Erebus Labs STEM Sensor

Overview

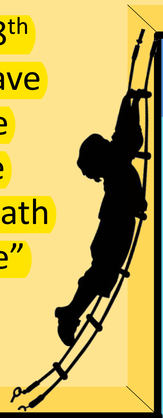
Current educational curriculum in the US lacks a focus on Science, Technology, Engineering, and Mathematics (commonly referred to as STEM). Negative interest begins in elementary classrooms where 50% of 8th graders have a hostile attitude towards math and science[1]. Furthermore, according to the United States department of education, only %16 of American high school seniors are proficient in mathematics and interested in a STEM career[2].

The STEM pipeline problem[4,5]

Objective

Our goal was to create a device that would allow students, or anyone who is interested, to easily measure the world around them. Getting kids interested in the ideas behind science and engineering is the first step to getting them interested in a STEM career later. We wanted to make the learning process as simple as plugging a sensor into a data collection device so students could focus on collecting data rather than programming complicated modules.

"50% of 8th graders have a hostile attitude towards math & science"



The Team

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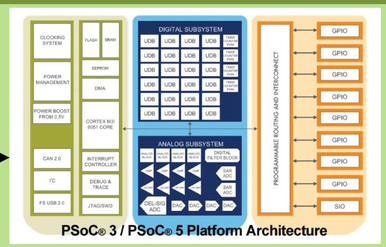
References

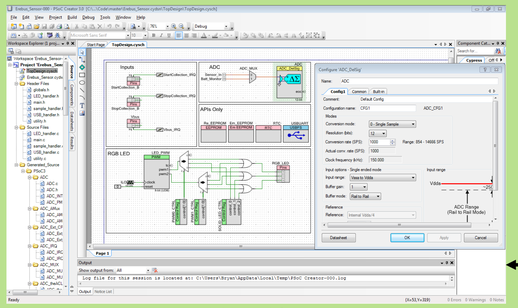
1. www.becpdx.org/nem/stemconnect.aspx
2. www.ed.gov/stem
3. http://nationsreportcard.gov/reading_math_2013
4. Image courtesy of http://www.businessandeducation.org/supporting-stem-pipeline
5. Data source: NCES Digest of Education Statistics; Science & Engineering Indicators 2008

Implementation

For the processor, we chose to use the Cypress PSoC 3 system on a chip. We chose this due to its low cost, feature set, and flexibility. The PSoC 3 architecture allows most pins to be used for any application (such as a GPIO or an ADC). It also has built in SRAM and EEPROM which helped us avoid the need for additional chips.



PSoC® 3 / PSoC® 5 Platform Architecture

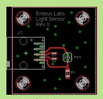

PSoC Creator Software

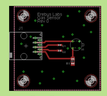
The PSoC Creator software which is used to program the PSoC 3 hosts API and block diagram based programming. While quite a bit of code still needed to be written by hand, the well documented APIs included in the software facilitated the rapid design of our prototype.

Our board design was done using the free version of CadSoft's Eagle PCB layout software. Additionally, the PSoC Creator software is free to download with no limits. This way schools or individuals who wish to work with our files are free to do so without the restriction of cost.

Final Result

Our final implementation consists of two parts; a base station and an individual sensor module. This modular approach allows for more flexibility in the future. For the initial build we chose to include light and gas sensor modules.

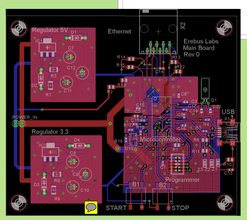

Light Sensor


Gas Sensor

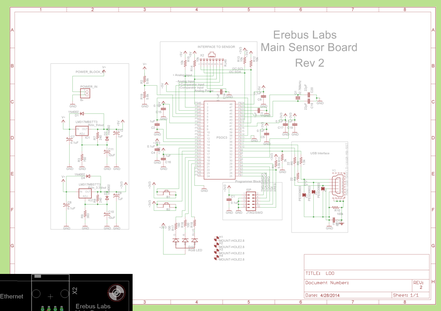
GUI Pic Goes Here

Using a GUI developed by our team, users are able to configure sample rate, download data, and view any errors present in the system.

The base station itself is simple to operate. It has a single RGB LED to indicate system state, and a single button that starts/stops sampling



Base Station Board



Base Station Schematic

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