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Quickscope - FPGA based oscilloscope

Project specifications

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1. Project brief

The project consists of a Basic Oscilloscope based on a Nexys Video FPGA board.

The system uses the internal 12 bits 4 channels ADC to read Analog values from a PMOD connector. It then shows the Analog values over time on screen through an HDMI connection

1.1. Equipement
- Nexys Video
- PMOD Rotary Encoder
- HDMI screen
- Probe / cable (PMOD compatible)
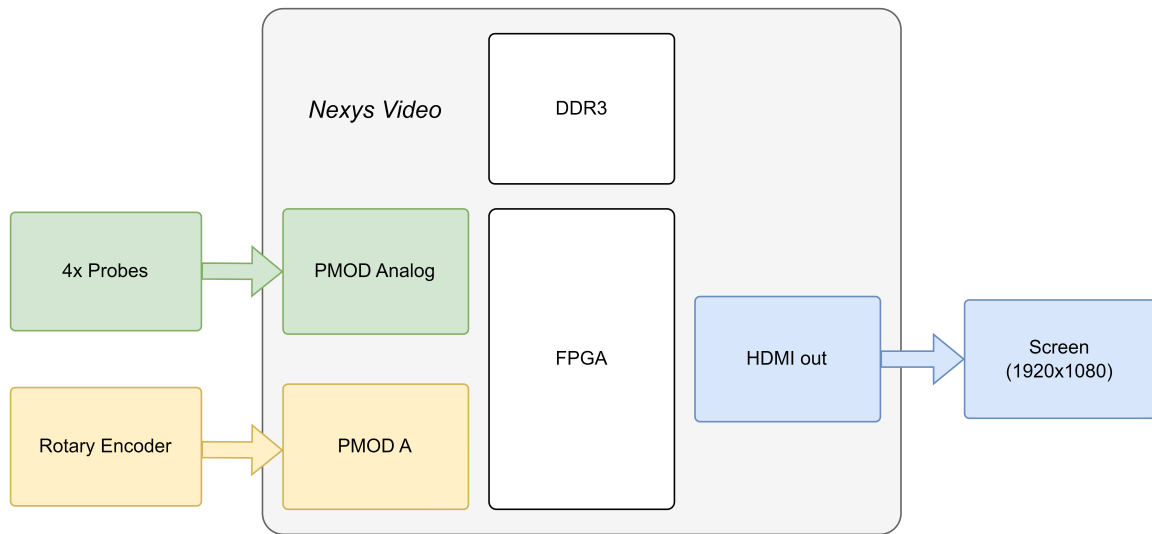
2. Project schematics

2.1. General

Figure 1: General Architecture of the system

2.2. Internal

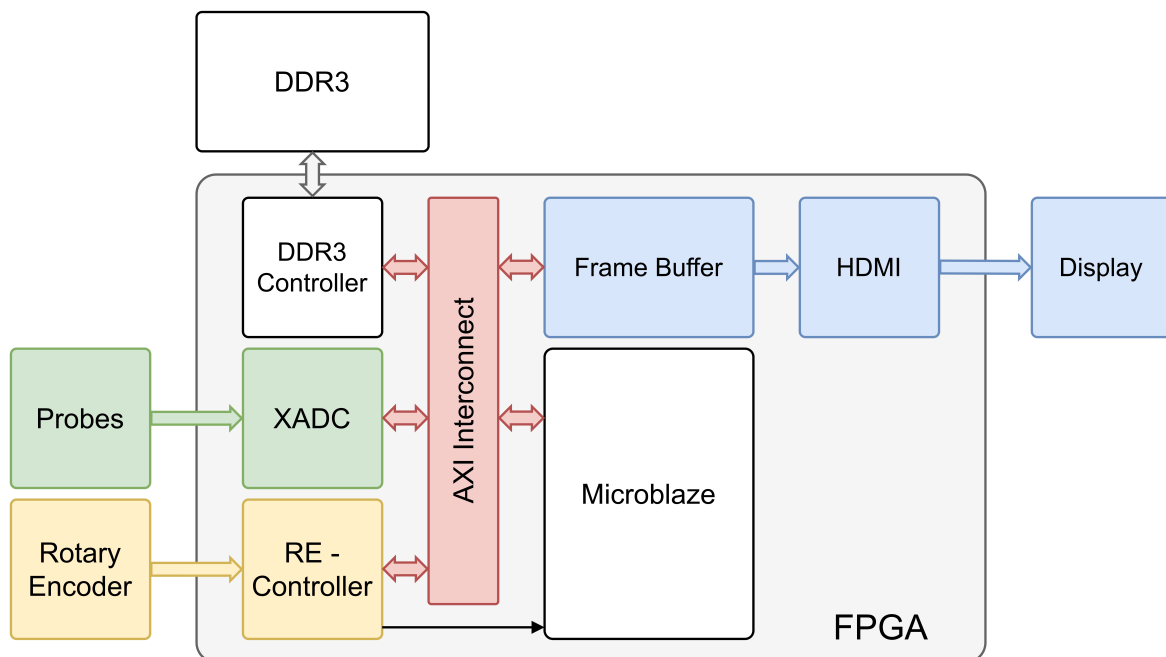Figure 2: Internal detailed diagram describing inner connections and specifics

