



# CALIFORNIA STATE SCIENCE FAIR 2014 PROJECT SUMMARY

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<b>Project Title</b> <b>Early Warning System for Earthquakes Based on Environmental Precursors</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The main goal is to design, develop, implement and test a device which could provide an early warning system for Earthquakes. The purpose of this project will be to detect and measure four relevant earthquake precursors; Radon Gas, Ozone, small Magnetic Field fluctuations and Low-Intensity compression waves.</p> <p><b>Methods/Materials</b> We obtained, magnetostrictive material (Metglas), piezoelectric plates, a UVB light source, a UVB sensor, darlington resistor, small piezoelectric plates, a pressure sensor and a temperature sensor. Each sensor was designed and built from off-the-shelf products. After designing and building each sensor, simulated data was acquired by each sensor separately. The Data was collected and calibrated using Vernier voltage, pressure and temperature probes and Logger Pro software. Each sensor was tested to its limit of detection. In every experiment we checked for stray electric and magnetic fields.</p> <p><b>Results</b> From our results we were able to detect very small levels of Ozone in our UVB detector, from the magnetometer we were able to detect magnetic fields fluctuations as small as 1 nT at 1-10 Hz at room temperature, from our Radon detector we can detect Gamma and Alpha radiation 1 meter from the detector. And from our low-intensity compression wave detector we are able to detect extremely small displacements.</p> <p><b>Conclusions/Discussion</b> With off-the-shelf products we were able to design, develop and implement and test a device that senses some important precursors of an earthquake. Our data indicates that the device does detect relevant and important earthquake precursors with a highly reliable accuracy at all times. Usage of 4 sensors instead of one increase the prediction accuracy and ultimately the development and deployment of a sensor based early warning system. Suggested follow-up efforts include large scale deployment of the sensors and sensor networks in earthquake prone regions for field tests and ultimately the development of a sensor-based early warning system.</p>	
<b>Summary Statement</b> This project is on developing, and testing a device which could provide an early warning system for Earthquakes based on precursors; Radon Gas, Ozone, small Magnetic Field fluctuations and Low-Intensity compression waves.	
<b>Help Received</b> Our project advisor, Mr. Dimauro helped us by correcting our mistakes on experimentation. My best friend Aaron Aliga helped me by providing needed equipment to build the prototypes. USGS, NOAA, EPA helped us with obtaining Earthquake data, Ozone and Radon level achieves	