MOBILE ROBOT PROGRAMMING FOR LINE FOLLOWING AND WALL FOLLOWING

The experience consists in assembling and programming a mobile robot that follows a black line on the floor until it reaches its goal, or it detects an obstacle in front of it. If an obstacle is detected, the robot turns left and begins to follow the obstacle's perimeter until it reaches the line to follow again.

These behaviours involve the application of a *line following* algorithm and a *wall following* algorithm that work together.

INVENTORY:
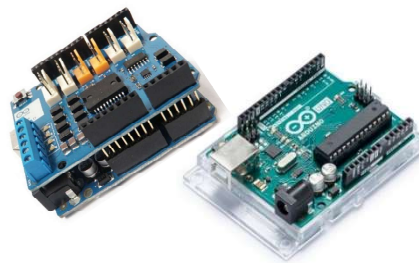
GoPiGo3   *Arduino Uno Rev 3 + Motor Shield*   *HC-SR04 ultrasonic*   *Line follower sensor*

Breadboard 80x60, jumper wires

3 to 8 decoder circuit and support for ultrasonic sensors

GoPiGo3 robot: differential wheeled mobile robot capable of moving in an environment with obstacles. It can translate and rotate. The kit includes an acrylic structure, 2 DC motors with magnetic encoders attached, motor cables, 2 wheels and a ball castor wheel for stabilisation as well as different structural parts as screws, posts and supports.

Arduino Uno Rev 3 microcontroller board

Arduino Motor Shield: dual full-bridge driver of inductive loads that.

8 x HC-SR04 ultrasonic distance sensor: it measures the distance to an object using ultrasonic sound waves. It provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm.

When test objects, the range of area is not less than 0.5 square meters and the plane requests as smooth as possible, otherwise it will affect the results of measuring.

2 x Line Follower sensor: works by detecting reflected light coming from its own infrared LED. By measuring the amount of reflected infrared light, it can detect transitions from light to dark (lines) or even objects directly in front of it. ***Note that when the sensor detects the line, its output is 1.***

TESTING AND IMPLEMENTING THE LINE-FOLLOWER SENSORS

After several tests, checking their outputs depending on the light and distance from the line, it was found that, for the best result, the sensors have to be at a few millimetres from the ground and possibly with a light source downwards.

If the right sensor detects the line, the robot will turn right.   if the left sensor detects the line, the robot will turn left.
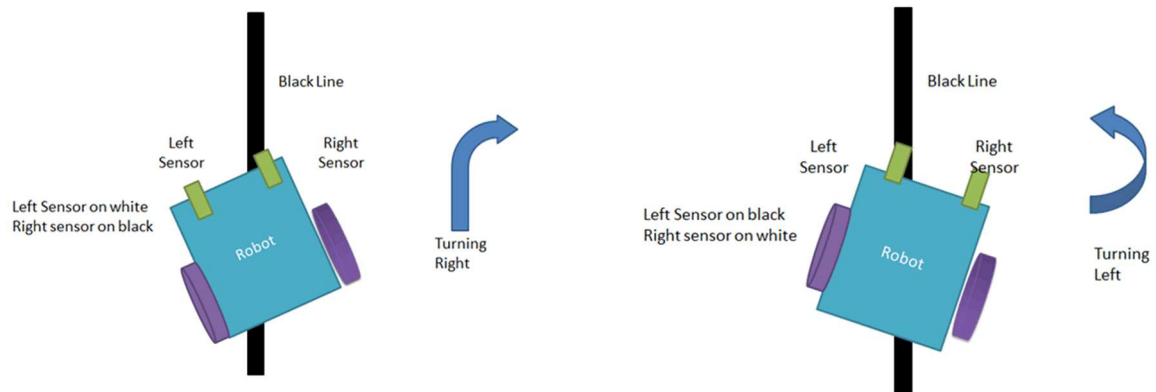

if both the sensors detect or do not detect the line, the robot will proceed forward.

ULTRASONIC SENSORS TESTING

8 ultrasonic sensors are used individually via the use of a decoder circuit. 3 pins from the Arduino board represent a 3 digits binary number that count from 0 to 7.

The decoder circuit allows to switch between the 8 sensors using the 3 inputs. However, for the scope of this robot, only the sensors on the front-right are used (front, diagonal right, right).
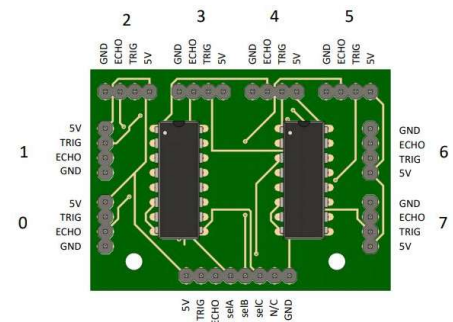
OBSTACLE AVOIDANCE AND WALL FOLLOWING

Obstacle avoidance: when the robot detects an obstacle with the front sensor, it turns left and starts following the obstacle perimeter.

Wall-following: using the right and diagonal-right ultrasonic sensors the robot follows the obstacle perimeter, but it keeps staying at a distance from it.