Roobopoli

TEST MANUAL and Calibration of ROOBOKART sensors

Summary

Track history

revision	date	description
RelA, 10	18/05/2020	First release

Firmware configuration

Once the Roobokart has been assembled, before compiling and programming the microcontroller with the obtained binary file, it is necessary to identify the correct values of some parameters dependent on the hardware and that may differ from vehicle to vehicle.

Below are these parameters and suggested for each of them, a method of evaluating the correct value.

Braking

This adjustment procedure must be carried out if at traffic lights, the Roobokart does not stop in time or retreats. Perform the following procedure only if you don't see a right stop of the Roobokart

Due to inertia, when the vehicle is in motion, it is not enough to set the speed of the engines to zero to stop it quickly when it is required, as happens for example near the traffic light, but it is necessary to impose a speed opposite to that which was being held, just enough to make the driving force quickly manage to cancel out the inertia but without then inducing a change of direction.

This braking force is achieved by imposing a speed opposite to the cruising speed. This speed value is engine-dependent and may differ from vehicle to vehicle, so it must be determined.

A typical value varies between -10 and -5. To find the correct value, you have to do this.

Load a code on the Roobokart that makes it travel a straight path for a few seconds and then apply an opposite speed to the previous one.

If the vehicle starts to retreat after stopping, decrease the braking speed intensity.

Repeat this until the robot stops.

set the new value to replace the default value in the file

roobopoli/roobokart/roobokart_def.h

```
#define  BRAKING_FORCE_DEFAULT  -12
```

Threshold for traffic light colors

This adjustment procedure should be carried out if the preset default values do not correctly detect the colors of the traffic light. Run the following procedure only if you don't observe the right detection of the traffic-light colors.

To ensure that through the color sensor it is possible to detect the correct color of the horizontal traffic light and in time to be able to brake the vehicle, it is necessary to set a threshold value such that the color can be detected a few moments before the Roobokart is located with the color sensor that looks at the RGB LED strip.

To measure the threshold to be set, place the stationary vehicle with the sensor about 1cm from the traffic light. Load code that reads red and green colors and prints values read on PC via USB.

Set the read values to the default values in the file

roobopoli/roobokart/roobokart_def.h

```
#define  RED_THRESHOLD_DEFAULT  160
#define  GREEN_THRESHOLD_DEFAULT  310
```

It is possible that the bed value must be increased by at least 30% to ensure proper operation in all light situations and with all the different brands of LEDs and light intensity emitted.

It is recommended to feed the LED strips with a stabilized power supply to avoid abnormal oscillations of brightness.

PID control constants in Nav_mode

This procedure should be performed if the Roobokart does not follow correctly the white line on the right of the lane or when starting rotates on it.

The Roobokart at startup could start rotating on itself. This is most likely due to an incorrect engine connection. In particular, the connections of the left and right motors and/or the polarity could be reversed.

In the absence of a mathematical model, we empirically determine the values of the three constants.

Set Kp to its default value, the released value, and Ki= 0 Kd =0.

If with these settings, the robot oscillates a lot and then loses the line decrease Kp by 1.

If, on the other hand, the robot moves away from the line to the right or left without oscillating increase by 1

Repeat this operation, until, while oscillating, the robot manages to follow the line for a straight stroke and in a soft curve.

Then set the Kp value, set Ki to 1 and increase by 1 until the robot can perform tighter turns. It is recommended to keep to low values, possibly less than 10 and if necessary try to increase by 0.1. Decrease by 1 if the oscillation increases until the line is lost.

Also fixed the value of Ki, set kd to 1, increase by 0.5 until the oscillation subsuits. Keep to low values, possibly less than 10, and if necessary increase by 0.1. Decrease by 0.1 if the robot fails to perform the tightest curves.

This procedure arises from the experience and observation of the behavior of the Roobokart. Other procedures could be more effective.

Left and right IR sensor threshold
The parameter to be modified appropriately is

```
#define  IR_THRESHOLD  0.8
```

This is located in the roobopoli/roobokart/roobokart_def.h file

to find the correct value you must upload the file "Roobokart_ Test.bin"

Run a putty client.exe and select the COM assigned by the operating system (it is visible in Windows Device Manager) leaving the default speed of 9600.

Take test 1; The values read by the three IR sensors, the right, the left and the center will be printed on video.

By placing the side sensors on a white and a black surface you can identify the value to be inserted as a threshold.

Central IR sensor threshold

Remember that the central sensor, in the basic mission serves exclusively to recognize the presence of the road sign, through the blue band.

therefore, you must also set the threshold for this parameter

#define ROADSIGN_DETECTION_THRESHOLD_DEFAULT 0.8

This is located in the roobopoli/roobokart/roobokart_def.h file

to find the correct value you must upload the file "Roobokart_Test.bin"

Run a putty client.exe and select the COM assigned by the operating system (it is visible in Windows Device Manager) leaving the default speed of 9600.

Take test 1; the values read by the three IR sensors, the right, the left and the middle, will be printed on video.

By placing the central sensor on the road surface and on the blue of the sign, you can identify the value to be entered as a threshold.