EMBEDDED SYSTEMS DESIGN:

USING the ALTERA DE2-115 DEVELOPMENT AND EDUCATION BOARD

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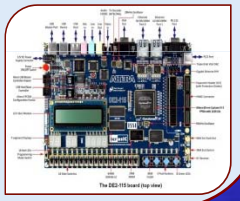
FPGA BASED EMBEDDED SYSTEM DESIGN

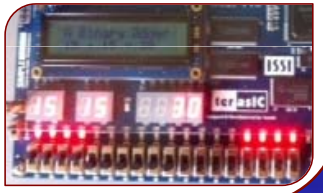
- Altera DE2-115 mounted Cyclone IV FPGA basis for programmable logic.
- Verilog used to describe hardware system.
- Architecture description language C/C++ used to describe system software.
- Codesigns utilize Nios II Soft-Core RISC processsor.
- Use of IP Cores expedite generation of hardware description files.



1ST DESIGN: BINARY ADDER

Hardware-only system designed to:

- Take in binary values through two sets of slide-switches and display value on red LEDs.
- Show decimal conversion of binary value on 7-Segment Hex displays.
- Add the two binary values and display the sum on 7-Segment Hex display.
- Display all information on 16x2 Character LCD module.



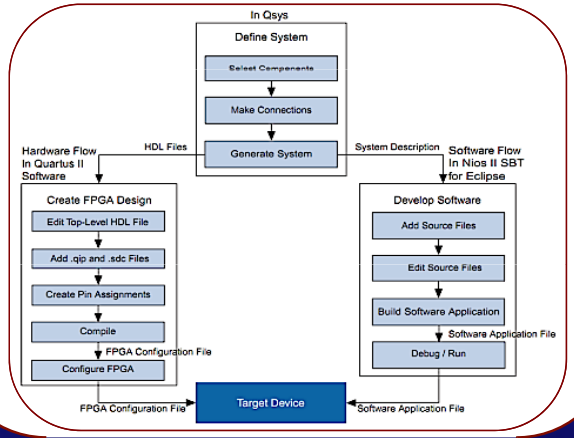
FUTURE DESIGN: tPad

Goal: Utilize Nios II Soft-Core RISC processor in design to:

- Send continuous pixel data stream to 8” TFT-LCD with 800x600 resolution (tPad)
  - Understand required timing characteristics of LCD.
- Incorporate Altera IP Cores to generate System on Programmable Chip (SOPC).
- Develop system software description files using C/C++.

METHODS: DESIGN FLOW

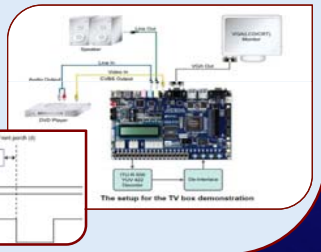
Optimized system design and implementation through partitioning of hardware description and system software.



2ND DESIGN: TV DECODER

Hardware-only system designed to:

- Convert signal from RCA output to VGA input signal for computer monitor.
- Required research:
  - Timing characteristics and implementation within hardware-only system.
  - Role and function of analog-to-digital and digital-to-analog converters in video processing.



CONCLUSIONS

- Embedded systems provide a computing advantage in real-time data processing.
  - Realized through customizable logic of FPGAs.
- Soft-core processors prevent use of unnecessary logic elements, resulting in more resource-efficient systems.
- Video streaming requires hardware specific data formatting to meet timing characteristics.
- Intellectual Property (IP) Cores allow engineers to streamline system design.
- Top-level system architecture is vital in the design and implementation of digital designs.

ACKNOWLEDGEMENTS:
This project is sponsored by NASA Office of Education through the Curriculum Improvement Partnership Award for the Integration of Research (CIPAIR), Grant Number NNX10AU75G.
Made possible through the efforts of COMETS faculty Dr. Amelito Enriquez, Dr. Wenshen Pong and Dr. Hamid Shahnasser