



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

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Project Title HazardBot: Surveying Hazardous Environments	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Create a sophisticated, yet low-cost, mobile robot platform with various sensors to survey hazardous environments. The robot is to be controlled from a remote distance. All data gathered from the sensors is analyzed and displayed on a web interface, along with a live video feed.</p> <p>Methods/Materials The main computing platform is the Raspberry Pi microcomputer, connected to a 10-bit Analog to Digital Converter. Six channels on the ADC are used to gather the voltage data from the temperature, smoke and flammable gas, alcohol gas, and carbon monoxide sensors, as well as the two batteries. Baseline tests were conducted by exposing the sensors to different levels of carbon monoxide, smoke, flammable gas, and alcohol gas to calibrate the sensitivity. A webcam is also used to provide a live video feed to help the operator navigate. For the robot's motion control, the PIC18F4620 microcontroller is programmed to decode messages from a wireless receiver and operate the two servo motors accordingly. All components are wired together on a breadboard. The Raspberry Pi interfaces with the PIC18F4620 using coded messages to allow the robot to be controlled from iPhones, iPads, tablets, computers, or any device that supports a compatible web browser.</p> <p>Results The robot could navigate in all directions, while analyzing the environment for hazardous airborne substances. The robot successfully detected different levels of gases and displayed the results on a web page over a Wi-Fi network. The live video feed provided a very high quality video stream to the web browser. The battery monitoring program functioned as expected, displaying data on current battery life and showing how much power each battery has.</p> <p>Conclusions/Discussion We learned that batteries can experience brownouts, when a battery voltage level drops below critical threshold for control circuits to function properly. This would occur only when a demand for current would spike more than the maximum current that the battery can supply, as in the start of a motors. In order to prevent the brownout occurrences, separate batteries needed to be used for the control circuit and the motors. We also encountered an issue with cross detection between sensors. The sensors detected more than one type of gas. Therefore, we could not positively identify what kind of gas was detected.</p>	
Summary Statement The robot built is sophisticated, yet low-cost, used for surveying hazardous environments.	
Help Received Dad helped with soldering and cutting display board.	