Name(s)	Project Number
Anna K. Simpson	**S0899**

Project Title

Chemical Sensing with Porous Silicon on an Autonomous Robot

Abstract

Objectives/Goals

The challenge of this project was to create an autonomous robotic system that could sense chemical vapor. Using porous silicon, which changes color when chemical enters the pores, I hypothesized that I could create a highly sensitive vision sensor to interface with a LEGO RCX microcomputer using standard electrical parts. The microcomputer could then be programmed to respond autonomously to the chemical vapor.

Methods/Materials

A porous silicon optical interference filter was attached to a photodiode, and then combined with an LED that matched the spectrum of the silicon to make a chemical sensor. The system was put into a black box to eliminate the effects of ambient lighting. Characteristics of the signal, such as noise, were measured, and I did repeated tests using a syringe and various concentrations of ethanol to determine the size of the signal change. I taught myself the programming language LabVIEW to create the necessary programs for data collection and robot response to chemical.

Results

Isolating the LED, porous silicon, and photodiode inside the box kept the noise and drift of the sensor readings very small. The change caused by the chemical was far greater than this noise, generally 8-10 units greater. The robot was able to quickly detect and sound an alarm when chemical was present, even when it was just over a container of chemical with a syringe to draw the outside air in.

Conclusions/Discussion

I created, wrote control programs for, and tested a chemical sensor on an autonomous robot and demonstrated that it could sense chemical vapor with sufficient accuracy to sound an alarm. My success in developing and testing the sensor system also suggests possible future expansions to the project, such as making this autonomous robotic chemical detector mobile.

Summary Statement

In this project, I created, wrote control programs for, and tested a chemical sensor on an autonomous robot and demonstrated that it could sense chemical vapor with sufficient accuracy to sound an alarm.

Help Received

Used lab equipment under the supervision of and recieved porous silicon samples from the lab of Professor Michael Sailor at UCSD