Informatics Large Practical (ILP) Notes

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Introduction

The Brief

Program an autonoumous drone wich will collect readings from air quality sensors distributed around an urban geographical area as part of a (fictitious) research project to analyse urban air quality.

- you will be marked heavily on the readibility of your code (it must be passed on)

Important Variables

Threshold distance to collect sensor reading = 0.0002 degrees
Number of Sensors = 99
Daily Sensor Readings to be taken = 33 (specified)
Reading from reciever has 2 components:

- reading: char string of air polution (0.0-256.0)
- battery: 0.0-100.0 of sensor
  - if battery $< 10\%$ → `battery = null` → `flagNewBattery(sensor)`

Other Information

- 'What3Words' is used as the sensor location system

Drone Movement Restrictions

- the drone nust stay inside the confinement area at all times
- the drone 'flight path' has at most 150 'moves'
- A "move" is a straight line of len 0.0003 degrees
- the drone can only move in direction multiples of 10 degrees
- the drone path should be a closed loop
- the drone life cycle has a pattern which iterates (1) making a move, and (2) taking a sensor reading
- the drone must move before making a reading even if the a sensor is in range at the starting point
  - NS: come to that point last
- the drone cannot connect to two or more sensors without making a move

Web Server

There is a web server with synthetic data (readings/battery)

Webserver Filestructure (maps, words, buildings)

~/maps

Contains thelist of sensors to be visited (for each day)
Filestucture: `maps/year/numericMonth/numericDay/air-quality-data.json`
Example:

```
{
  ...
  "location": "what.three.words",
  "battery": 94.53979,
  "reading": "null"
  ...
}
```

~/words

Contains the WhatThreeWords's square coordinates
Filestructure: `~/words/first/second/third/details.json`
Example:

```
{
  "country": "GB",
  "square": {
    "southwest":, {
      "lng": -3.187428,
      "lat" 55.945936
    },
    "northeast":, {
      "lng": -3.18738,
      "lat" 55.945963
    }
  },
  ...
}
```

~/buildings

Contains a geojson of the 4 regions in which the drone cannot fly (AT, DHT, Library, Inf Forum/Bayes/DSB)
Filestructure: `buildings/no-fly-zones.geojson`

The Implementation Task

Project Name: `aqmaps.jar`

The command: `java -jar aqmaps.jar 15 06 2021 55.9444 -3.1878 5678 80` should load the `air-quality-data.json` file for the data, connecting at port 80, start th drone at (lon, lat) (55.9444, -3.1878) and use the number 5678 as the random seed for the application.

Output Files Your application should write two text files in the current working directory, `flightpath-DD-MM-YYYY.txt` and `readings-DD-MM-YYYY.geojson`

flightpath-DD-MM-YYYY.txt should be 150 lines long with structure
`(int) linenumber, (double) lat-before, (double) lon-before,`
`(int) movement-angle, (double) lat-after, (double) lon-after,`
`(string) what.three.words` (essentially a csv)

readings-DD-MM-YY.geojson 33 geojson `Point` 'markers', of the locations with the same structure as the `~/maps/YYYY/MM/DD/air-quality-data.json` with the following 4 properties:

- `location`– What3Words string
- `rgb-string`– polution coded danger color as per fig. 5
- `marker-color`– rendered from rgb-string
- `maker-symbol`– lighthouse | danger | cross | nosymbol

Programing Language Java 11
You are permitted to use any software under free licence (Mapbox is recomended).

Coursework 1

1.1 Introduction

Don't submit late. Something about a heatmap.

1.2 Getting Started

Create a new maven project (on eclipse?) with:

- Group Id – uk.ac.inf
- Artifact ID – heatmap

1.4 The Implementation Task

Input: 10x10 grid (.txt) file of air quality 'predictions'.
Output: the command `java -jar heatmap.jar predictions.txt` should produce a heatmap.geojson output file. (`rgb-string == fill`

1.5 Marking Scheme

Correctness (15) Readability (10)