

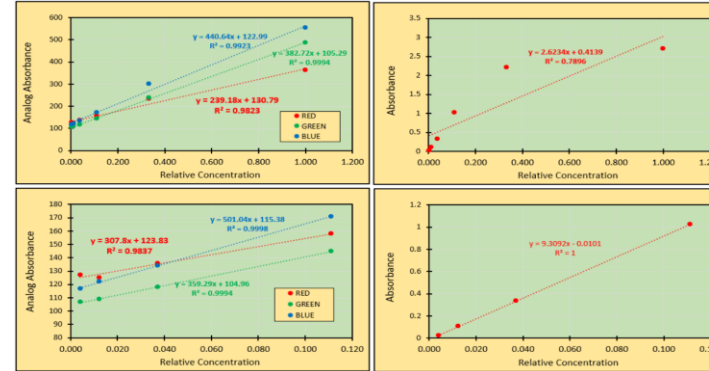
Developing an Automated Spectrophotometer with RGB LED and LDR Sensor Using Arduino Microcontroller

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Q1: Research Questions:

The research focuses on developing a spectrophotometer using RGB led, LDR sensors, 3D printed sampling cartridge, and Arduino Mega. This was conducted to show viability of RGB Spectrophotometer using inexpensive technology in conjunction to systematic programming to reproduce commercial spectrophotometers

Q3: Data Analysis & Results:



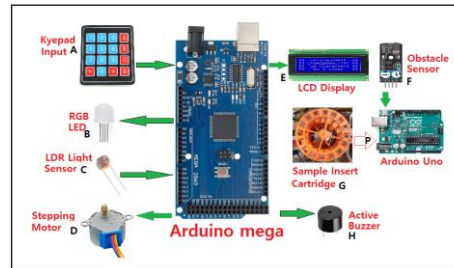
Chemical Testing Articles	Red Food Dye		Methylene Blue	
	TRUE	Measure	TRUE	Measure
1	0.045	0.048	0.5	0.43
2		0.038		0.59
3		0.052		0.4
4		0.049		0.62
5		0.044		0.55
6		0.046		0.47
Mean		0.046		0.51
STD		0.00141		0.028284
Accuracy		2.60%		2.00%
Precision		3.05%		5.55%
Accuracy = Abs (True-Measure)*100/True				
Precision = STD*100/Mean				

This table shows the result of a T-Test; the accuracy deviates by around 2%, and the precision by 3-5%. These numbers could surely be reduced.

Our results are structured such that the bottom graph is an expanded version of the leftmost points of the top graph. This is for reader clarity. The results are incredibly promising, all except two showing higher than .99 as its regression coefficient.

Q2: Methodology/Project Design:

Using the Arduino Mega as the central board, different parts were used to allow user input (Keypad), shine RGB light (led), quantify light intensity (LDR sensor), rotate cuvettes (stepping motor, Sample insert cartridge), and display the results (LCD Display). A custom program was created to read the first 6 cuvettes, calculate the best light according to the R2 formula, and then quantify the density of the solution for the next 10 cuvettes with the same type of solution. Finally, the LCD displays the results of the density.



Q4: Interpretation & Conclusions:

- Our research conclusively shows that it is possible to expand upon existing spectrophotometers' capabilities and preserve the accuracy to a considerable degree whilst simultaneously reducing the cost by an exorbitant amount.
- It is possible to improve accuracy, further research would include this as a top priority. It achieves a high regression coefficient (above 0.995) for various samples, demonstrating that it sometimes outperforms commercial spectrophotometers.
- This innovation offers a portable, affordable alternative to traditional spectrophotometers, potentially impacting clinical labs, pharmaceuticals, and environmental monitoring.