PC-Based Logic Analyzer/ Pattern Generator Design

Group Members:
Yam Kin Ho
Tsang Wai Ho
Luk Yu King

Project code: VL01-05
Project Supervisor: Vincent Lau
Introduction
Nowadays, portable devices are becoming more and more common. They are normally small and user-friendly with similar functions compared with the non-portable ones, like card readers, PSP (Play Station Portable), flash driver...etc. In our project, we would like to produce a PC based portable testing device with 32 channels which functions as a logic analyzer as well as a pattern generator---a two in one device. Logic analyzer is useful testing equipment which is used to obtain the TTL waveform of the testing circuits from the 32bit channels. Besides, Pattern generator performs the exact opposite function to the logic analyzer which user generates certain signals in the PC. Both of them are for the purpose of debugging a circuit.

Aim and Objectives
Our aim is to produce a portable USB device with 2 functions (Logic Analyzer & Pattern Generator) as well as the user interface in PC at the end of the project. FPGA would be used in the hardware of the device and Verilog HDL was used to customize it. In software part, the graphical user interface would be developed by Labview. In our device, the following features would be achieved.

Features of the Logic Analyzer with Pattern Generator:
- 40 MHz sampling rate
- 32 channels (probe)
- USB device (plug and play function)
- High speed data transfer
- Small size
- A user friendly PC interface
- Affordable for most people
- Flexible triggering option
- A variety of patterns can be easily obtained by using MATLAB (a software that can be used to generate waveform by typing equation)
- External clock can be used
Data Flow
For the logic analyzer, the entry signals will pass from the channels and enter to the FPGA which is the main part of the device. This contains many control logic like buffer, triggering control, SRAM control as well as the clock system. Then the signals will exit from the FPGA, pass through a USB controller and change into USB signals before being transferred to the PC and the waveform is displayed by software called LabView.

For the pattern generator, a certain signals can be generated by MatLab. Then, the signals will pass into the device in the opposite direction from the logic analyzer.

Hardware
Software (FPGA)
Software (PC)
Future Work

- Sampling frequency can be modified by improvement the design of FPGA.
- Testing points should be inserted to the PCB for the maintenance, testing and configuration part.
- Functions of the design can be increased to comfort the user.
- USB specifications should be better handled in order to control the USB controller easily.