Development of a CO2 Analyzer for Health Monitoring

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***Abstract*— The development of this CO2 analyzer is for health monitoring purposes for diseases such as Cardiovascular disease, Asthma, & COPD. It is a low-cost high-efficiency device consisting of colorimetric sensing technology. The colorimetric sensor consists of a pH dye, reactive element, and base coated on a Teflon membrane. It is used in the form of measuring light transmittance via simple LED along with the flow rate, ambient relative humidity, and barometric pressure. It is also consisted of a built in rechargeable and long-lasting battery for easy use.**

I. Description of your project

Asthma has been a disease since approximately 400 BC. It has become a huge issue today and an estimation of 6.2 million children under the age of 18 have been clinically diagnosed with it. Asthma is a huge risk factor for developing Chronic Obstructive Pulmonary disease also known as COPD. This very similar disease tends to develop in people past the age of 40. As of today, an estimated 24 million Americans are diagnosed with it according to the National Institute of Health.

The goal for this device is to be able to monitor the health of an individual's progress. The base of this system involves an individual breathing into a flow tube consistently to which will then be transmitted into a signal and the given results will be displayed via smartphone application which will be explained in further detail below. The smart phone application is also an application made specifically for this device from a fellow ASU graduate student.

One of the most important factors of this device is the structure of the flow tube itself apart from the housing. It is a huge aspect to have accurate flow rate measurements when utilizing a volumetric Capnography. The flow tube has what is called a Bent-tube design used to restrict any direct ambient light from the pathway. The Bent-Tube design also produces better flow of CO_2 directly into the surface of the colorimetric sensor which will be introduced shortly. It has deep channels in the base of the sensor chamber to reduce the impact of light interference by rejecting reflected light. An example of the flow tube is shown below in figure 1.

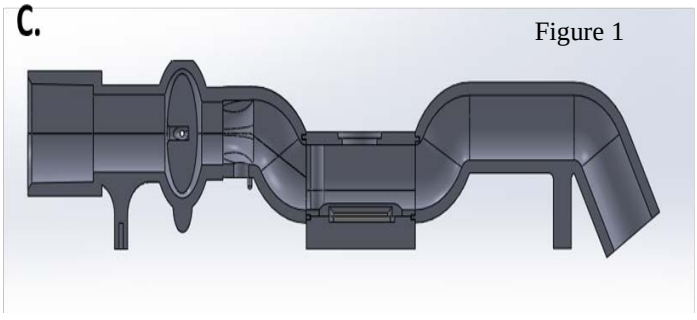

Figure 1

The colorimetric sensor, is a sensor created by another ASU graduate. It is a solution of M-Cresol Purple, Glycine, and quaternary amine base coated in a thin film of a porous Teflon membrane. In a short general explanation, the sensor will change to a lighter color based upon the sensation of CO2. The higher CO2 levels, the more light from an LED will be transmitted through the sensor. The color change is then translated into a signal as previously stated and can be manipulated for better accurate results through software.

Next, within every research experiment there will always be a problem. A big issue we encountered throughout this development was we found that the flow sensor was subject to temperature change. It was giving inaccurate measurements of inhalation and exhalation along with inaccurate changes on end-tidal and slopes when comparing it to a commercial manufactured device. The results for this can be seen in figure 2. A solution that is currently in progress

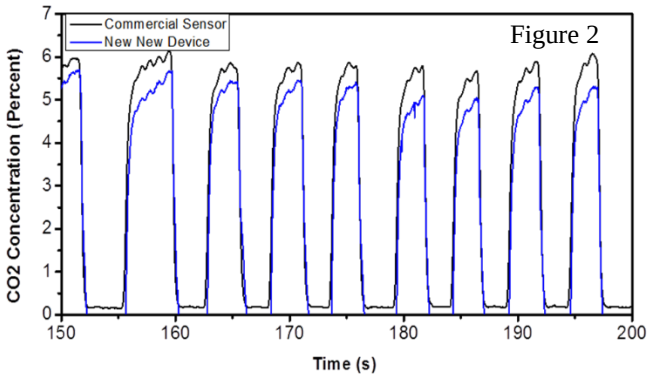

Figure 2

is implementing a heater to the flow sensor itself to get it to reach normal body temperature at 35 Celsius.

Furthermore, the signaling processing algorithms began to take place via MATLAB to further analyze the data and be able to manipulate it for more accurate results.

References

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