CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

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Project Number

34379

Project Title

4eyes: An Ultrasonics-based Solution to Collisions Involving Cellphone Distracted Pedestrians

Abstract

Objectives/Goals

The goal of this project was to investigate the use of ultrasonics on a mobile device to help prevent collisions that involve pedestrians distracted by cellphone use. The objectives were to characterize ultrasonic sensors, build and program a prototype device, and analyze device performance in different experiments.

Methods/Materials

A large set of experiments were conducted, including: sensor calibration, single/dual sensors, effect of material type and distance, field and angle of view of sensors, different object shapes and types, object motion, etc. The prototype device was built and programmed using a microcomputer and sensors, mainly ultrasonic sensors. Material types tested include metal, plywood, ceramic, glass, rubber, plastic, foam, etc. Obstacle detection ability was tested at different distances, angles, and orientations. Device performance was investigated for stationary objects and objects in motion. Real-world testing was also conducted. To account for device motion in a more controlled way, a motion simulator was constructed and programmed. Data logged by the programs was uploaded to Microsoft Excel for analysis.

Results

The ultrasonic sensor was calibrated and its characteristics were determined. Hard as well as soft objects were detected well when stationary. The sensor was found to have a distinct field of view. Moving obstacles in different planes were detected. Measurement error was characterized for rectangular and cylindrical objects, and cylindrical objects were clearly more difficult to detect. Real-world experiments showed that different obstacle types were detected while the device was in motion, but the detection range varied.

Conclusions/Discussion

A dual-sensor configuration (4eyes) was found to provide a good balance between sampling speed and uncertainty in measurements, and a flipped configuration improved the field of view. Motion simulator experiments showed that detection accuracy was very good for larger objects for both horizontal and vertical movement. However, narrow cylindrical objects were challenging to detect. These results can not only help avoid accidents involving cellphone-distracted pedestrians, but also have other applications including obstacle detection for the visually impaired.

Summary Statement

This project investigates ultrasonics for obstacle detection on a mobile device to help prevent collisions involving pedestrians distracted by cellphone use.

Help Received

I would like to thank my teachers for motivation and support. Parents helped with taking pictures & board layout.