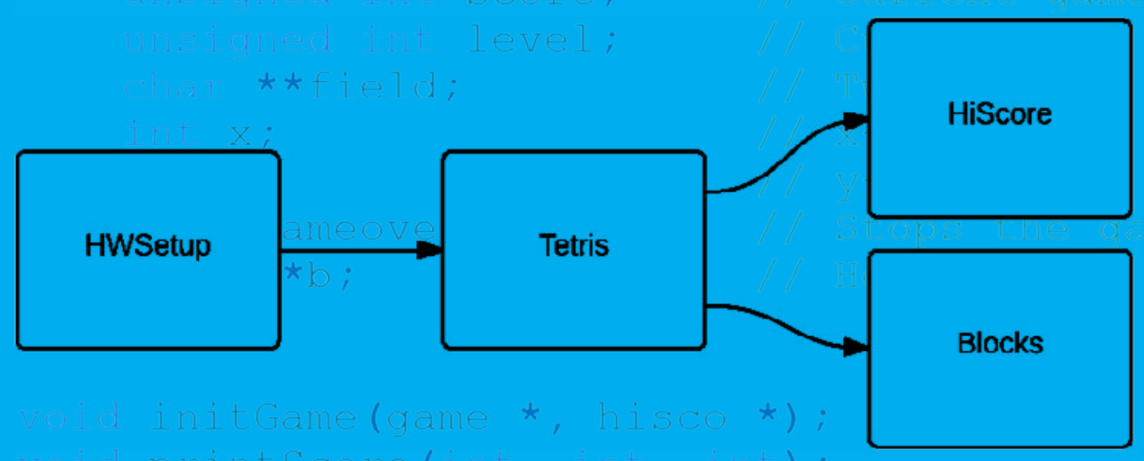
Writing the software implementation in C

The SW is developed in C, where the finished HW implementation from the ZYBO board, makes it possible to generate the necessary functions, including:

- A timer to set the pace of the game
- A method to send input from the keyboard
- The ability to save and load high scores

When the game starts, all the HW components' drivers are instantiated and used in functions that describe its behaviour - this way it can be used in the SW logic of the game. E.g. the description of what to do when a button is pressed on the keyboard, generating an interrupt. All this is described in the "HWSetup"-file.

The HWSetup sends the signals, e.g. an interrupt caused by the keyboard, to the game logic, which is described in the "Tetris"-file. This file also includes the printing method of the game, as well as all the information needed to actually print the Tetris-field and its pieces!



... and finally enjoying the result!

The final game is rendered as ASCII-graphics, and has the ability to save and load high scores. You are made aware of the next high score you're about to beat, and how many points you are from achieving this (in parenthesis).

The object of the game is of course to solve the rows, and this is where you get your points. Simultaneously solving several rows lands you a nice multiplier, too!

It is possible to control the pieces by nodging them to either the right or left, while you of course can rotate them as well! The speed of the descending pieces can be increased, to give the advanced users an opportunity to skip waiting at the early levels.

Statistics are obtained to calculate the most likely piece used to solve rows with - this can give you an idea of whether or not you might be using the same tactic as others.