**Initio Programming: Obstacle Avoidance**

**AIM:** After completing this worksheet you should be able to integrate your Python programming knowledge to create obstacle avoidance behaviour in your Initio robot.

**You Need:** To complete this worksheet you need to have an Initio that is connected to a keyboard, mouse and monitor (see WS1), to understand how to start and stop IDLE from the Linux Command Line (see WS2), and to be able to use files to store Programs (WS5). You also need to know the commands to operate the Initio motors and sensors (WS3 & WS4). You should be able to use If statements (WS7) and while loops (WS8) in Python programs.

**Challenge:** Implement obstacle avoidance behaviour on an Initio robot.

**Designing the program:** Before you can implement a behaviour, you should try to define what that behaviour involves. In this challenge we will define obstacle avoidance behaviour to mean: “The Initio should move forwards while there is nothing closer than 50cm (an obstacle) and should turn (either right or left) when there is an obstacle (something closer than 50cm)”.

We can illustrate this with a flow chart



**Question 1:** What sensor and motion commands do you expect to use for this challenge?

You can go ahead and attempt to write the program now – or you can follow the suggested steps below.

**Step 1:** Write a python program containing a while loop, which will make your Initio move forward while there is no obstacle and then stop when an obstacle appears. Test your program works.

**Step 2:** Extend your program so that you have a Python program that will move forward while there is no obstacle, then will turn while there is an obstacle, and then stops. Test your program works.

**Step 3:** Now you want to extend the program so instead of going around one while loop (while there is no obstacle) and then a second (while there is an obstacle) and then stopping, it instead repeats going around the two while loops. You can do this with a third while loop that contains the other two and which starts with while True:

**Question 2:** Write out how you are going to test that your program works.

**Question 3:** Execute your program. Does it work? YES/NO

**Extending the Program:** While you have successfully implemented obstacle avoidance behaviour, the behaviour of your program isn’t as nice as you might like. For instance, you have to use Ctrl-C to stop the program running and then stop the Initio at the Python command line.

**Exercise 1:** Extend the program so you can stop and start it easily by waving your hand really close to the ultrasonic sensor (e.g. closer than 5cm). You might want to look at WS9 for hints about this. You will want it to start when something is closer than 5cm followed by being further away than 5cm (the hand appears and then moves away) otherwise it may start and then immediately stop because the hand is still there.

**Remember:** When you have finished working with the robot type initio.cleanup() at the command, exit IDLE, and select Shutdown from the Raspberry Pi menu item. Once the robot has shut down, switch it off.



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