Lab 2

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Introduction

This laboratory explored the use of an agent-based model to simulate the potential paths taken by UAVs in the Dublin region with the help of a noise map of the city. There are concerns related to noise pollution in the city and as such the paths taken by the UAVs is of concern. Ensuring that there are no further increases in noise pollution for Dublin residents, while utilising the potential of UAVs to efficiently carry out deliveries was investigated in this lab. The UAVs are tasked with delivering a parcel to some random location on the map. Once delivered, they return to the closest hub and begin their next delivery. The hubs were selected in locations which had higher noise pollution and areas where deliveries would be crucial. The delivery radius was set to 3km. The UAVs move towards their destination by following simple rules. The UAVs have a vision radius of 200m and are programmed to pass through pixels which they have been passed through many times before if there are no other pixels available.

Body

The following variables were included in the code.

```
breed [ walkers walker ];

breed [ hubs hub ]

walkers-own [ goal tofrom ]

patches-own [ popularity popular-patch]

globals [ mouse-clicked? deliveries ]
```

Figure 1 – Code showing the declaration of variables

The code for the setup is included below. I included one hub location in the setup and the remaining hubs were placed using the mouse as the simulation began. A total of 15 hubs were placed.

```
to setup
  clear-all
  import-pcolors "Dublin_Noise_Map.png"

  create-hubs 1[
    setxy 585 412
    set color [186 85 255];purple
    set size 10
    set shape "house"
  ]

  create-walkers walker-count[
    setxy random-xcor random-ycor
    set goal one-of patches
    set tofrom 1
    set color blue
    set size 2
  ]
  set deliveries 0
  reset-ticks
end
```

Figure 1 – Code showing the setup of the function

The code to control the direction of the UAVs is included below. All the UAVs began the simulation with a delivery to be delivered.

```
to move-walkers
  ask walkers [
    ifelse patch-here = goal [ ;check if the delivery location or hub has been reached
      set tofrom abs(tofrom - 1);update the orientation of the UAV
      ifelse tofrom > 0[ ;if the UAV has delivered
        set deliveries deliveries + 1 ;increase the number of deliveries by 1
        let closest-hub min-one-of hubs [distance myself] ;assign the closest hub to the UAV to closest-hub
        set goal [patch-here] of closest-hub ;update goal of the UAV to travel towards the closest hub
      ][
        set goal one-of patches in-radius delivery-radius ;update goal of the UAV to travel towards its delivery location
      ]
    ][
      walk-towards-goal
    ]
  ]
  recolor-popular-paths
end
```

Figure 2 – Figure showing the code controlling the direction of the UAVs

A total of 500 UAVs were simulated. After clipping the noise pollution image from the sample pdf provided, its resolution differed from the specification provided. I also removed the scaling information from the image to ensure the UAVs would not interact with it in the simulation. Some noise pollution data which was behind this scale is lost from my simulation. My cropped image was of resolution $1175x823$. I scaled the delivery distances and vision distances accordingly. The simulation was allowed to run for 10,000 ticks.

Results

The output of the simulation is displayed below.

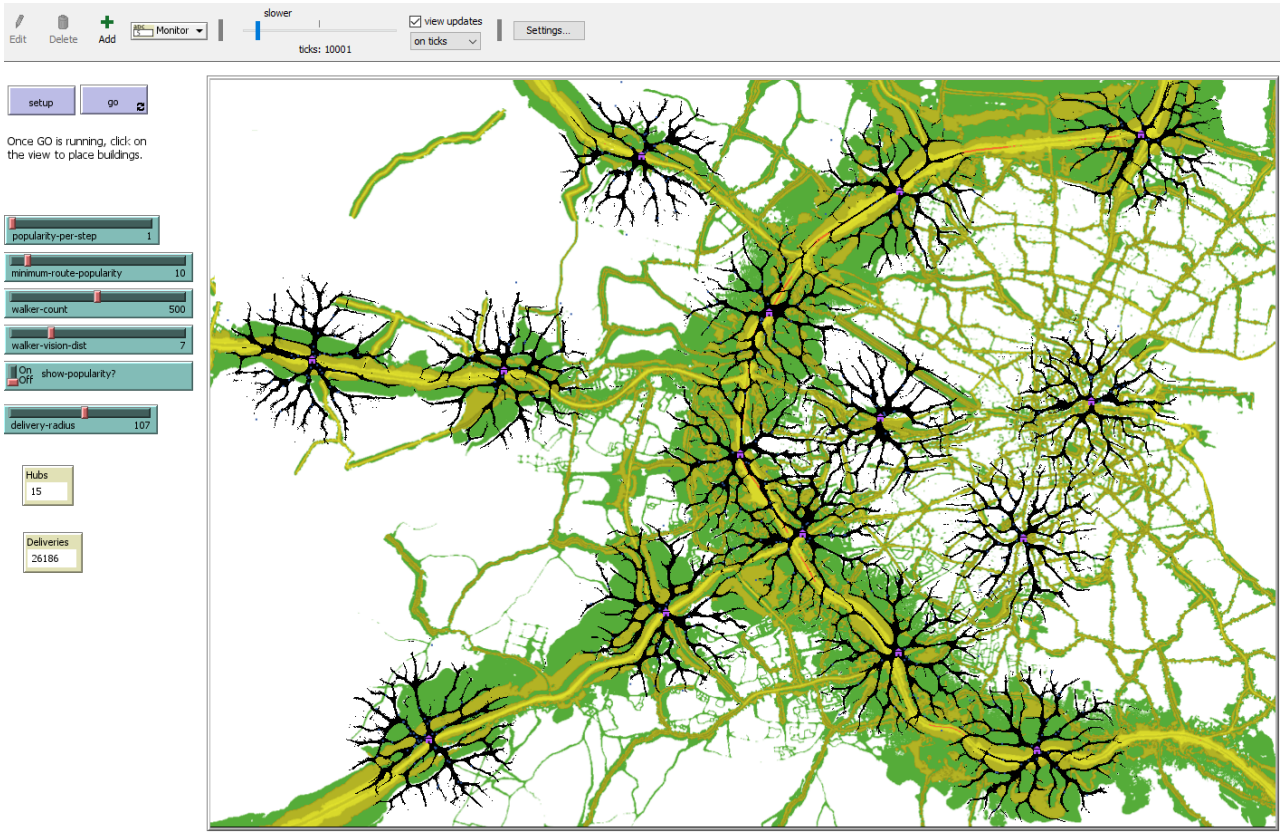

Figure 3 – Output of the simulation is included above.

The UAVs created paths which they followed as they completed deliveries. The emergent property of the paths created by the UAV agents is known as branching fractals.

Conclusion

The simulation was successfully implemented. Some aspects of the coding for the simulation were difficult to perfect due to difficulties with debugging as I am new to the software language. Other aspects of the coding environment such as its interactivity are very enjoyable. The colour scaling of the noise pollution map was un-intuitive as yellow is brighter than green but represented a higher noise pollution level than green. I am beginning to gain a much greater insight into the possibilities of this software after this lab.