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Sensor Report

Table of Contents

Introduction

The Automated Dog Walker will be able to differentiate between asphalt, sidewalk, grass, and brick. It will also detect obstacles, people, and other dogs and prevent the dog from approaching them. It should be moved with little effort from the dog, however be strong enough to keep the dog from moving in an undesirable way. Special sensors are going to be needed to do all of the above in an affordable manner.

In order to accomplish the tasks, the Automated Dog Walker will use the following sensors

- CMUcam vision board for differentiating surfaces.
- Sonic Ranger Finder SRF04 for detecting obstacles, people, and other dogs.
- Potentiometer and Bump Sensor for steering input from dog

Sonic Range Finder SRF04

The SRF04 is a simple device that can measure distance. It has a range of 3" to 10' and does not have problems with any environments. It only requires two I/O lines, Trigger and Echo and requires minimal software to interface. A pulse is sent out on the trigger pin and the echo pulse is monitored to find the distance to the closest object. At a price of $26, it is more expensive than using IR but is easier to interface, does not require calibration for environments, and also works in all environments.

Potentiometer and Bump Sensor

Since the dog walker will heavier than the dog, there is a need for way for the dog to allow the robot to follow it. A potentiometer can be mounted in the front of the robot and a bump sensor can be placed on a shaft connected to the potentiometer. If a small amount linear force is applied to the shaft, it will close the bump switch, and make to robot move forward depending on the angle the shaft makes from the center of the robot. This will act kind of like a trailer hitch, causing one wheel move more than the other to align itself with what it is attached to.

CMUcam Vision Board

The CMUcam is a microcontroller interfaced with a CMOS camera on a chip that allows simple high level data to be extracted from the camera's streaming video. The board communicates via a RS-232 or a TTL serial port and has the following functionality:

· Track user defined color blobs at 17 frames per second
· Find the centroid of a blob
· Gather mean color and variance data
· Transfer a real-time binary bitmap of the tracked pixels in an image
· Arbitrary image windowing
· Dump a raw image

· Automatically detect a color and drive a servo to track an object upon startup
· Ability to control 1 servo or have 1 digital I/O pin

The CMUcam can be set to continuously dump data or return one value upon a camera request. In order to keep the complexity of the code simple, the camera will use the latter mode by taking advantage of the poll mode of the camera.

The main function that will be used is the get mean function. This function takes the current frame, and returns the mean red, green, and blue value, along with the deviations of the colors. The lighting will be controlled with LED's to allow consistent values regardless of environment.

The camera can also analyze a region of the frame. This could be helpful in detecting edges of surfaces, and allow faster response to changes in environment. The benefits of this method have not been tested, but will be considered if it is worth the extra overhead.

References

http://www.cs.cmu.edu/~cmucam