CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
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Project Number
J0935

Project Title
Traffic Flow Improvement Using Automated Braking Distance Control

Abstract

Objectives/Goals
My goal is to build a system that will prevent automobile accidents caused by human error and in turn significantly reducing traffic congestion and improve traffic flow. I will achieve my goal by designing and constructing a proof of concept model for automated braking distance control. This system will synchronize traffic by keeping cars automatically flowing at the minimum safe braking distance from the car in front. My prototype will use a microcontroller, an ultrasonic sensor to measure distance, and a motor controller to control the speed. In real time my software will control my prototype such that braking distance follows an exponential relationship to the speed.

Methods/Materials
Arduino Microcontroller
Motor Control Module
Ultrasonic Linear Sensor
Model Car
I used breadboard to assemble and test my hardware. The program was developed in Arduino's programming environment. For testing, I measured the speed and the distance at which my model synchronizes with an obstacle. I tabulated the results and compared them with the theoretical braking distances for different speeds. To test my design in a real world environment, I drove my model on a treadmill with an obstacle in front. I had to install proximity sensors on the side of the car for this test to keep it centered on the treadmill. By varying the speed of the treadmill I tested if my car would pace itself. In order to test the prototypes practicality I also injected an obstacle while in motion to see if the prototype's reaction time was fast enough for it to be practical.

Results
The braking distance follows an exponential relationship with the speed. I used Distance=Speed^2/200 to calculate the theoretical braking distances for my model car. The arbitrary constant 200 represents the capabilities of my car's motor and sensor. The readings recorded were identical to the theoretical calculations.

Conclusions/Discussion
In real time, my program computes the braking distance, reads the distance to the obstacle, then decides whether my car should decelerate, accelerate, or stop. If the braking distance is greater than the sensor reading, the car automatically decelerates. It accelerates when the sensor reading is greater to catch up to the minimum braking distance.

Summary Statement
The goal is to build a system that will prevent automobile accidents caused by human error and achieve traffic synchronization using automated braking distance control in turn significantly reducing traffic congestion on the road.

Help Received
Father mentored in hardware design