CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

Name(s)
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Project Number
J0232

Project Title
Creating a GVS: Gyroscope-based Water Vessel Stabilizer

Abstract

Objectives/Goals
Seasickness affects many people on water vessels. Some people are particularly vulnerable to motion sickness and feel seasick simply by setting foot on a boat.
The goal of this project is to design, build, and evaluate two methods for reducing water vessel motion. I was inspired to create such a system after hearing a memorable seasickness story from a family member.

Methods/Materials
My hypothesis is that the physical properties of gyroscopes can be used to create a system for reducing the side to side roll of water vessels. I have always associated gyroscopes with stability and have been fascinated by their properties. My first objective is to understand the physics of gyroscopes and then apply the gyroscope properties toward creating a motionless reference device.
The overall objective is to create a system that centers around a gyroscope by using a microcomputer control system. A sonar sensor is used to monitor the roll information. The data read from the sonar distance sensor and the gyroscope reference device is used to control two stepper motors and underwater fins (like airplane stabilizers) to counter balance vessel rolls. The fins only work for moving vessels. For anchored vessels, I evaluated a stabilizing concept by attaching a gyroscope directly to the inner hull of a vessel.

Results
I built two gyroscopes, one with plastic rings from a knitting kit and the other with an old computer hard drive. I increased the effectiveness of the HD gyroscope by gluing down 40 washers to the spinning platters. I tested the hard drive gyroscope by putting it in a PVC tube mounted to rotate freely. I used a video camera to measure the effect of this gyroscope creating a force equal to 0.026 Newton.
Next, I installed the gyroscope on the inner hull of a test vessel. The gyroscope reduced the water rolls by 92.5%.
Finally, I built a prototype of a vessel, parallax microcomputer, stepper motors, sonar sensor, fins, and tested it in a pool. In order to simulate vessel motion, the vessel fins were placed in front of the pool pump pipe forcing water through the fins. The vessel rolls were reduced by ~90% with the stabilizing system running.

Conclusions/Discussion
The above experiments show the practicality of water vessel gyroscope stabilizers for commercial and military applications. Aircraft carriers, oil exploration vessels, and commercial passenger ships can all benefit from such systems.

Summary Statement
This project is about creating a gyroscope-based control system for reducing water vessel motion.

Help Received
My advisor helped operate the power tools and my sister taught me the Basic Computer Language.