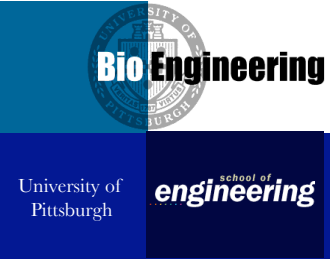


BLIP: A New Tool for Instrumentation Education

David Weiser
George Stetten, MD, PhD
University of Pittsburgh
Department of Bioengineering

BMES Annual Meeting
Baltimore MD. Sept. 2005



Introduction

With the shift in focus of bioengineering to tissue engineering and biomechanics, interest in electronics among bioengineering students has been waning. However, the need to understand basic electronics and their use in instrumentation can't be overlooked. In an attempt to revitalize the "gadgeteer" among new bioengineers, we developed a simple microcontroller-based instrumentation device that each student is required to build and use throughout the class, and then can own for later use. We call it the Breadboard Laboratory Instrumentation Processor (BLIP™).

Design

The current design of BLIP (v1.1) can act as an analog data acquisition, signal generator, frequency counter, duration timer, and digital event logger. BLIP reports data to a computer in the form of "typed" characters. No special software is required, just a text editor or spreadsheet. The processor takes power from the USB port of the computer, or from an inexpensive powered USB hub, which also supplies power for the custom circuitry constructed by students as part of the instrumentation laboratory course into which the BLIP is integrated.

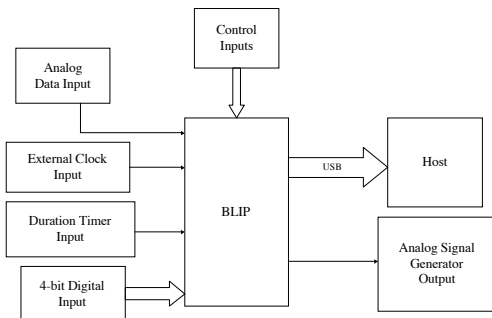


Figure 1: Block Diagram Schematic of inputs and outputs of BLIP v1.1

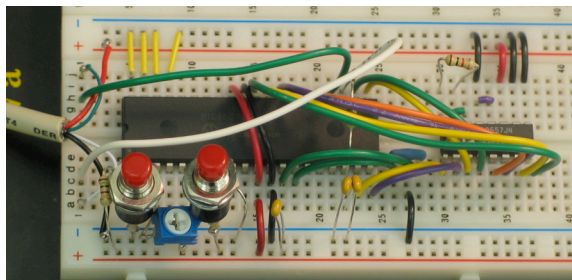


Figure 2: Fully constructed BLIP v1.1 as it would be constructed by a student.

Specifications

Analog DAQ:

Low Speed

- Sampling Frequency: ~0.3 Hz - 3 Hz
- Data Acquisition: Continuous stream

High Speed

- Sampling Frequency: 7 kHz - 50 kHz
- Data Acquisition: 64 sample packet

Signal Generator:

Low Speed

- Waveform Types: Sine wave, Triangle wave, and Square wave
- Frequency Range: 460 Hz - 6.8 kHz

High Speed

- Waveform Types: Square wave
- Frequency Range: 2 kHz - 80 kHz

Frequency Counter:

- Signal Input: Square wave oscillating between 0V and 5V
- Input Frequency Range: 1 Hz - 65 kHz

Duration Timer:

- Reports the number of rising edges on an external clock input between rising edges of the duration timer input

Digital Event Logger:

- Four digital inputs
- Maximum Event Frequency: 3 Hz

Results

BLIP v1.1 was introduced into the Bioinstrumentation class at the University of Pittsburgh in the Spring semester of 2005. After integrating BLIP into several of the lab assignments, students were requested to complete an anonymous survey concerning the use of BLIP in the course. (Figure 3)

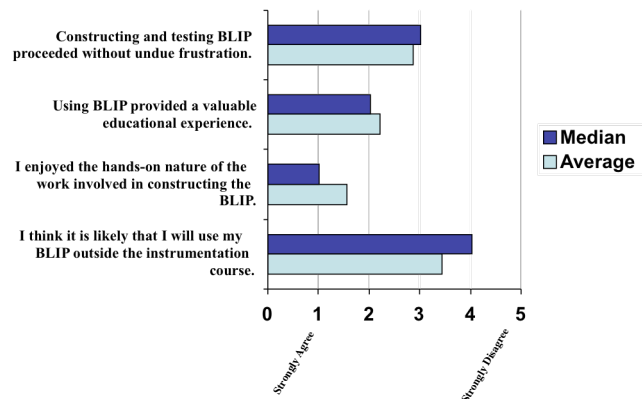


Figure 3: Student responses to BLIP in from an anonymous survey

Conclusion

While BLIP does not completely replace certain basic laboratory equipment such as the oscilloscope, it can be a valuable tool in sparking the interest of Bioengineering students in electronics. Letting each student own a BLIP avoids the need to share expensive equipment among a group of students and provides an easily maintainable and updatable alternative to such equipment. We are currently planning to use the BLIP again in our instrumentation course and in a collection of educational projects known as PittKit™, which we aim to export via an open resource at our website www.pittkit.org or www.vialab.org.