CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

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Project Number

J1022

Project Title

Crash Avoidance System

Abstract

Objectives

Design, build, and code a remote-control car that automatically stops when it senses an object in front of it. The automatic stopping should engage when it senses an object that is half as tall and a fourth as wide as the car.

Methods

Three candidate sensors (Maxbotix, Ultrasonic, and VL53LOX) were obtained and tested using a non-motorized platform. A prototype vehicle was made by wiring into a remote-controlled car, attaching a sensor to the front of the car, and programming a controller to turn the car s motor off when an object is detected a meter away from the sensor. I observed that the car coasted forward after the motor was turned off. The prototype was revised by adding two relays that made the car s motors turn in reverse before turning off when an object was detected 20 cm away. This new prototype was tested using wall heights and positions, and cylinder diameters and positions with three sensors.

Results

With the VL53LOX sensor the car stopped prior to hitting walls 5.7 cm or taller, the Maxbotix sensor avoided walls as short as 3.8 cm, and the Ultrasonic sensor could detect walls as short as 0.6 cm. The VL53LOX sensor stopped for a cylinder 3.8 cm or wider and offset no more than 5.1 cm from the center of the sensor. It could avoid a wall as long as the edge of the wall was offset no more than 4 cm. The Ultrasonic sensor could only reliably detect a cylinder that was 6.4 cm in diameter and offset no more than 5.1 cm. It could only avoid a wall with a portion directly in front of the sensor. The Maxbotix sensor could always detect cylinders 3.8 cm in diameter and sometimes 1.3 cm in diameter and stop before a cylinder offset as far as 12.7 cm. It could detect a wall with an edge offset 3.75 cm and sometimes 7.5 cm.

Conclusions

My design met the project objectives. The VL53LOX and Maxbotix sensors stopped the car before hitting a cylinder one fourth the width of the car. The Ultrasonic sensor automatically stopped prior to hitting a wall five percent the height of the car. The Maxbotix sensor could detect objects offset as far as the edge of the car. For maximum performance, all three types of sensors could be mounted on the front of the car.

Summary Statement

I modified a remote-controlled car, adding a proximity sensor and additional control circuitry, so that it automatically stops when it senses an object in front of it.

Help Received

I built the car, conrol circuit, and wrote the code by myself. I got help from my dad learning the basics of coding and understanding how some of the electrical componants work.