**Proposal to the IEEE Denver Section**

**Support for a Cherry Creek High School Program to investigate Non-invasive Glucose Monitoring Using Photoacoustics**

**Date:** September 10, 2016

**Name of Applicant:** Clyde Oakley

**Position/Title of contact person:** Science Teacher

**Affiliation:** Cherry Creek High School – Science Department

**Requested Funding Amount:** $1000 but any amount would be helpful. (Project cost is $2898, of which $500 has been covered by another grant.

**Project description:**

The project is for students to design, build, and test a Photoacoustics system to determine if it can be used as a non-invasive glucose measurement device for diabetics. Students last year constructed a photoacoustic test system from scratch and measured glucose concentrations with it. The system did not have sufficient repeatability and sensitivity but students proposed a number of promising improvements to increase the sensitivity significantly. This year those and other recommendations will be carried out.

**Educational Value:**

This project incorporates all component of STEM. The objective is stated in the section above. This is work that would ordinarily be done in graduate school yet it can be accomplished using the physics principles learned in this high school class. I am unaware of a project of such magnitude and significance being done in any other high school anywhere.

Students will apply knowledge of light waves, optics, photonics, sound waves, energy conversion, electrical design and construction, mechanical design and construction, use of digital oscilloscope, analysis using MatLAB software and experimental design. They will also learn about diabetes and the potential impact on health care that this project could have.

The project is operated as it would be in an Engineering design firm with different groups designing subsystems and communicating regarding development of consistent specifications. Thus students also learn about project management, Gantt Charts, Bills of Material, Task lists and other valuable lessons regarding how a major project is conducted. Finally they learn to do investigational research, write papers , develop posters to show their work, and defend their posters to engineers, university professors, and grad students in a Poster Symposium sponsored by CSU and the Cherry Creek School District.

**Measures of success:**

The primary measure of success will be the completion of a functional PA glucose detection system presentation of the work at an internal poster symposium. If appropriate, I would like to propose that the students present their work at and IEEE Denver Section “Dine and Learn.” The posters and presentation will include an evaluation of the system as a means to create a non-invasive glucose detection system that can be used on humans. The work will be evaluated by engineers and faculty and other interested community goal. A stretch goal is to obtain information that has sufficient value for publication.

**Tie to IEEE:**

I hope that there will an opportunity to have students present this work at some local IEEE forum. One possibility would be to present it at a Denver Section “Dine and Learn” as mentioned above but I am open to other possibilities.

**Use of Funds:**

The uncovered funding is for equipment and supplies that has been purchased with funds borrowed from other accounts which must be repaid and for equipment and supplies not yet purchased.

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| ***Budget Categories*** |
| **Personnel**: (not  Salary or sub-time),  Guest speakers, etc. |
| |  |  |  | | --- | --- | --- | | **Equipment and Supplies** |  |  | | Diode 1625 nm w fiber | $695 | Thorlabs 1625 nm, 50 mW, E Pin Code, SM Fiber-Pigtailed Laser Diode, FC/PC | | TO-9 1930nm with fiber | $1,000 | Akela and Seminex collaboration | | Small 2 axis x-y | $0 | Loaned by MD Medtech | | 2 axis goniometer | $230 | Thorlabs | | Vertical motion manual actuator | $0 | Loaned by MD Medtech | | Glucose | $45 | 2.5 kg anhydrous dextrose - Flinn Scientific | | Temperature Aquarium controller | $65 | Omega through Cole Parmer | | 2 25 mm Borofloat windows | $47 | Edmund optics | | 2 10 mm Boroflat windows | $30 | Edmund optics | | USB to scope | $20 |  | | Lab view 2014 2 seats | $387 | National Instruments | | Second Oscilloscope | $379 | Rizol 1054DZ Charge to CTE budget | | **TOTAL** | **$2,898** |  | |
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| **Total Costs $2,898** |