3. Imperatives

- 4x Analog Inputs
- Voltage range 0V - 3.3
- Maximum 1 Mega sample / s
- 1920x1080 at 60 FPS
- Ajustable parameters
  - Sampling rate
  - Vertical scale (Amplitude)
  - Horizontal scale (Time)

4. Register decriptions

4.1. Rotary encoder

4.1.1. Data Register [RO]

31 - 3	2	1	0
X	BUTTON	ROTATE LEFT	ROTATE RIGHT

Table 1: Rotary Encoder Value Register

4.1.2. Clear interrupt Register [WO]

31 - 1	0
X	CLEAR

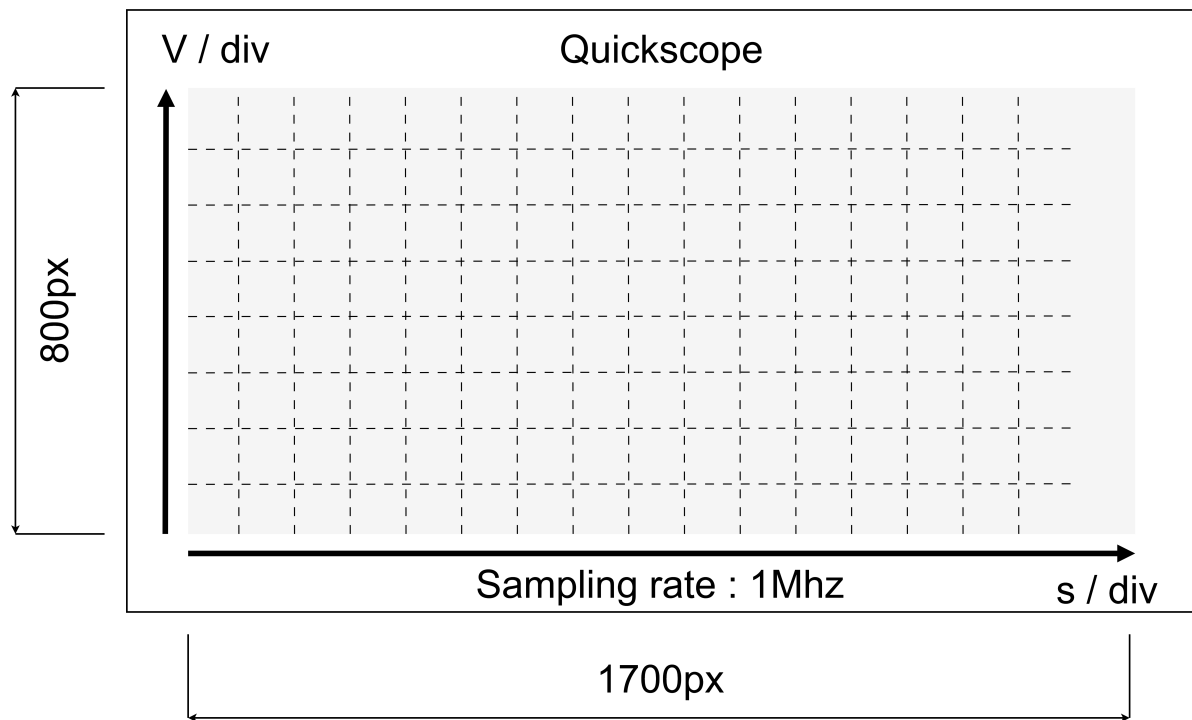Table 2: Rotary Encoder Clear Interrupt Register

4.2. Rotary encoder

Figure 3: Frame organization 1920x1080 screen.

