Escola Superior de Tecnologia e Gestão Instituto Politécnico da Guarda	**Laboratorial Work**

Nº 4			
Group: 3.1 ←Identify your group			
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Fill in the header record with the names and numbers of the group members and add "(missing)" next to the name, in case any member of the group missed the class. After finishing the laboratorial work, create a PDF doc called "Grupo X.X – LW X.PDF" submit it via the form at http://bit.ly/2TL0lKS.

If the answers to the questions is Java code, you must use color black and font Courier New to write the code. Also, indent all the code. A penalty of 50% will be applied if you forget to do this.

1. Complete the following text about the SONAR range finder sensors used in your robot.

   The SONAR sensors used in the RB kit have an interface of type PWM Signal. This sensors can only be connected to ports digital of the IntelliBrain because they work with pulses. These sensors use the so called time of flight operation principle. In order to program one of this sensors to calculate the distance to an obstacle in front of it (using directly and only the resources of the digital ports), we need to program the following steps. Firstly, we need our program to send to the sensor a pulse with at least 10uS. Secondly, our program need to ping the sonar. Finally, the program needs to measure the amplitude and then convert it in distance by the formula.

2. Improve the function FollowWallV2 developed in class, to control the robot to navigate inside the arena of the Robô Bombeiro contest, always following the right wall and solving the various types of corners that it finds. Follow the tips given by the professor in class. Demonstrate the navigation of your robot to the professor before submitting this LW.

```
private static SonarRangeFinder frontSonar;

private static final int R_FRONT_WALL = 15;

frontSonar = new ParallaxPing(IntelliBrain.getDigitalIO(4));
```

```
frontDist = frontSonar.getDistanceCm();

private static void followRightWallv2(){

        if (frontDist < R_FRONT_WALL)
              turnAngle(90);
        if(rightDist < 0)
              rightDist = 100;

        float error = rightDist - R_DIST_WALL;
        int delta = (int)(error * GAIN);

        if(delta > 5)
              delta = 5;
        else if(delta < -5)
            delta = -5;

        move(BASE_POWER, delta);
  }

private static void turnAngle(int angle){
        LeftMotor.setPower(-8);
        RightMotor.setPower(8);
        try{
              Thread.sleep(angle*(390/90));
        }
        catch (InterruptedException e){}
  }
```