USB Oscilloscope

Project Statement

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Statement of Need

Signal capture is critically important for anyone working with electronics. Typically, the tool of choice is the digital oscilloscope, which displays a captured waveform on a screen. Digital oscilloscopes are generally characterized by their sample rate, analog bandwidth, bit-resolution, and memory capacity. Typical starter oscilloscopes have ~100 MHz bandwidth, 8-bit resolution, two channels, and sample at a rate of ~1 GS/s. The capability of these oscilloscopes is limited by their internal memory capacity, which forces users to trade between measurement duration and resolution. Measurement capability improves with increased memory capacity, but at a higher price (starting at ~$1000). High performance oscilloscopes with large memory capacity can exceed $100,000, forcing consumers to choose between short duration, high resolution measurements, or long duration, low resolution measurements. Thus, there is a need for affordable, high performance oscilloscopes with the capability of real time data streaming from oscilloscope to computer.

Preliminary Requirements

The oscilloscope must have the ability to stream data to a computer in real time, while competing with the resolution and bandwidth of high performance oscilloscopes. The interface between oscilloscope and computer must be user friendly and available on a majority of computers. The oscilloscope must be affordable for the average consumer.

Basic Limitations

In today’s market, the universal serial bus (USB) is the most common link between a computer and a peripheral device. The latest revision of the USB specification (3.0) requires a maximum data transfer rate of 4.8 Gb/s, limiting the performance of the proposed oscilloscope. Analog signal data must be converted into a digital form before streaming into the computer. High performance analog to digital converters are expensive (~$100), decreasing the affordability of the proposed oscilloscope. Additionally, the project must be completed before May of 2013 within a reasonable budget (~$1000).

Questions

- What operating systems must the oscilloscope be compatible with?
- What specific programs must the oscilloscope interface with? If such programs are unavailable to the consumer, what additional options do they have?
- Is it possible to use multiple USB cables for a single peripheral?
- How will we test and verify the performance of the oscilloscope?
- Is it possible to implement a function generator in addition to the oscilloscope and still maintain performance and affordability?
- Are there any aspects of the oscilloscope that may be patentable?