Multimedia SoC Design

Final project

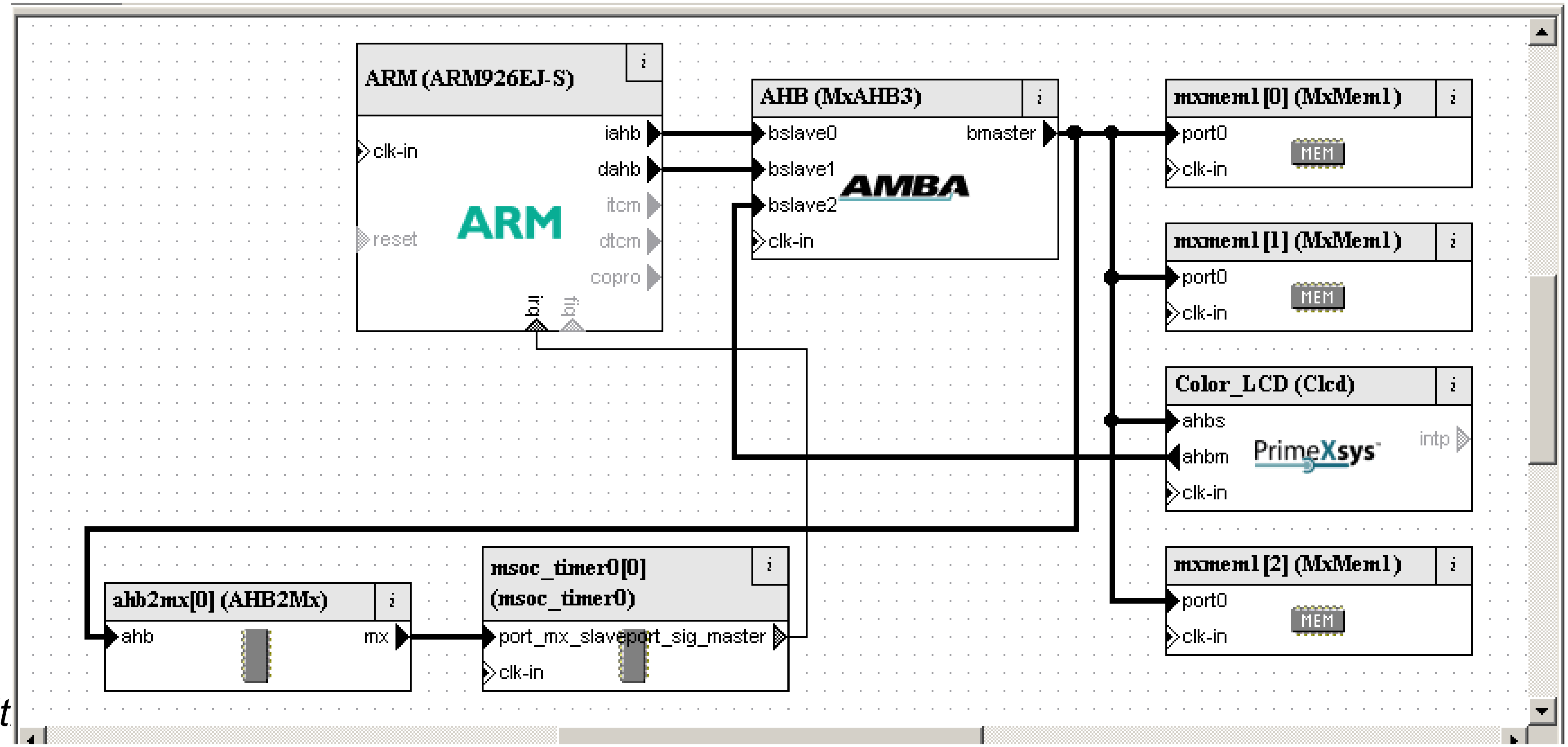
Digital display timer

Target of this project

- Design a digital display timer with fast background updating rate
  - Background: a moving picture
  - Foreground: digital display

Project platform

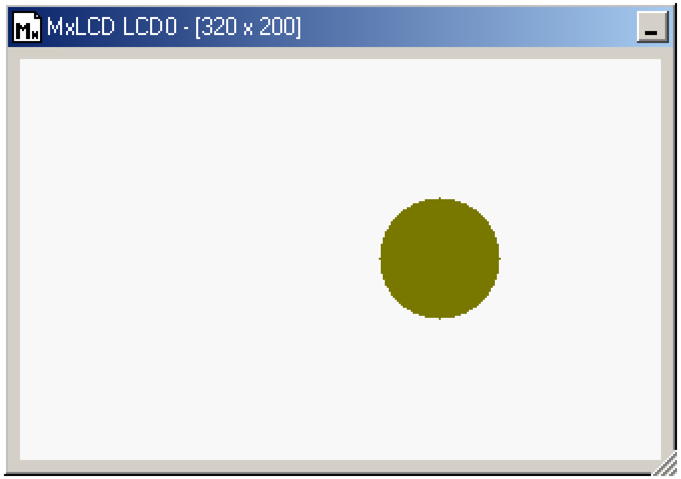
- Timer interrupt is used to update time display
- After alpha blending, new frame is set to CLCD

