Automated Water Sampling

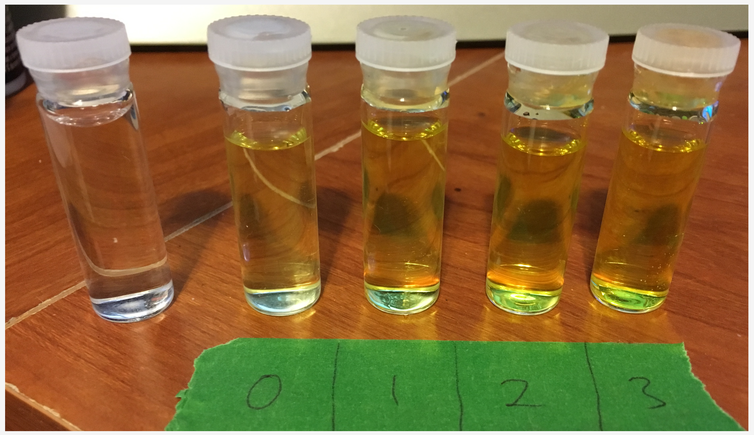
Thompson Rivers University

Chad Fawcett

Supervisors: Kevin O'Neil, Sharon Brewer

The Problem

Testing water for disinfecting chlorine species is an essential part of ensuring safe, clean drinking water. If you live in a city, you most likely never even think about your water. A resident can simply turn on their tap and have safe drinking water instantly. Most cities have expensive automated systems constantly monitoring and treating the water. In the smaller surrounding communities, this is rarely the case. Water will be treated locally, often for just a handful of homes. These are the communities that cannot afford costly automated system and resort to manual testing.



Manual testing for the chlorine species involves observing the colour after chemical reaction and relating the colour to the concentration of the disinfecting chlorine. In order to keep the water safe there must be a certain level of disinfecting chlorine.

Testing manually presents many difficulties. From room lighting to partial colour blindness, there is a lot that can interfere with properly reading a sample.

Colour blindness happens to be a fairly common occurance among people. It's estimated that approximately 8.0% of men and 0.4% of women are affected by some type of colour blindness. Nearly 95% of those affected have a common abnormal perception of red and green colours. This is important to know as a lot of water testing mixtures turn a red or green tint for the different amounts of chlorine/pH in the water.

Manual data entry also allows room for error. Even with a cautious data enterer, typos can still happen which could cause issues. Either a false positive, causing alert for people drinking the water, or even worse, a false negative, which would mean the people drinking the water may never be alerted to a water quality issue.

The goal of this project was to research the possibility of developing an automatic colour sensor for water quality testing.

Hardware

The hardware consists of a micro controller, colour sensor, and portable computer. The Arduino is a very popular and easily accessible micro controller. Adafruit RGB Colour sensor is a simple sensor that connects to the Arduino to sense real world colours with very accurate results. Both pieces of hardware are connected to a portable computer that does the colour analysis in order to determine chlorine levels.

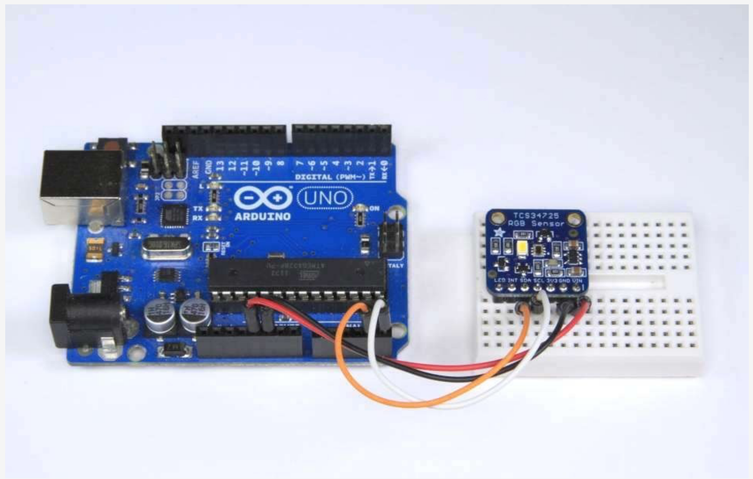


Photo by Adafruit

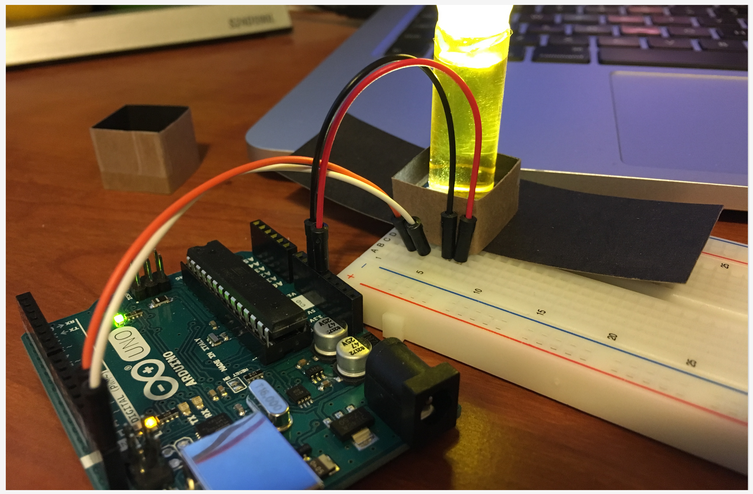
Software

The Adafruit TCS34725 Colour Sensor Driver is an Arduino libarary developed by Adafruit to easilly communicate with the colour sensor using an Arduino. The sensor communicates over the I2C protocol. This library makes the reading from the sensor much easier as the use does not have to worry about the complications of communicating with the sensor.

Connecting a portable device allows for more complex data analysis and colour comparison to known values. Once the reading has been determined the portable device could store the record for further reporting.

The Results

Based on the research done, I would say the Adafruit RGB Color Sensor paired with an Arduino would be a great setup to do water sampling. While the tests performed were only done using a chlorine reagent, the hardware and software could easily be modified to work with various other reagents.
The hardware solution could also be paired with many different software solutions. My tests incorporated connecting the Arduino to a computer to read the results, but this is not the only option. Smart phones would allow for a very portable solution to run the analysis software. Another mobile solution would be to create a standalone solution that displays the results directly to a display. This last solution, however possible, is heading more in the direction of what is already available on the market. The standalone devices are usually very closed and more expensive because they can't take advantage of the popularity of smart phones to bring down the price.



With the time spent researching these details, we can see that it is in fact possible to make a cost effective automatic chlorine sampler. Reducing the amount of steps an operator takes can help prevent mistakes and false readings. By having the reading in an electronic format right from the source, it also prevents false reporting and delayed reporting.

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