



**CALIFORNIA STATE SCIENCE FAIR  
2016 PROJECT SUMMARY**

<b>Name(s)</b> <b>Sophie Q. Carter</b>	<b>Project Number</b> <b>J0906</b>
<b>Project Title</b> <b>Indoor Navigation Using Magnetic Fields</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The goal of my project is to be able to locate a person indoors using a magnetic map created by data collected on a cell phone.</p> <p><b>Methods/Materials</b> I used a Motorola Droid cell phone equipped with magnetometer, gyroscope, accelerometer, and GPS. I used the AndroSensor app to record sensor data from the phone. I also used the computer program Matlab to create my magnetic maps. I collected magnetometer data in nine aisles at Ralphs. I took three runs down each aisle, two facing South and one facing North. I interpolated the magnetometer data and created magnetic maps of each aisle. Then I had an assistant collect data in four of the nine aisles. I compared the four mystery aisles to my magnetic maps and could determine which aisle the mystery data was collected from. I used Matlab to write a computer algorithm that could match the mystery data to the correct aisle by reading it's mean squared error(MSE). The lowest MSE would be the corresponding match for the mystery data.</p> <p><b>Results</b> The magnetic field throughout the aisle varied from about ten to fifteen micro Teslas and these variations could be detected by the cell phone. The data could be used to create accurate magnetic maps. The Matlab program matched the mystery runs correctly to their corresponding aisle. Overall, the experiment was successful.</p> <p><b>Conclusions/Discussion</b> Buildings have magnetic signatures that are unique and reproducible from one location to the next. I created an algorithm that correctly identified which aisle of a grocery store I was walking through using my cell phone. My experiment has many future applications and can eventually be used as an indoor navigation system.</p>	
<b>Summary Statement</b> I demonstrated the possibility of indoor navigation using a cell phone to measure magnetic fields in buildings.	
<b>Help Received</b> Dr. Carter advised me in the project by showing me how to use Matlab.	