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). Resistance to STEM begins in primary education 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[3,4]

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 data collection as plug-and-play as possible for simplicity while still allowing access to internal hardware and software for those who have a desire to dig a little deeper.

"50% of 8th graders have a hostile attitude towards math & science" [1]

The Team

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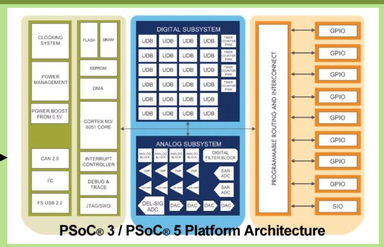
References

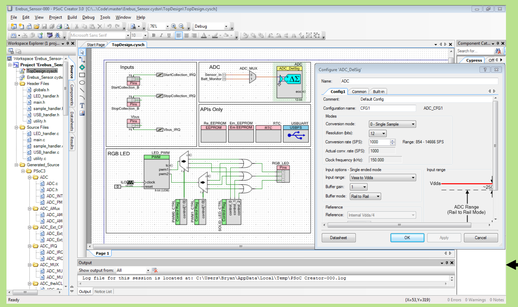
1. www.becpdx.org/nem/stemconnect.aspx
2. www.ed.gov/stem
3. Image courtesy of http://www.businessandeducation.org/supporting-stem-pipeline
4. Data source: NCES Digest of Education Statistics; Science & Engineering Indicators 2008

Implementation

For the processor, we selected the Cypress PSoC 3. We chose this chip due to its feature set and flexibility. The PSoC 3 architecture utilizes programmable interconnects which allow many chip functions to be routed to a desired pin; it also includes Universal Digital Blocks (UDBs) which facilitate custom hardware designs such as a full speed USB controller.



PSoC® 3 / PSoC® 5 Platform Architecture

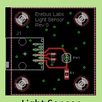

PSoC Creator Software

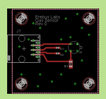
Well documented APIs in PSoC Creator, the software which is used to program the PSoC 3, enabled rapid design and development by allowing us to make high level function calls without the requirement of low level register reading and writing to implement firmware functionality.

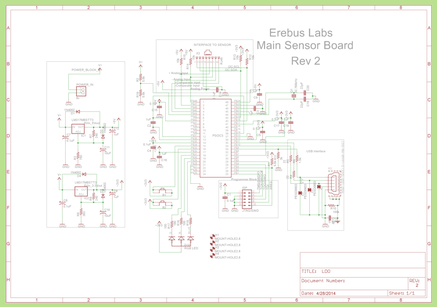
Our board design was done using the free version of CadSoft's Eagle PCB layout software. Additionally, the PSoC Creator software is free to download with no limits. This use of free software for all development stages supports the sponsors' goal of an open and accessible project.

Final Result

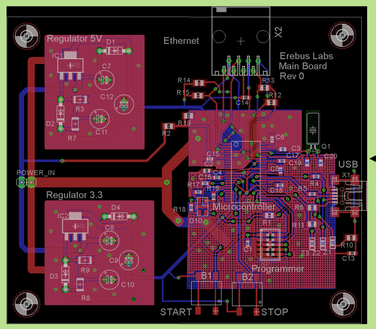
Our final implementation consists of two parts; a base station and an individual sensor module. This modular approach allows for more flexibility in the future. For the initial build we chose to include light and low-oxygen sensor modules.


Light Sensor


Low Oxygen Sensor



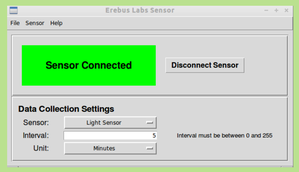
Base Station Schematic



Base Station Board

The base station itself is simple to operate. It has a single multi color LED to indicate system state and two buttons that start or stop sampling.

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



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