Each Analog Input has its own vector containing the pixel to show on the screen. Each vector has 11 bit

5. Pseudo-code Microblaze

```c
void main()
{
  read_last_values_adc();
  update_display();
}

void routine_interrupt_re()
{
  value = read_reg_value_re();

  switch(value)
  {
    case LEFT:
      left();
    case RIGHT:
      right();
    default:
  }

  if(value == BUTTON_PRESSED)
    select();
}
```

6. Project planning
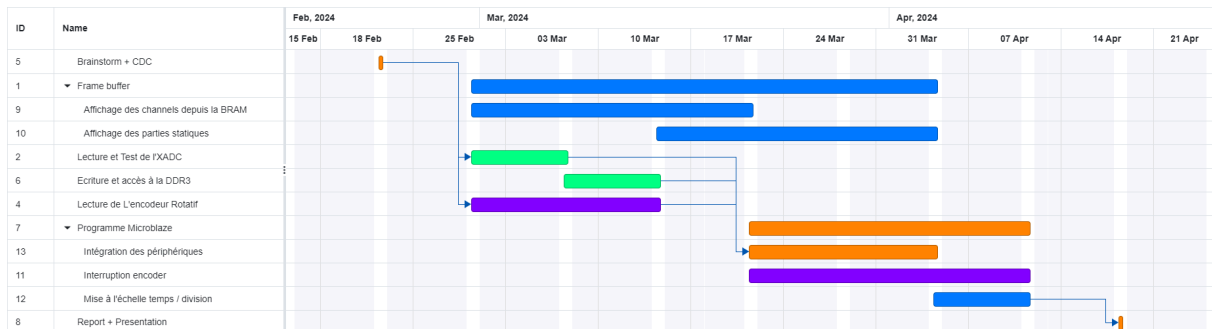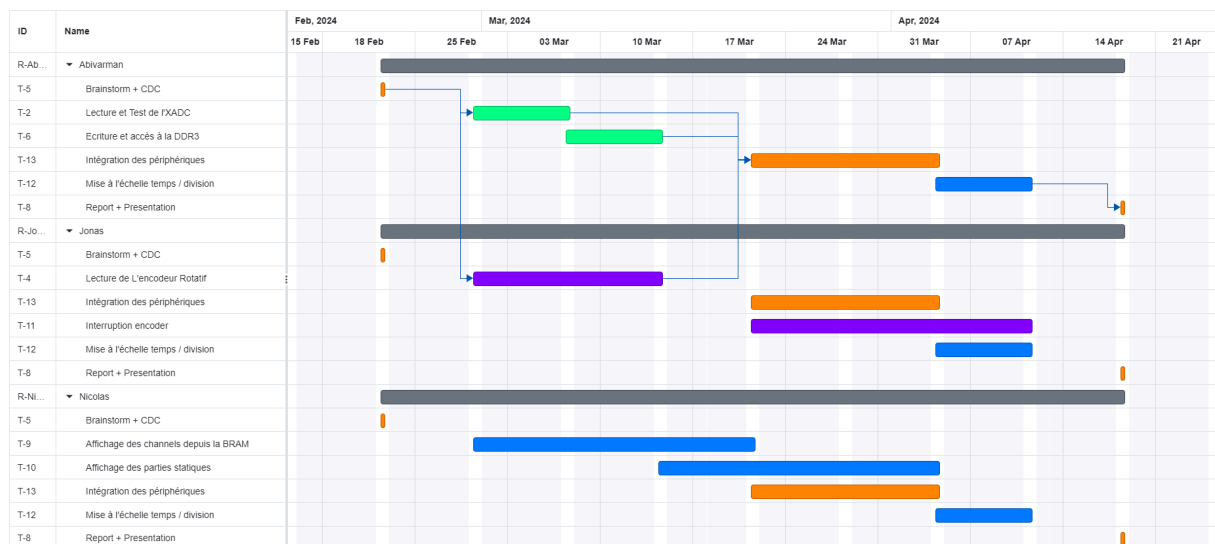
Due date : 06 / 05 / 2024

Figure 4: GANTT planning diagram (10 weeks)

Figure 5: GANTT resources repartitions