Research Experiences for Teachers and Young Scholars in Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST)

csats Center for Science and the Schools

Development of Ozone Gas Sensor Casings

Gabriella McCracken [1], Alex Tellado [2], and Dr. Thomas Jackson [2] (Mentors)

[1] Tyrone Area Senior High, Tyrone, Pennsylvania; [2] Department of Electrical Engineering, Penn State University

Overview

Ozone sensors and monitoring systems are used in a wide range of monitoring and controlled applications. Ozone gas sensitive semiconducting power allows for high accuracy when analyzing this data. Ozone sensors have a high value to the ASSIST project because of ozone levels being linked as a factor for asthma attacks.

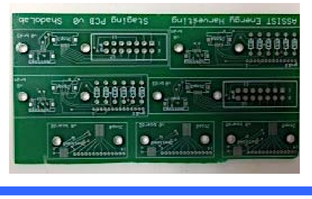
Motivation

The goal of this project was to design sensor casings and housings for flexible cables on a microscopic scale. After designing the sensors, casings needed to be created in order to house sensors, flexible cables, and a control board. In order to manufacture these housings, a Da Vinci 1.1 Pro 3D printer was used.

Figure 1: The Control Board that reads that amount of Ozone.

Figure 2: The actual sensor that is attached the flexible cables, The cables and the sensor can be designed to be any size.

Casings need to house the sensor, flexible cables, and control board on a very small scale. An idea for housing could be a watch where a control board which can be cut to any size, could be attached and the casings could be mounted onto the face of the watch much like the ones seen below.

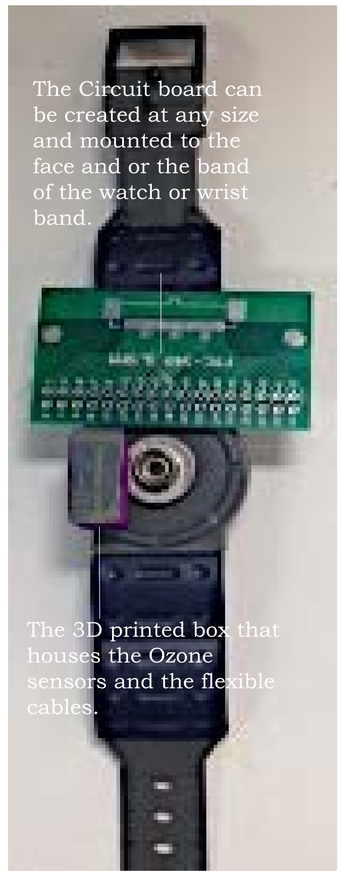


Methodology

The design for sensor housings are drawn up on the Sketch Up program which is the design program that came with the printer. The design is then converted to a program called MeshLab.
After analyzing the design in this program, it can be transferred to the XYZ printing program where it can then be printed on any scale. These designs have to meet the requirements that were found which includes a certain size and density. The finished product is a rectangular "box" that has the structure and design to be mounted on a watch and contains areas for flexible cables.

The Da Vinci 1.1 Pro 3D printer uses ABS Plastic, also known as filament, to manufacture the design being printed. The plastic that was used for the box was ABS plastic which has a melting point of 221° C. The "box" was printed to the exact dimensions of 10 mm by 12.26 mm. The density of the box was 50%. The printing program enables the printer to print any density from a range of 5%, which is considered hollow, to 90%, which is considered full. This box was printed at a lower density in order to achieve more of a flexible design.

Results



This design has enabled the release of Ozone gas to be tested with the sensors. The design ultimately has made this possible with channels for gas to flow through and flexible cables to be contained within the small container. This plan has been modeled with high accuracy with precision.

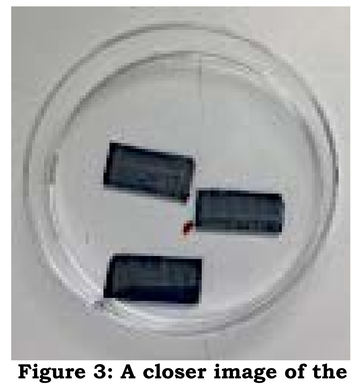


Figure 3: A closer image of the sensors.

These micro-sensors will enable the world's population to monitor the amount of Ozone that they are breathing in. The use of a casing not only protects that sensor from moving around in the watch, but has the power to encase the gas within so that the sensor can get an exact read on it.

Future Work

Over 23 million people struggle with Asthma and over 100 million are hospitalized with Asthma related symptoms. The use of Ozone Sensors can impact the treatment of Asthma. While 3D printing presented many challenges, it provided a good base for the development of these casings. This box is the first design for the type of casings that could be implemented for a wearable device. Now that the limitations including size and density are known, there can be different designs for the ultimate goal of sensors and casings for the wearable device.

The ASSIST RET and Young Scholar programs are funded by NSF nanosystems engineering research center grant EEC 1160483.