6.111 Final Project Abstract

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Position Control for an Autonomous, Miniature Vehicle

Abstract:

Modern Global Positioning Systems utilize a complex array of satellite data in order to triangulate the position of a target to within a few feet. However, such systems are limited by factors such as interference when positioning objects that are located inside of buildings. The aim of this project is to fill in this blind zone by emulating the GPS model in order to control the position of an autonomous, miniature, and wireless vehicle placed in an indoor field. By relying on hardware rather than software programs, we can develop a system that is cheap, fast, and reliable in order to provide indoor positioning.

To begin with, two National Television System Committee-standard (NTSC) cameras will act as GPS satellites that provide a complete view of the "field". The incoming video data will be stored on the Zero-bus turnaround (ZBT) Static random access memory (SRAM) located on the labkit. Based on the visual data collected by these cameras, we can use filters to locate the car and be able to calculate the position. The Field-programmable gate array (FPGA) will then guide the vehicle to the correct destination by wirelessly transmitting appropriate signals to the receiver on the vehicle. A pre-determined feedback loop consisting of the vehicle's motion and the camera's continuous monitoring of the position will be paramount in driving the car with a desired speed and direction. Additionally, a graphical user interface will be created to offer user control of the system, which in this case allows the user to designate a desired position for the vehicle and track current motions using video feeds. The user interface will also allow the user to switch between camera views and be able to view the current and desired car coordinates.

Some possible extensions of the project include developing an algorithm for machine learning in order to avoid obstacles and using other types of detection, such as temperature, illumination, etc., to improve the accuracy of the system. This system can also be useful in other contexts, such as a personal robot in the home which can perform tasks assigned by the user.