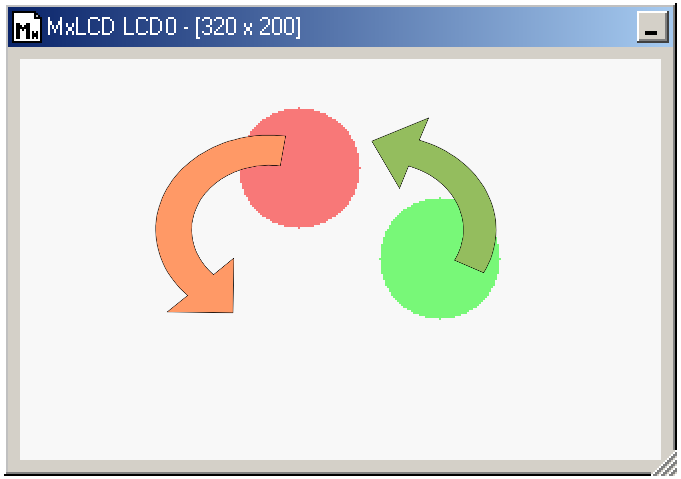


Mult

Function view

- Red circle rotates if new blended frame is ready
- Green circle rotates with interrupt
  - Please replace green circle with digital display





Software [1/2]

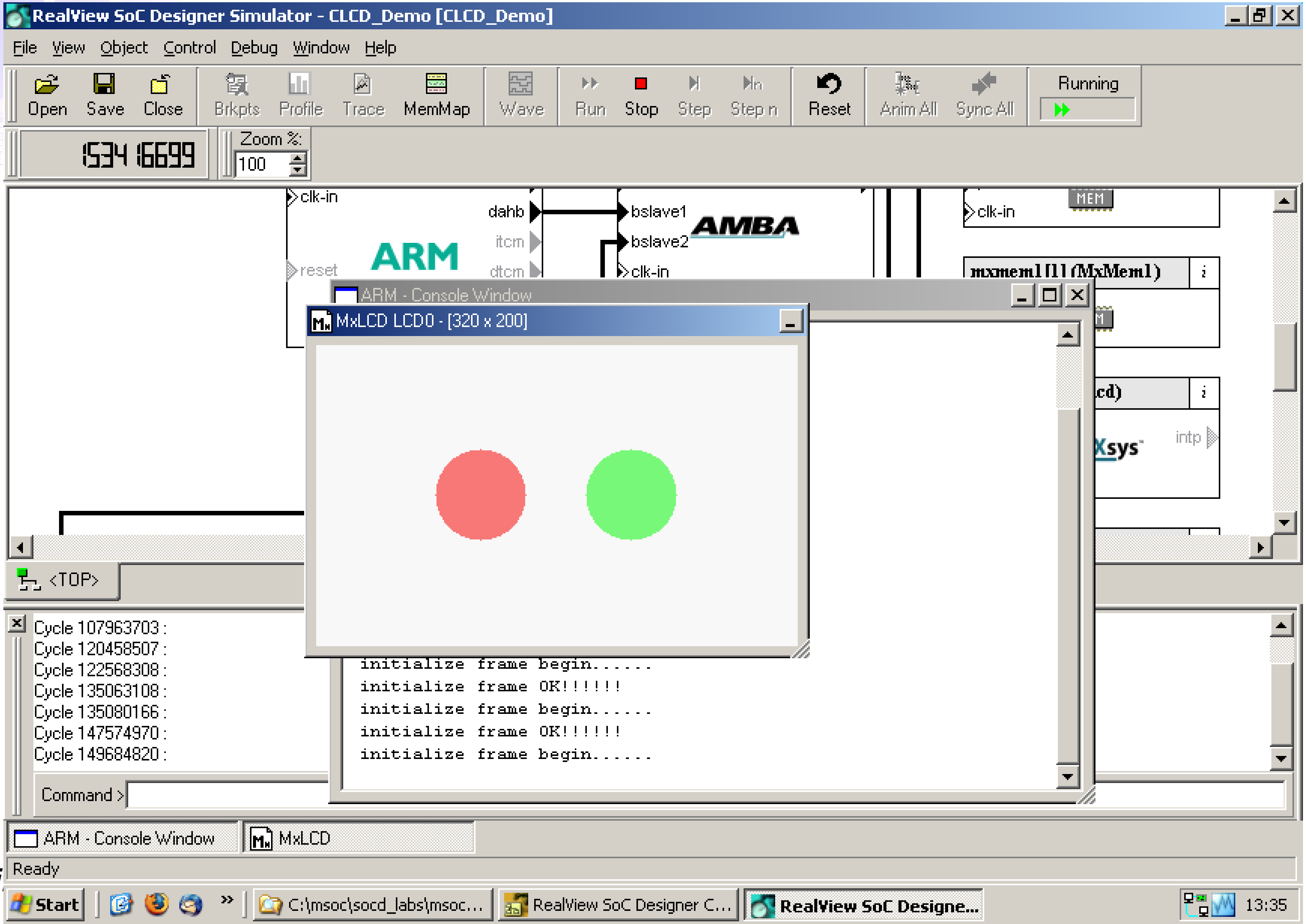
- Software
  - Currently, 20 frames red circles and 20 frames green circles are stored in arm code(.axf)
    - The binary is pretty huge
  - Function to be completed
    - vframe * **construct_timer_frame**() {
    - **// Please generate time display for example "10:10"**
    - **// in size 320x200 according to variables "hour" and**
    - **// "minute" here**
    - return (vframe *)array_pframeG[frame_no_fg];
    - }

