CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

35464

Project Title

Can Mindstorm NXT Parts Be Used to Construct a Prototype Obstacle Alert System to Aid the Elderly and Vision Impaired?

Abstract

Objectives/Goals

The purpose of this project was to create an engineering prototype obstacle alert system using Mindstorm NXT parts to aid the elderly and vision impaired by calculating the closing time of an approaching object and issuing two warnings of increasing urgency in English, Spanish, or Mandarin.

Methods/Materials

Mindstorm NXT parts and software were used to construct a small scale prototype sensor system as the basis for proving a design for a larger scale system. The project included defining requirements, calibrating and constructing the ultrasonic sensor system, programming the warning and language selection logic, building and calibrating the moving test car, and then testing the integrated sensor system with the moving test car using 5 runs at each of three calibrated velocities. For a given calibrated velocity the expected warning distances were compared to the actual distances as read from a measuring tape. The range sensitivity of the detection system was also measured as a function of the angle between the car and the sensor system.

Results

The sensor system logic successfully issued the two warnings in the operator-selected language of English, Spanish, or Mandarin. The first warning was issued within 9 cm of the expected distance and the second warning was issued within 5 cm. The warnings for the slower car speeds tended to be early and the warnings for the faster car speeds tended to be late. These results are consistent with the sources of error present in the experiment. The measurements also indicated that the range sensitivity drops dramatically when the angle between the car and the detection system is greater than 10 degrees.

Conclusions/Discussion

A prototype multilingual obstacle alert system constructed from Mindstorm NXT parts has been successfully demonstrated. Design requirements of being lightweight, low cost, and accurate were all met. There are some shortcomings in the sensor system which would need to be addressed in future work such as limited off-axis detection range and software loop delay. Most significantly, a single approaching target was used during testing. In reality, there could be multiple approaching objects so additional testing is needed to ensure the user is warned of the fastest approaching object.

Summary Statement

My project used Mindstorm NXT parts to construct a prototype sensor system to aid the elderly and vision impaired by calculating the closing time of an approaching object and issuing a sequence of warnings in English, Spanish, or Mandarin.

Help Received

In addition to providing their encouragement and financial support, my parents helped me videotape my presentation and started timers for me when asked.