# Lab 02

# Avoid-Obstacle, Follow-Object and Random Wander Worksheet

Robot Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Team Member Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Team Member name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Purpose

In your own words, state the purpose of lab 02 in the following space.

## Part I – Random Wander (Layer 1)

What was the general plan you used to implement the random wander and obstacle avoidance behaviors?

## Part II – Test the Sonar Sensors

Based upon your testing, what is the maximum and minimum range for the sonar sensors on your robot?  
Max: 30cm

Min: 2cm

What is one advantage of using a sonar sensor instead of an infrared sensor?

Sonar sensors will not be disrupted by ambient light or dust.

In the following space, discuss the accuracy of the sensor.

## Part III – Test the Infrared Lidar Sensors

Based upon your testing, what is the maximum and minimum range for the infrared lidar sensors on your robot?

Max: 39

Min: 1

What is one advance of using an infrared lidar instead of a sonar sensor?

In the following space, discuss the accuracy of the sensor.

## Part IV – Collide Behavior

What distance did you use for the collide behavior?

Did you use the lidar, sonar or a combination of the two sensors? How did you decide?

How could you implement collide behavior for sensors other than the front sensors?

## Part V – Runaway Behavior (Layer 0)

How did you represent the feel force function on your robot?

How did the robot respond with respect to the force felt, note that it could move in reverse, or it could turn a certain angle, think about what makes most sense for potential field navigation.

How does your robot handle getting the robot unstuck when the vectors sum to zero?

## Part VI – Follow Behavior (Alternate Layer 0)

In your own words, describe how to implement proportional control to follow an object,

Are there situations where the robot would get stuck when following? If so, how would the robot correct for that?

## Part VII – Subsumption Architecture – Smart Wander Behavior (Layers 0 and 1)

What is the difference between on-off and proportional control?

How did feedback control improve the random wander and avoid obstacle state machine?

## Part VIII – Subsumption Architecture – Smart Follow Behavior (Layers 0 and 1)

You robot currently runs either a smart wander or smart follow behavior. How could you create a state machine that integrates smart follow and smart wander? What type of input would trigger the avoid versus the follow behavior?

## Conclusions

1. How well did your software design plans match the reality of what you implemented on the robot?
2. How well did your software design plans match the reality of how the robot performed? Compare it to the theory you learned in class.
3. How did you create a modular program and integrate the two layers into the overall program?
4. Did you use the sonar and IR sensors to create redundant sensing on the robot’s front half?
5. How could you create a smart wander routine to entirely cover a room? Similar to what a Roomba does.
6. What kind of errors did you encounter with obstacle avoidance behavior?
7. How could you improve obstacle avoidance behavior?
8. Were there any obstacles that the robot could not detect?
9. Were there any situations when the range sensors did not give you reliable data?
10. How did you keep track of the robot’s states in the program?
11. Did the robot encounter any “stuck” situations? How did you account for those?
12. What should the subsumption architecture look like for the addition of the go-to-goal and avoid- obstacle behaviors?
13. What did you learn?
14. What did you observe?
15. What questions do you still have?

## Appendix

Insert your properly commented, modular code in the following space.