Quiz: Faster Line Tracking

Introduction to Mobile Robotics > Faster Line Tracking Exploration

1. Which of the following factors contributes to the failure of the fast line-tracking program with the default front-mounted Light Sensor? Circle all that apply.

a. The distance from the driving wheels to the Light Sensor

b. The distance from the front swivel wheel to the Light Sensor

c. The robot's "reaction time" to seeing light or dark

d. The height of the Light Sensor above the table surface

e. The thickness of the line

f. The color of the line

g. The length of the line

A, C and E contribute to the problem.
A, the distance from the driving wheels to the Light Sensor is long, creating a long lever arm with the sensor at the end. This way, even small turning movements at the wheels are translated into large horizontal movements of the sensor, throwing it across the line. This concept is illustrated further by the "Overpowered" video in the Fast Line Tracking Investigation
C, the robot's "reaction time" to seeing light and dark effects how quickly it can stop its motors (or have them change direction) once it registers a dark value. If it were instantaneous, then the robot would always be able to stop with the Light Sensor above the line, but it takes a fraction of a second, which is enough time for the robot to turn and send the Light Sensor over the line.
E, the thickness of the line has a serious effect on the robot's ability to detect it. If the line were thicker, the robot would be able to not change anything and still change directions while it's Light Sensor was seeing dark, meaning that it was above the line. Similarly, if the line were as thin as a thread, than there's no guarantee that the robot would even recognize it at all.
B, the distance from the front swivel wheel to the Light Sensor has no effect at all. The swivel wheel's only purpose on the robot is to provide more support. It has minimal control on the robot's motion.
D, the height of the Light Sensor above the table surface will impact whether the Light Sensor can track a line at all, but not whether it can track the line fast or slow. The height above the surface effects the light threshold, which, in turn, effects the robot's ability to track the line. If the robot tracks the line slowly, though, then the threshold is set correctly for it to be able to track the line quickly, and other factors are in play that are preventing it from doing so.
F, the color of the line does not make a difference as to whether or not the Light Sensor can track it quickly. Again, the color of the line only impacts the light threshold, so if it is set appropriately for the robot to track the line slowly, then it is also set appropriately for it to track the line quickly. If the robot cannot, there are other factors in play that are preventing it.
G, the length of the line makes no difference whether the robot is going fast or slow. It could only matter if the line were so long that it would lead the robot into an area with different lighting conditions, which may change the threshold. This still does not impact the Fast Line Tracking behavior, just the Line Tracking behavior in general.

2. You solved the problem by moving the Light Sensor to the back of the robot and tracking in reverse. Which (one or more) of the factors from the list in Question 1 did this affect, and why did it solve the problem?

A and B are effected.

By moving the Light Sensor to the rear of the robot, you changed the distance from it to the two driving wheels, as well as the distance from it to the swivel wheel. The distance from the Light Sensor to the swivel wheel makes no difference, as the swivel wheel does no driving of the robot. But shortening the distance between the Light Sensor and the driving wheels makes a big difference. In the new configuration, the Light Sensor is on the end of a much shorter lever arm from the driving wheels, so small rotations in the wheels don't effect the position of the sensor as much. The wheels still respond at the same speed, but because the sensor is closer in, it no longer gets thrown over the line, as illustrated in the video in the Reverse section of the Faster Line Tracking Investigation.

C, the robot's reaction time is not affected at all by changing the light sensor configuration.

D, the height of the Light Sensor above the table surface should not be affected by changing the orientation. The two mounting positions are the same height above the table. It is, however, possible to mount the Light Sensor one module lower on the rear of the robot, but this is not the recommended position.

E, F, G – none of the characteristics of the line are changed at all by repositioning the Light Sensor.