Camera with movement detection

- and more

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… almost ...

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What

A camera controller

1. Receives picture stream
2. Identifies background
3. Detects movement relative to background
4. Sends modified picture to monitor

Implementation steps

1. - Talk to camera over SCCB to configure
   - Paint on VGA monitor
2. - Output from memory to VGA
3. - Grab frames to memory and output from memory to VGA
4. - Grab frames to memory do detection and output to VGA

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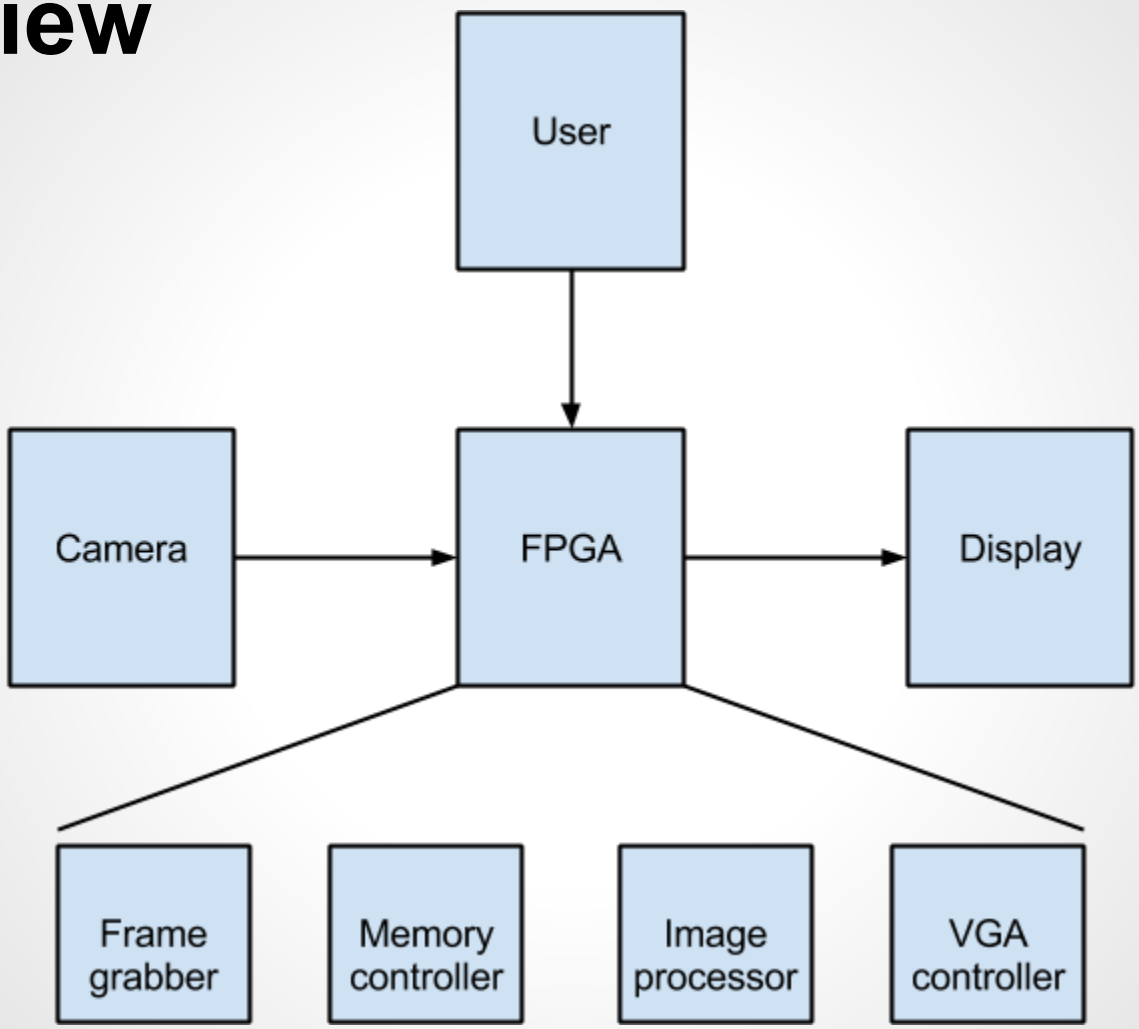
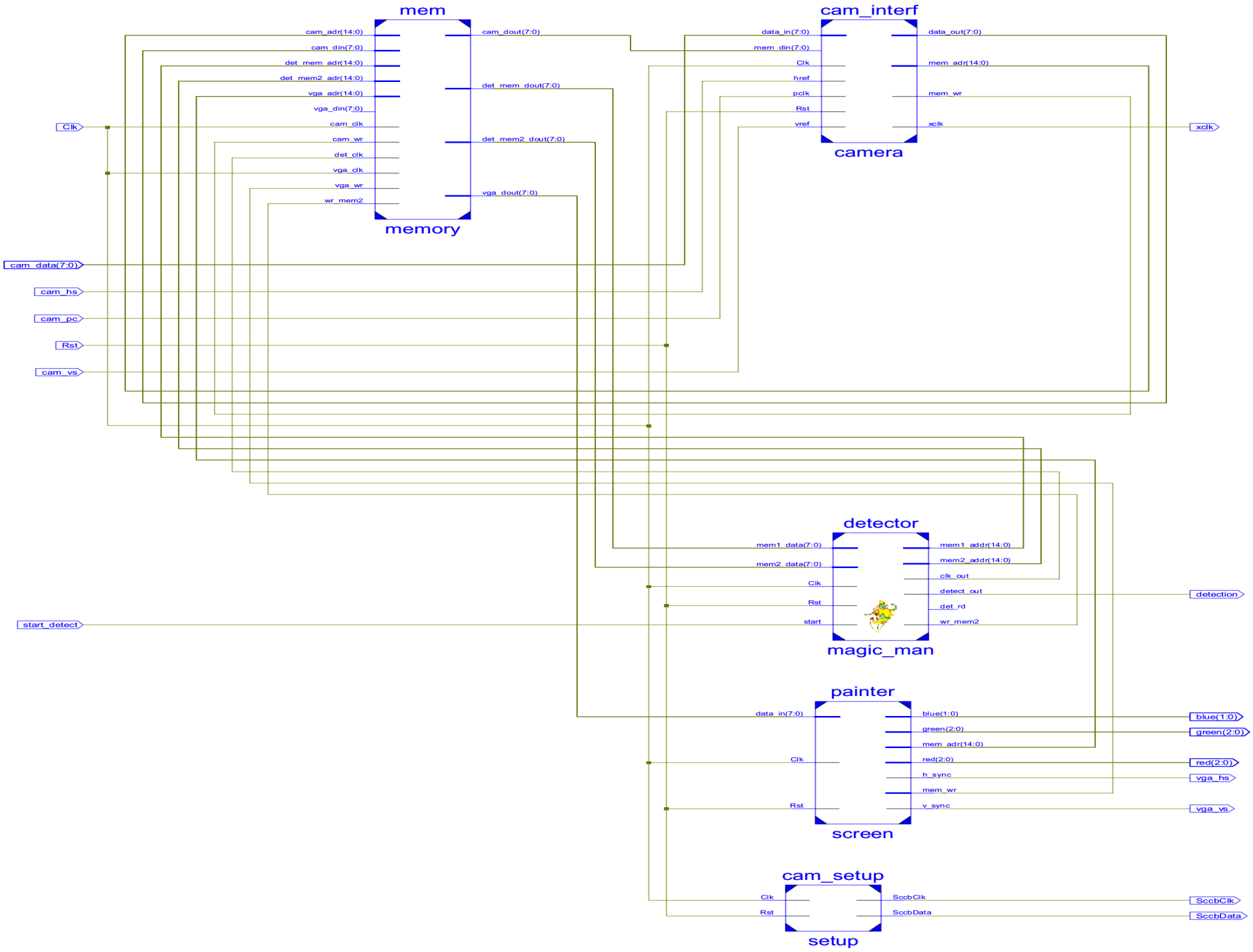
4. **- Grab frames to memory, do detection and output to VGA**

