The Applications of Peristaltic Pumping Systems in Chemistry Laboratories

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The purpose of this project is to determine the applications of automated peristaltic pumping systems in high school classrooms and other chemistry laboratories. A lack of affordable, accurate, and time efficient solution and liquid measurement options is frequently a problem for high school teachers, students, and professional chemists. The first step in creating a potential solution to this problem was surveying teachers and professional chemists to develop a set of criteria and constraints. Through the survey, it was determined that a solution must be more accurate and faster than current high school laboratory measurement devices, be able to dispense at least three different chemicals simultaneously, safely handle acids and bases, have built in functions for titrations and dilutions, and have a total cost of no more than $300. Using these criteria, a potential solution was designed, which ultimately was comprised of peristaltic pumps, optical encoders, an Arduino Uno microprocessor, and a laser cut acrylic enclosure. This prototype, named the ChemiCube, underwent several thorough accuracy, durability, and efficiency tests. Using intermediate test data, the ChemiCube was reengineered three times to be more accurate, affordable and durable. The most recent design of the ChemiCube satisfies every one of the criteria presented as part of the problem and has even demonstrated additional functionality, such as acting as a STEM education tool. This project and the ChemiCube provide convincing evidence that automated peristaltic pumping can be a very viable and affordable solution to the measurement struggles faced by students, teachers and chemists.

Awards Won:

Second Award of $2,000