CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
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Project Number
S1207

Project Title
Software for Autonomous Visual Tracking and Calculation of Trigonometric Parallax

Abstract

Objectives/Goals
The goal was to create software for an autonomous system using two cameras capable of tracking a rolling ball and determining its position through trigonometric parallax calculations.

Methods/Materials
Two Panasonic Ethernet cameras were used. A program, written in DrScheme, located the ball within the images, moved the cameras to center the ball, and calculated the position of the ball using trigonometric parallax. The images from the cameras were saved as jpeg files and then converted to xpm format for compatibility. The ball was found in the image using a randomized binary search algorithm. By using a variance function, outlying pixels were removed from the returned list of pixels representing the ball. The average of this list was used as the center of the ball. Using the angular position of the cameras, the point of intersection of the cameras' fields of view was calculated. This point represented the location of the ball.

Results
The ball search algorithm proved to be stable and immune to noise in the image. The visual tracking software functioned well, although slowly. The trigonometric parallax worked accurately within the limits of the cameras' six degree incremental rate of turn.

Conclusions/Discussion
The visual tracking software performed slowly due to the need to save every image first as a jpeg file and then as a converted xpm file. The resolution of the cameras angular movement was limited to six degree increments, in turn limiting the accuracy of the trigonometric parallax calculations. Planned future improvements include: eliminating the file read and write during image capture and conversion; rewriting the code in C++ for faster operation; and selecting a different camera and servo system with better angular resolution.

Summary Statement
Software for an autonomous system using two cameras capable of tracking a rolling ball and determining its position through trigonometric parallax calculations was created and tested.

Help Received
Parents helped format report; Mentor helped refine code