

Using Light Emitting Diodes as Light Sensors for the Detection of NO₂

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This project aimed to develop and test an inexpensive and effective detector of NO₂ using LEDs (Light Emitting Diodes). I hypothesized that an LED that was configured as a light sensor would respond to changing levels of NO₂. In theory, the LED's output voltage would decrease as concentrations of NO₂ increased, because NO₂ absorbs light at specific wavelengths. The response should be especially apparent in LEDs which detect light within the wavelengths of the absorption peak of NO₂ (~ 300 - 550nm). I built two circuit boards, measured the detection ranges of all LED sensors on the first version of the sensor with the use of a monochromator and an oscilloscope, and recorded output voltages for both versions of the board when they were exposed to the sun on days with varying concentrations of NO₂ as determined by a state air monitoring station. I also conducted tests with my second circuit board to determine if it could detect changes in the amount of NO₂ in vehicle exhaust over time. The data collected with the monochromator and oscilloscope showed that LEDs can detect light in specific wavelength bands. In addition, some LED readings from both boards showed a decrease as the concentrations of NO₂ increased. In the vehicle exhaust test, the data collected from the LEDs correspond closely to NO_x concentration data collected simultaneously by an emissions monitoring system. All of the data that I have collected thus far suggest that LED sensors can detect NO₂.