Project Proposal

Capturing, Analyzing, and Displaying Visible Light

February 23, 2011
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Project Abstract

The goal of this project is to capture visible light with wavelengths between 380 nm to 750 nm using a digital color light sensor, decipher and analyze the appropriate primary channels and display the color, as well as three harmonious or complementary colors, on a small 16-bit color liquid crystal display.

Strategy

This prototype will consist of a color light sensor (see figure 1), the Zilog Z16F microcontroller board, and a liquid crystal display (LCD) panel (see figure 2) capable of showing 16-bit colors. Using theatrical color filters (gels), I will direct visible, colored light into a color sensor. The sensor will then sample the light long enough to provide an accurate assessment (exact details to be determined during development). It is expected that this color sensor will provide a representation of either red/blue/green or red/blue/yellow primary channels. Many sensors provide a digital representation of the channel, such as a 10-bit integer value where 0 represents zero saturation and 3FF represents full saturation.

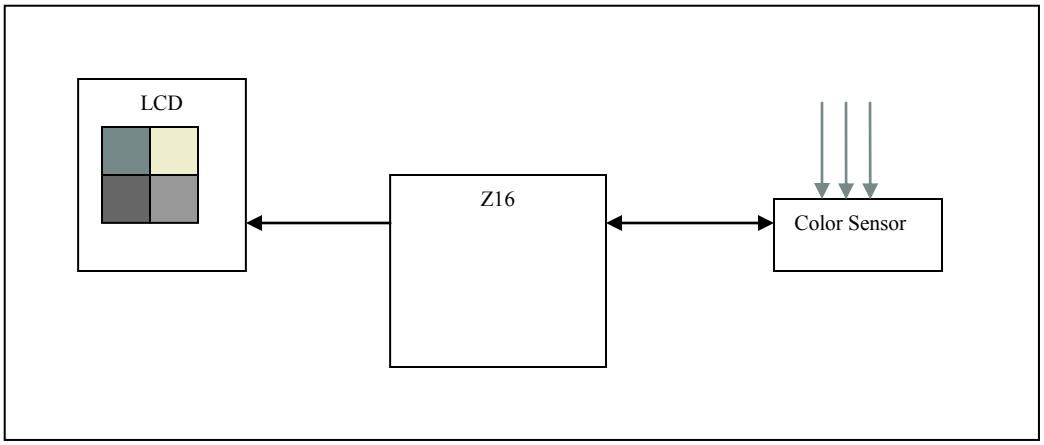
Figure 1: Sample Color Sensor

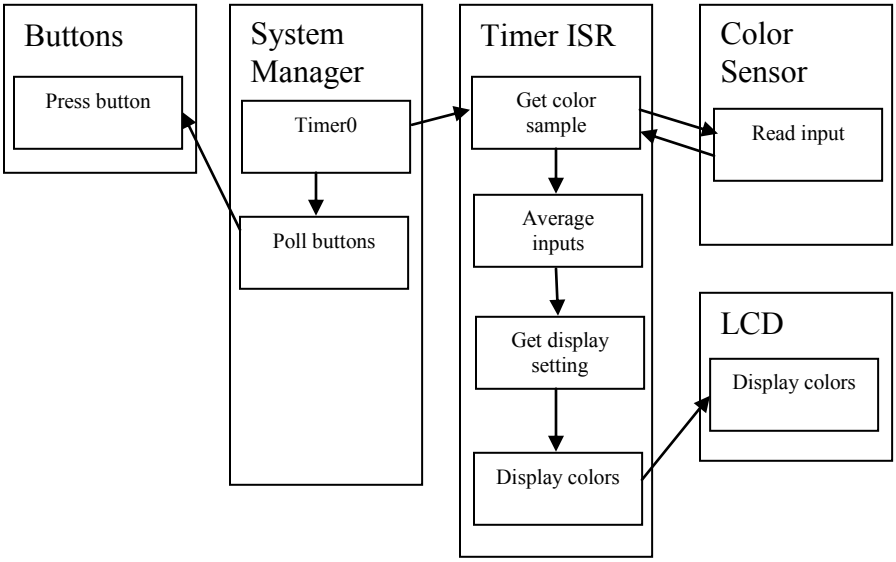
Figure 2: Sample LCD Screen

Once the primary channels are captured, I will mathematically calculate three complementary colors or three harmonious colors based on the toggling of a button. Complementary colors are colors cancel out the hue and will produce an achromatic mixture (white, gray, black) when combined. Harmonious colors are colors that, when viewed together, produce a pleasing combination. This is open to interpretation based on differences in age, gender, or culture but several mathematical functions exist to determine a harmonious combination.

Using a 16-bit LCD panel, I will display four quadrants containing the base color and the three complementary or harmonious colors.

Basic block diagrams depicting the hardware components and program data flow are shown below.





Unknowns

This project provides minimal unknowns beyond those of integrating the components. I will have to rely heavily on the data sheets to determine how to interact with the various components. I have never worked with an LCD display either, so this will give me an opportunity to understand their limitations. I am assuming that they operate on a similar persistence of vision requirements like our LED arrays.

Implementation Plan

I must first purchase the sensor and LCD display. Components that satisfy my requirements for this project are fairly abundant and low cost so I do not foresee any issues with ordering them. During the shipping lag time, I will write the appropriate algorithms to calculate the harmonious and complementary color channels as well as to perform the other various tasks.

After the components arrive, I will build the prototype in two phases. First, I will integrate the color sensor and write the code used to capture the various color channels. For debugging purposes, I will output the data through a serial port to my PC. I must also account for filtering the light source and ambient light, as the theatrical gels are assuming that pure white light is passing through them. Since I will be using a inexpensive flashlight or other light source, it will likely have a warm light source that will appear more orange. If this poses a problem with the gels, it must be accounted for and filtered out. I estimate approximately two weeks to complete this phase.

After capturing light has been completed, I will integrate the LCD panel to display the color digitally. In addition, I will perform the required calculations to find the colors harmonious and complementary colors. I estimate that this phase will require three weeks to complete. I should have approximately one full week to debug and test the project.

Key Milestones

3/5/2011 – Receive ordered components
3/20/2011 – Complete color sensor integration and testing
3/22/2011 – Provide project status report
4/12/2011 – Complete LCD integration and testing
4/19/2011 – Class demonstration
4/26/2011 – Final report due