On the use of programmable logic in FabLabs

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Self introduction

- Cord Elias
- Electrical Engineer
- Self employed: Embaix–Consulting
- Focus: Embedded Systems
- Motivation for being here: Providing and getting new ideas, make an offer, meeting interesting people
On the use of programmable logic in FabLabs
RGB LED Matrix Display
Control: challenging (timing)
Control with programmable logic: Very good fit
Programmable logic

- Complex Programmable Logic Devices (CPLD’s)
- Field Programmable Gate Arrays (FPGA’s)
- Ever heard about it?
- Ever used it?
Some myths about programmable logic

- Very complicated to use
- Only for people with engineering degree
- Development tools are very expensive
Introduction Programmable logic Basics FabLab implementation

On the use of programmable logic in FabLabs
Typical maker scenario

Arduino with Breadboard
Introduction
Programmable logic Basics
FabLab implementation

Nicer maker szenario

 Arduino with FPGA–Shield

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FPGA Basics (1)

Inner FPGA components
FPGA Basics (2)

Main FPGA manufacturers:
- Altera®
- Xilinx®
- > 90% market share
FPGA–Basics (3)

What do I need to get started with FPGA’s?

- FPGA–Board (costs: around 100€)
- Cost free development tool (from FPGA manufacturer)
FPGA–Basics (4)

What do I need to know to get started?

- Basic knowledge of FPGA functionality
- Basic capabilities with development tools
- Basic VHDL knowledge (not mandatory, but highly recommended)
Development workflow

- Design entry
- Synthesis
- Implementation
- Bitstream generation
library IEEE;
use IEEE.STD_LOGIC_1164.ALL;
use IEEE.STD_LOGIC_UNSIGNED.ALL;

entity led_io33 is
    Port ( clk_50 : in STD_LOGIC;
           led_o : out STD_LOGIC);
end led_io33;

architecture Behavioral of led_io33 is
    signal cnt_r : std_logic_vector(23 downto 0) := (others=>'0');
begn
    process(clk_50) is
        begin
            if rising_edge(clk_50) then
                cnt_r <= cnt_r + 1;
            end if;
        end process;

    led_o <= cnt_r(23);
end Behavioral;

On the use of programmable logic in FabLabs
Topics

- FPGA board(s)
- FPGA design software installation
- Appropriate documentation
- Staff training
Proposal: FabLab standard
Beginner level
Tool installation guide
”Get Started”
Well worded out examples for typical FabLab digital electronic design tasks
FabLab staff training

- Kickstart workshop
- Development of Library with examples and design patterns ("Cookbook")
- Establish FabLab programmable logic design network
- Onsite programmable logic workshops
Summary

- Programmable logic can be very useful for FabLab users
- Utilization of programmable logic is feasible in a FabLab environment
- Some effort is necessary
- Challenge can be mastered collaboratively!