Vexriscv SoC with UART and AXI-GPIO

THis is an example based on a 32 bit GPIO with Vexriscv SoC.

Instructions:

Copy your demo folder from litex installation directory `litex/litex/soc/software/demo` and paste it inside your project directory. Use the main.c file provided in this example in the demo application and replace it with the main.c file located inside your newly copied demo folder in project directory.

1. Simulation

We can simulate the integration application code in main.c using litex_sim tool in litex.

Run the following command to generate your SoC:

```
litex_sim --integrated-main-ram-size=0x10000 --cpu-type=vexriscv --axigpio
--no-compile-gateware --sim-debug
```

Before running the simulation, you have to create the binary of your application code residing in demo. The python script below converts the application code to demo.bin, which is later loaded on to the RAM.

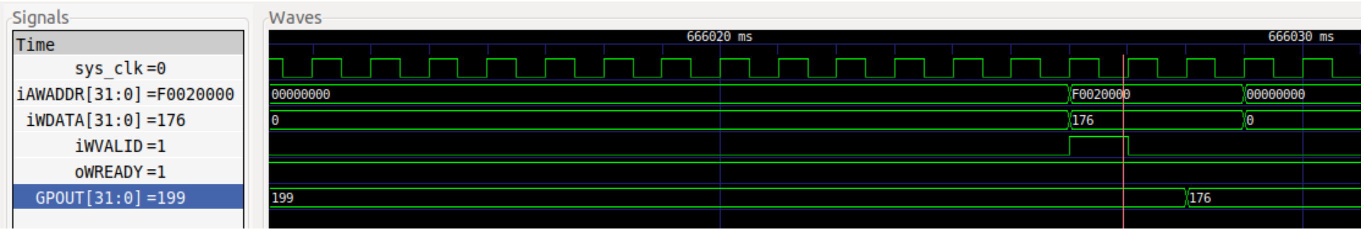
Run the following command to generate .bin file from .py file:

```
python3 ./demo/demo.py --build-path=build/sim
```

Run the following command to execute your applicationcode onto the processor:

```
litex_sim --integrated-main-ram-size=0x10000 --cpu-type vexriscv --axigpio
--ram-init=demo.bin --sim-debug
```

Output:



2. Hardware

Connect your Digilent Basys 3 board with your machine. We will be using the same design which we used in simulation to verify on the board. The following board file written in python creates the same SoC and later build and load it onto the Basys3 board.

Note: Before using this GPIO design on hardware, we need to replace the board files with the necessary changes provided in the `board files` directory.

Run the following command to generate your SoC:

```
./../../litex_installation/litex-boards/litex_boards/targets/digilent_basys3.py --integrated-main-ram-size=0x10000 --cpu-type=vexriscv --axigpio --build --load --uart-name=serial
```

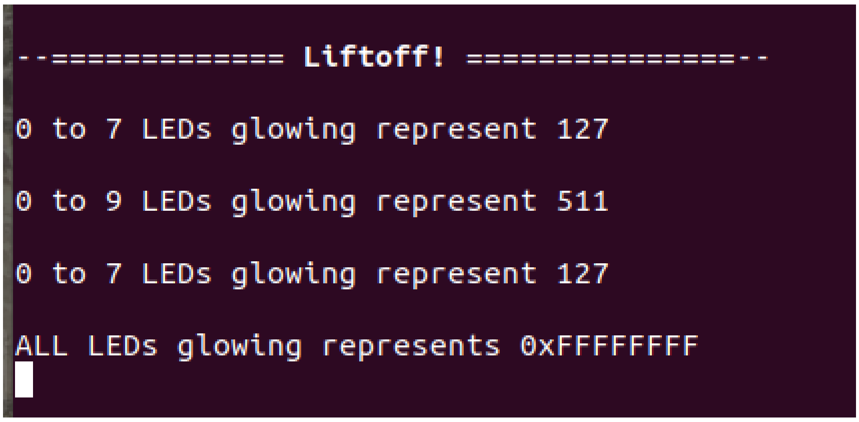
Run the following command to generate .bin file from .py file:

```
python3 ./demo/demo.py --build-path=build/digilent_basys3
```

Run the following command to execute your application:

```
litex_term /dev/ttyUSB1 --kernel=demo.bin
```

Output:



```
--============= Liftoff! ===============--

0 to 7 LEDs glowing represent 127

0 to 9 LEDs glowing represent 511

0 to 7 LEDs glowing represent 127

ALL LEDs glowing represents 0xFFFFFFFF
```

Application

This test performs the write operation on specific addresses and the data is passed to GPIO OUT, which is mapped to the LEDs on the board. This can be verified using the GTKwave.