CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)

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Project Number

S0701

Project Title

CESAR: Computer Executed Semi-Autonomous Robot

Abstract

Objectives/Goals

I plan to design a computer-controlled robot which will demonstrate the capabilities of robotic autonomy. By designing an "intelligent" program to control the robot, it will be able to navigate around obstacles without user input by using a sonar transducer. Furthermore, I plan to show the limitations of full autonomy for a mobile robot of similar function. My working model will be semi-autonomous. This robot will be designed primarily for reconnaissance-type missions, rescue work, and as a semi-autonomous powered vehicle for the handicapped. CESAR's semi-autonomy will allow for very little human control thus granting one human operator the ability to control many such robots.

Methods/Materials

In order to create CESAR, I had to first design and then build a working, all-terrain mobile robot. For maximum effectiveness, I installed two wireless video cameras, a two-way audio system, a variety of switched devices such as headlights, beacons, and a siren, and I also implemented both sonar and bump sensors for autonomy. For exact position determination, an onboard GPS system is used. Once I had a working model, I had to write a program in Visual Basic to control the robot wirelessly (via a wireless LAN) while taking both sonar and bump sensors into account.

Results

The hardest aspect of the project, by far, was designing the navigation algorithm to control the robot. After much testing, however, I was able to create a working obstacle avoidance navigation algorithm. In testing the robot, I realized the limitations of sonar due to the many variables that affect the sonar signals. CESAR proved to be very capable on all sorts of terrain and despite occasional errors, the sonar never completely failed resulting in a collision.

Conclusions/Discussion

After seeing the limitations of full-autonomy, especially when the purpose of the robot comes into account, I concluded that semi-autonomy is the best choice when it comes to mobile robots going into unknown territory and conducting a specific task. Overall, the sonar worked well and the robot was able to successfully navigate around obstacles.

Summary Statement

CESAR is a mobile semi-autonomous robot designed for reconnaissance-type missions, rescue work, and as a safer powered wheelchair for the handicapped.

Help Received

A friend helped me program the robot and a neighbor welded part of the steering system.