Software [2/2]

- Function to be completed

  ```
  void
  InitFrameBuffer(const vframe* pframe,
                  const vframe* pframe_fg,
                  unsigned int alpha,
                  unsigned int base)
  { ......
    // Please provide 16 alpha options
  ```

Demo


RealView SoC Designer Simulator - CLCD_Demo [CLCD_Demo]
File View Object Control Debug Window Help
Open Save Close Brkpts Profile Trace MemMap Wave Run Stop Step Step n Reset Anim All Sync All
Running
1534 16699
Zoom %:
100
clk-in
dahb
itcm
dtcm
reset
ARM
bslave1
bslave2
clk-in
AMBA
MEM
clk-in
mxmem1[1] (MxMem1)
cd)
Xsys
intp
ARM - Console Window
MxLCD LCD0 - [320 x 200]
<TOP>
Command >
ARM - Console Window
MxLCD
Ready
Start
C:\msoc\socd_labs\msoc...
RealView SoC Designer C...
RealView SoC Designe...
13:35

```
Cycle 107963703 :
Cycle 120458507 :
Cycle 122568308 :
Cycle 135063108 :
Cycle 135080166 :
Cycle 147574970 :
Cycle 149684820 :
```

```
initialize frame begin......
initialize frame OK!!!!!!
initialize frame begin......
initialize frame OK!!!!!!
initialize frame begin......
```

Basic requirements

- Functional:
  - Add display of digital timer(ex: 12:34). Range: 00:00 ~ 23:59
  - Alpha option: 0 ~ 15/16 (current example give only one option: 8/16 = 0.5)
- Constraints
  - Interrupt interval is fixed to 150000000. Do not change it!
  - Each digital and ":" size: 60(width)x90(height)

Judgment criteria

- [1] Speed of background red circle moving. Interrupt period is set to 150000000. This period is used to set the display of digital timer (ex: 10:10 -> 10:11)
- [2] Memory usage
- [3] ARM code size
- [4] Look and feel
- Priority: [1] => [2] => [3] => [4]

Advanced options [1/3]

- There are actually no restrictions!
- Possible action:
  - AM/PM display
  - Turn on cache
  - AMBA configuration
    - Parking setting
    - Multi-layer
  - Dedicate camera/memory model to store red circle video data

Advanced options [2/3]

- Compress the graphic data([0-9], :)
  - Embedded compression => uncompress while using
- Use ARM to draw the timer digital (reduce code size)
- Smart drawing => redraw necessary parts
- No int main() => reduce code size
- Look and feel
  - Change the red circle to a more beautiful one
    - **Radius should not be changed!**
  - Dynamically adjust alpha (GPIO or force memory content)
  - Dynamically adjust digital font (GPIO or force memory)

Advanced options [3/3]

- More alpha option
- Add hardware accelerator
  - DMA
  - Alpha blending
- Verilog implemented module and co-simulation
- emulation

Requirements – Oral

- Each group prepare an **15-minute** oral presentation on **6/18**
  - ☐ Basic requirement: show your approaches, performance, and special ideas
  - ☐ Advanced requirement: show anything you did better with quantitative analysis
- No more than **15** slides (PPT format)
- Email slides to msoc@video.ee.ntu.edu.tw
  - ☐ File name: MSOC_ORAL_GroupID.PPT
  - ☐ E-mail title: MSOC_ORAL_GroupID
  - ☐ Example:
    - MSOC_ORAL_01
    - MSOC_ORAL_01.PPT
- **Deadline: 6/17 24:00**

Requirements – Source Code

- Files to be send
  - SoC designer project, ARM code
    - clear comments should be included in the source code
  - Oral slide in PPT format, report in PDF format
- Email file to msoc@video.ee.ntu.edu.tw
  - File name: MSOC_FINAL_GroupID.zip
  - E-mail title: MSOC_FINAL_GroupID
  - Example:
    - MSOC_FINAL_01
    - MSOC_FINAL_01.zip
- **Deadline: 6/25 24:00**