CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Maya Varma

Project Number

31346

Project Title

Brake Time: A Smart Traffic Alert and Control System for Manually-Driven and Autonomous Vehicles

Abstract

Objectives/Goals

Driver distraction is a major cause of traffic crashes in the United States. According to National Highway Traffic Safety Administration (NHTSA) statistics, distracted driving was the cause of 5,474 deaths and 1,517,000 injury crashes in 2009. The increased use of devices such as smart phones for texting and talking is the likely culprit.

This project aims to improve safety at intersections controlled by traffic lights by alerting drivers approaching the intersection about an impending change in the state of the signal from green to red, allowing them to plan ahead and stop the vehicle safely. The same system can be used when the vehicle is driven by a robot, to slow down and stop the vehicle safely. It can also be used as an intelligent stop sign; as a virtual hazard warning system; or as an aid for visually impaired drivers.

Methods/Materials

I have designed and built a prototype of the system, consisting of a transmitter module mounted on a traffic signal, and a receiver module attached to a Pololu 3pi robot. The system uses Xbee wireless modules for communication between the transmitter and receiver. When the traffic light is green, the transmitter periodically transmits the time remaining for the signal to change its state. The receiver uses this data to estimate when the robot would arrive at the intersection at its current speed, and issues an alert if it has determined that the signal would change before the robot can safely cross the intersection.

Results

I have successfully demonstrated the system and performed measurements of its effectiveness at various speeds of the robot vehicle and for various durations of the green signal. The results show that the system can accurately warn drivers when there is a real risk of running a red light, without causing false alarms. I have also experimented with multiple transmitters, designed to simulate multiple intersections in the proximity of the vehicle, and the robot vehicle was able to discern the right signal based on its position, orientation, and direction of travel.

I have filed a U.S. Patent application on the project (No. 61450668, 3/9/11).

Conclusions/Discussion

The results from my tests show that the traffic alert/control system can be built at a low cost. The system uses only a small amount of power, allowing it to be used at intersections in rural areas. The system will save numerous lives that could be lost to distracted driving.

Summary Statement

My project is a system to warn the distracted driver of a vehicle approaching a traffic intersection or other hazard, of an impending change in the state of the signal from green to red.

Help Received

Mr. Doug Ryder prepared the U.S. Patent application for me.