Overview


User
Camera
FPGA
Display
Frame grabber
Memory controller
Image processor
VGA controller


mem
cam_adr(14:0)
cam_din(7:0)
det_mem_adr(14:0)
det_mem2_adr(14:0)
vga_adr(14:0)
vga_din(7:0)
cam_clk
cam_wr
det_clk
vga_clk
vga_wr
wr_mem2
cam_dout(7:0)
det_mem_dout(7:0)
det_mem2_dout(7:0)
vga_dout(7:0)
memory
cam_interf
data_in(7:0)
mem_din(7:0)
Clk
href
pclk
Rst
vref
data_out(7:0)
mem_adr(14:0)
mem_wr
xclk
camera
Clk
cam_data(7:0)
cam_hs
cam_pc
Rst
cam_vs
xclk
detector
mem1_data(7:0)
mem2_data(7:0)
Clk
Rst
start
mem1_addr(14:0)
mem2_addr(14:0)
clk_out
detect_out
det_rd
wr_mem2
detection
magic_man
start_detect
painter
data_in(7:0)
Clk
Rst
blue(1:0)
green(2:0)
mem_adr(14:0)
red(2:0)
h_sync
mem_wr
v_sync
blue(1:0)
green(2:0)
red(2:0)
vga_hs
vga_vs
screen
cam_setup
Clk
Rst
SccbClk
SccbData
SccbClk
SccbData
setup

Problems / Solutions

- Cellular RAM too slow
- BRAM too small
- SCCB specification
- Illegal default values
- Pixel clock on non clock port
- DSP causing trouble sometimes
- Hard to prototype in software on the board

Problems / Solutions

- Don’t use Cellular RAM
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- Don’t use Cellular RAM
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Problems / Solutions

- Don’t use Cellular RAM
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- KISS, only implement write functionality
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Problems / Solutions

- Don’t use Cellular RAM
- Scale down video image
- KISS, only implement write functionality
- Find example code and do guesswork
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Problems / Solutions

- Don’t use Cellular RAM
- Scale down video image
- KISS, only implement write functionality
- Find example code and do guesswork
- No good solution found
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Problems / Solutions

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- In future version, try to bypass DSP
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Problems / Solutions

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- Find example code and do guesswork
- No good solution found
- In future version, try to bypass DSP
- Simulate more, prototype on PC

Lessons learned

- Do calculations beforehand
- Implement in small steps
- Datasheets does not always have the answer

Conclusions

- Did not reach our goal
- Got a “working” prototype
- We learned a lot and feel more comfortable with VHDL now

Questions?