DACME Project: Line Follower Robot

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DACME

# Scope

The purpose of this project was to create a line follower robot based on given specifications, with modification as needed by hardware limitations. We were then to design a testable Arduino script that would make the robot follow a line on the ground using the line follower sensors attached.

# Deliverables

* A presentation detailing the specifications and operation of the line follower sensor
* An Arduino script for the line follower program
* One working line follower robot

# I/O

## Inputs

* IR Sensors 1-5 (Analog) – Sends a signal with a value between 0 and 1000 depending on the distance from the object pointed at and the object’s color. Darker, closer objects correspond to a lower value.

## Outputs

* Servos 1 & 2 (Digital) – Signal is sent to motors with changing speed based on pulse width modulation. Values range from 0 to 180, with 0 corresponding to full speed clockwise, 180 corresponding to full speed counterclockwise, and 90 to full stop

# The Code

The Arduino script establishes a white level threshold and a black level threshold for values received by the IR sensors, then checks those values continuously checks those values against the analog values of the sensors in a series of if statements that represent conditions that the line follower could encounter (i.e. one where just the far right sensor detects a darker surface). It is then locked into a loop that writes to the correct direction of turn and continues to execute until the correct conditions are met. The default “else” state is for the robot to go forward. There are functions for right and left turns, as well as a function for analog reading.

# Results

The code and presentation are completed, and the robot responds to stimuli correctly, with the correct servo outputs being triggered by a pen at the same distance from the sensors that the ground would be. However, there were several issues encountered. When placed on the practice track the robot will respond very inconsistently to the tape on the ground, sometimes not heeding it at all and sometimes triggering off when there is no tape on the board. This could possibly be due to the fact that the tape was too wide for the amount of space between sensors and always led to a situation where two or more were triggering or that the sampling rate isn’t high enough due to the number of cases to be checked against leading to a higher processing time. More testing may be required with the black and white thresholds as well. In addition, there was a problem with the servos being difficult to zero and not staying zeroed for a significant period of time. This can be fixed but the inconsistency may be difficult to standardize on a large scale.

# Conclusion

The robot was developed successfully and to specifications. Apart from the problematic track performance the sensors respond and the code goes in to the correct cases when triggered.

## Future steps

We would recommend a different servo for later iterations of this robot. The current ones used are inconsistent, far more powerful than needed, and difficult to adjust. High speeds would take the robot off the track anyway, so the current motor is disadvantageous.

For this Summer camp, the only steps needed would be to test the different factors that led to inconsistent performance on the track, then adjust corresponding parameters in the experiment (whether that be changing thresholds, robot speed, or width of tape for the track) but changes would be small tweaks to the code or the experiment itself.