Learning Roomba

Module 3 - Controlling Movement
Outline

- Why is Movement Important?
- Types of Movement
- How to control the Roomba
- Movement Code Support
- Exercise
Why is Movement Important?

- Necessary for a robot to get from one location to another
- Necessary to actively interact with the environment
- Necessary to achieve many tasks
Types of Movement

- Straight Motion (Forward/Back)
- Point Turns
- Swing Turns
Straight Motions

- Translational Motion
- No turns
- Both forward motion and backwards motion
- Wheels turn in the same direction at the same speed
Point Turns

- Rotational Motion
- No translational motion
- Left and Right turns in place
- Wheels turn in different directions at the same speed
Swing Turns

- Both Rotational and Translational Motions
- Turn while also moving forward or backwards
- Wheels rotate at different speeds
How to control the Roomba

- Break path into separate motion commands

Forward 3
Turn 90
Forward 4
Turn -90
Forward 4
Turn -90
Forward 3
Turn -90
Forward 6
Turn -90
Forward 3
Turn 90
Forward 1
Turn 90
Forward 2
How to control the Roomba

- Limitation
  - Commanded Path is not the same as traveled path
    - Wheels Slip
    - Uneven Ground
    - Collision with obstacles
    - Other Reasons
Movement Code Support

- drive(distance)
  - Roomba will drive the specified distance in meters
  - Straight motions
- turn(angle)
  - Roomba will turn the specified angle in degrees
  - Point Turns
Movement Code Support

- `forwardForTime(speed, duration)`
  - Roomba will drive at the specified speed for the specified duration in seconds
  - Straight motions

- `turnForTime(speed, duration)`
  - Roomba will turn at the specified speed for the specified duration in seconds
  - Point Turns
Movement Code Support

- **forwardSpeed(speed)**
  - Roomba will drive at the specified speed until told otherwise
  - Can be combined with turnSpeed(speed) for swing turns

- **turnSpeed(speed)**
  - Roomba will turn at the specified speed until told otherwise
  - Can be combined with forwardSpeed(speed) for swing turns
Exercises

- Write a program to use all the types of motion

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

public class MyRoombaProgram{

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

        Roomba roomba = new Roomba();

        roomba.drive(1);
        roomba.turn(90);
        roomba.forwardForTime(.3, 5);
        roomba.turnForTime(.3, 3);
        roomba.forwardSpeed(.3);
        roomba.turnSpeed(.3);
        roomba.pause(3);

        UserService.disconnect();
        System.exit(1);
    }
}
```
Exercises

- Write a program to go forward for 1 meter, turn around, and return to start position

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

public class MyRoombaProgram{

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

        Roomba roomba = new Roomba();

        roomba.drive(1);
        roomba.turn(180);
        roomba.drive(1);

        UserService.disconnect();
        System.exit(1);
    }
}
```
Exercises

- Write a program to go forward for 1 meter, turn left for 5 seconds, and go backwards for 0.5 meters

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

public class MyRoombaProgram{
    public static void main(String [] args){
        UserService.setServerAddress("localhost");
        UserService.setName("Your..Name");

        Roomba roomba = new Roomba();

        roomba.drive(1);
        roomba.turnForTime(-3,5);
        roomba.drive(-0.5);

        UserService.disconnect();
        System.exit(1);
    }
}
```
Questions?