Learning Roomba

Module 1 - Robotics Introduction
Outline

- Introduction
- What is a Robot?
- iRobot Roomba
- Building a Robot
- Why Robotics can be Difficult
- Programming a Roomba
Introduction

Through these lessons you will get a chance to:

- Interact with Robots
- Control robots by writing software programs
- Understand some Engineering, Math, and Science concepts

This lesson will get you started on your way to becoming a roboticist
What is a Robot?

- Possible Definition #1:
  - “A Machine that helps humans”
  - What does this include?
  - Does a toaster fall in this category? Is a toaster a robot?
What is a Robot?

- Possible Definition #2:
  - “A Machine that *intelligently* helps humans”
  - What does “intelligently” mean?
  - What machines pass the Robot IQ test?
  - Does it require the ability to think like a human?
    - How many machines are capable of doing so?
What is a Robot?

• Possible Definition #3:
  
  • “An artificial device that senses its environment, uses the information to make decisions, and then acts in the environment”

• Chosen as the working definition

• However, the definition is not perfect
  
  • What about a television? A television fits the requirements but is generally not considered a robot
  
  • What about a remote controlled plane?
  
  • What about an Unmanned Aerial Vehicle (UAV)?
What is a Robot?

- Example of a Robot

What should I do?

Environment Information

Actions

What should I do?
What is a Robot?

- Anthropomorphic Robots
  - “Robots that are human-like”
  - A sub-class of robots
What is a Robot?

- Science Fiction Robots
  - Examples in Star Wars, Star Trek, I, Robot, and Lost in Space
  - Technology in Science Fiction is not the same as Real-World Technology
iRobot Roomba

- Robotic Vacuum Cleaner
- Cleans floors without human control
iRobot Roomba

- Can also be used as a Robot for projects
- You are going to write Software Programs for the Roomba to make the Roomba perform tasks
Building a Robot

- Mechanical Components
  - Physical Structure of the Robots
  - Mechanical Engineers
- Electrical Components
  - Sensors, Power Systems, Motors, Computers
  - Sensing and Acting
  - Electrical Engineers
- Software Components
  - Decision Making, Thinking Ability
  - Computer Scientists
Why Robotics is Difficult

• Seemingly simple tasks are difficult for a robot
• Example: “Go to the Kitchen”
  • Formulating the problem
    • What is a kitchen?
      ▪ If it is a room with food and appliances to cook the food…
      ▪ What is a room?
  • Understanding the Environment
    • Does the robot have a map?
    • How does the robot read the map?
    • How does the robot build a map?
  • Executing the Task
    • Where as the robot now?
    • How does the robot plan a route to the kitchen?
Why Robotics is Difficult

- There are a lot of steps for a robot to be able to perform a task
- The previous example only shows a few of the steps for a robot to perform the task
- A robot does not have the same understanding and experience that a human does
Programming a Roomba

- Programming is the act of writing software programs
- Going to use the BlueJ development environment to write a sample program to drive the Roomba
Programming a Roomba

- Step 1: Start BlueJ
  - On MacOSX, click on the BlueJ icon on the dock
  - On Windows, run BlueJ from the “Start” menu
Programming a Roomba

- Step 2: Create a new Project
  - Go to the “Project -> New Project…” menu option
  - Type your name in the “File” field
  - Choose “Desktop” in the dropdown list
  - Click the “Create” button
Programming a Roomba

- Step 3: Create a new Class
  - Click the “New Class…” button
  - Fill in the name of “MyRoombaProgram”
  - Click the “Ok” button
Programming a Roomba

- Step 4: Write a Program
  - Double-click the “MyRoombaProgram” class
  - Remove all code in that file
  - Copy the program found on the following slide

```java
import roomba.roombanetwork.services.userservice.*;

public class MyRoombaProgram
{
    public static void main(String [] args)
    {
        UserService.setServerAddress("192.168.1.100");
        UserService.setName("drew");

        Roomba roomba = new Roomba();
        roomba.forwardForTime(1.3,3);
        roomba.turnForTime(3,5);
        UserService.disconnect();
        System.exit(1);
    }
}
```
Programming a Roomba

- Step 4: Write a Program

```java
import roomba.roombanetwork.services.userservice.*;

class MyRoombaProgram{

    public static void main(String [] args){
        UserService.setServerAddress("localhost");
        UserService.setName("Your_Name");

        Roomba roomba = new Roomba();

        roomba.forwardForTime(.3,3);
        roomba.turnForTime(.3,5);

        UserService.disconnect();
        System.exit(1);
    }
}
```
Programming a Roomba

- Step 4: Write a Program
  - Change “localhost” to the address provided by your teacher
  - Change “Your_Name” to your name
Programming a Roomba

- Step 5: Compile the Program
  - Compiling the program checks for errors and prepares it so that it can be executed
  - Click the “Compile” button
  - The bottom of the class file should show “Class compile - no syntax errors”
Programming a Roomba

- Step 6: Run the Program
  - Click on the Project Window (should be in the background)
  - Right-click MyRoombaProgram
  - A pop-up menu should appear
  - Click on “void main(String [] args)”
  - Click the “Ok” button.
Programming a Roomba

- What should happen:
  - If everything worked properly, a Roomba should…
    - Move forward for 3 seconds
    - Stop
    - Turn to the right in place for 5 seconds
    - Stop
Programming a Roomba

- A Quick Programming Tutorial is provided in the Module 1 Student’s Guide
- A few of the Roomba commands will be discussed
Programming a Roomba

- Roomba roomba = new Roomba();
  - Creates a Roomba object
  - Will communicate to the server to find a Roomba that is not being used by anyone
  - Pass an argument to specify a specific roomba:
    - Roomba roomba = new Roomba(“BobTheRoomba”);
- roomba.forwardForTime(.3,3);
  - 1st Argument is the speed to travel forward at
  - 2nd Argument is the number of seconds to move
- roomba.turnForTime(.3,5);
  - 1st Argument is the speed to turn at
  - 2nd Argument is the number of seconds to turn
Questions?