RichArduino Project Specifications
Version: 1.2
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Red Group

Hardware

Video Specifications

- Video output of the RichArduino will be through a HDMI 2.0 port directly connected to the Spartan 6 FPGA without an HDMI pre-emphasis controller
- Video output will follow DVI specification with 640 x 480 resolution
- Display will have a Black-white character output
- *Special character designs will be added for image rendering*

Serial Interface

- A USB 2.0 serial communication will exist between the RichArduino(device) and the External Machine Running the GUI interface(host)
- The FTDI FT201XQ (abbrv. FT) will facilitate USB communication with the host
- FT will use I2C bus to interface with the FPGA as an I2C slave
- Bus pins should be connected to general I/O pins for Spartan 6 for expansion

Shield

- The RichArduino will be have an MMA8452Q accelerometer breakout board
- The RichArduino will read values from the MMA8452Q using the I2C interface

FPGA

- RichArduino will use a Spartan 6 FPGA
- On boot up the FPGA and EEPROM will be programed by the SPI flash memory
- Flash memory will be programed through a JTAG header
- EEPROM will contain the monitor program
- FPGA will be an the I2C bus master
- *A single I2C bus will be shared by the FPGA, Shield, and FT* (reconsider to make the compliant with Arduino Shield spec)
- A GCLK pin will connected to the CLK pin of the FT

Power Supply

- The board will be powered by 5V out USB bus supply
- Use LP3990MF-1.2 power regulator to step down to 1.2 core voltage of the FPGA
- Power calculations will be done using board layout tool (current should be significantly less than the 150 mA)

Board

- The board will support a standard Arduino shield footprint
- Board will be 3.8 inches x 2.5 inches, 4 layer board with internal ground and power planes
- Board will be designed using ExpressPCB software

Software/Drivers

Software Repository: https://github.com/JabariBooker/RichArduino

Shield Specific Program

- Output raw reading of accelerometer along single axis of to display
- *Show readings along number line with ball indicating the current reading*[1]
- *Show multiple axes along separate number lines*
- *Create 2 axes graph that displays 2D vector within the coordinate space*
- *Crete 3D graph that displays 3D vector within the coordinate space*

Monitor Program

- Should monitor FT for incoming transaction over the I2C bus
- writing from EEPROM, RAM, and Registers shall be supported by the monitor program from GUI *(reading transactions of these entities as well*)
- Support a loopback interface for received data
- The base address of the a loading program and the length of the program will be specified by a header
- The program will be loaded into RAM sequentially based on the offset from the base address with Big Endian Byte order
- The RSRC Program counter will jump to the the start of a program after the number of bytes written to RAM is equal to the length of the program specified in the header

GUI/Assembler

- A two pass assembler will be created using C++ to convert RSRC assembly language into RSRC machine code
- The assembler will be integrated into a GUI interface using the QT GUI library
- The GUI will have a text input for the RSRC assembly language but will not assemble into machine code until a GUI button input by the user
- Assembled programs will add a header that demarks a new program as well as the the base address for the program
- Once programs are assembled and formatted, they will be sent to the RichArduino sequentially over the USB serial bus (this may require multiple transactions for a single line of machine code)
- GUI will use the FT open source drivers to pass machine code to the RichArduino over USB
- There will be a button input on the GUI to clear RSRC RAM and jump to the monitor program (soft reset)

Notes

Hold Reset low on power up, unttl GUI is connected
I2C pull resistor values, worry about capacitance of bus

[1] Optional requirements