



**CALIFORNIA STATE SCIENCE FAIR  
2005 PROJECT SUMMARY**

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| <b>Name(s)</b><br><b>James B. Bonner, IV</b>  | <b>Project Number</b><br><b>S0702</b> |
| <b>Project Title</b><br><b>Determining the Accuracy of an Ultrasonic Proximity Sensor vs. an IR Proximity Sensor using Autonomous Robots</b>  |                                       |
| <p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b><br/>The purpose of this experiment was to determine which type of proximity sensor, ultrasonic or infrared, is most accurate at detecting the presence of an object. The ability of proximity sensors to detect the presence of objects allows the ability of envisioning a foreign and dynamic surrounding without possessing the sense of sight. Therefore, proximity sensors can be used to replace the nonfunctioning eyes that burden the blind or to assist in the autonomous navigation of robots.</p> <p><b>Methods/Materials</b><br/>To test this problem, several objects, each varying in size, shape, and dimension, were placed in front of an autonomous robot, equipped with either the ultrasonic proximity sensor or the infrared proximity sensor. The object was placed at varying distances from the sensors to test the distance of each sensor's sensing range. In addition, the sensor's output energy was emitted at different angles.</p> <p><b>Results</b><br/>Following the completion of testing each sensor's accurateness at detecting the presence or absence of an object, the results indicated that the original hypothesis, which stated that the ultrasonic sensor would be the most accurate sensor in its ability of object detection, was supported.</p> <p><b>Conclusions/Discussion</b><br/>After conducting extensive research pertaining to electronic sensors and analyzing the experimental results, a probable explanation was postulated.<br/>The infrared sensor experienced difficulty in detecting objects from the 30cm marks. This is most likely attributed to the large #dead spots# infrared sensors experience when sensing objects from far distances. The autonomous motion trials also support this inference. In the autonomous motion trails the robot equipped with the infrared proximity sensor stopped much later than the robot equipped with the ultrasonic proximity sensor, implying that the infrared sensor's sensing range is shorter than that of the ultrasonic sensor.<br/>Another flaw the infrared sensor possessed was its high susceptibility to ambient infrared light. In trial where the ambient infrared light circuit projected infrared light with a wavelength of 940nm, the IR receiver module mistook these received beams of infrared light as reflections of the emitted light beams. This data proves that infrared proximity sensors misread the absence of an object when the IR receiver module intercepts ambient beams of infrared light.</p> |                                       |
| <b>Summary Statement</b><br>This purpose of this project was to determine which type of proximity sensor, ultrasonic or infrared, is more accurate at detecting the presence of an object.  |                                       |
| <b>Help Received</b><br>No help was received during the execution of this science project.  |                                       |