Urban Simulation by NetLogo

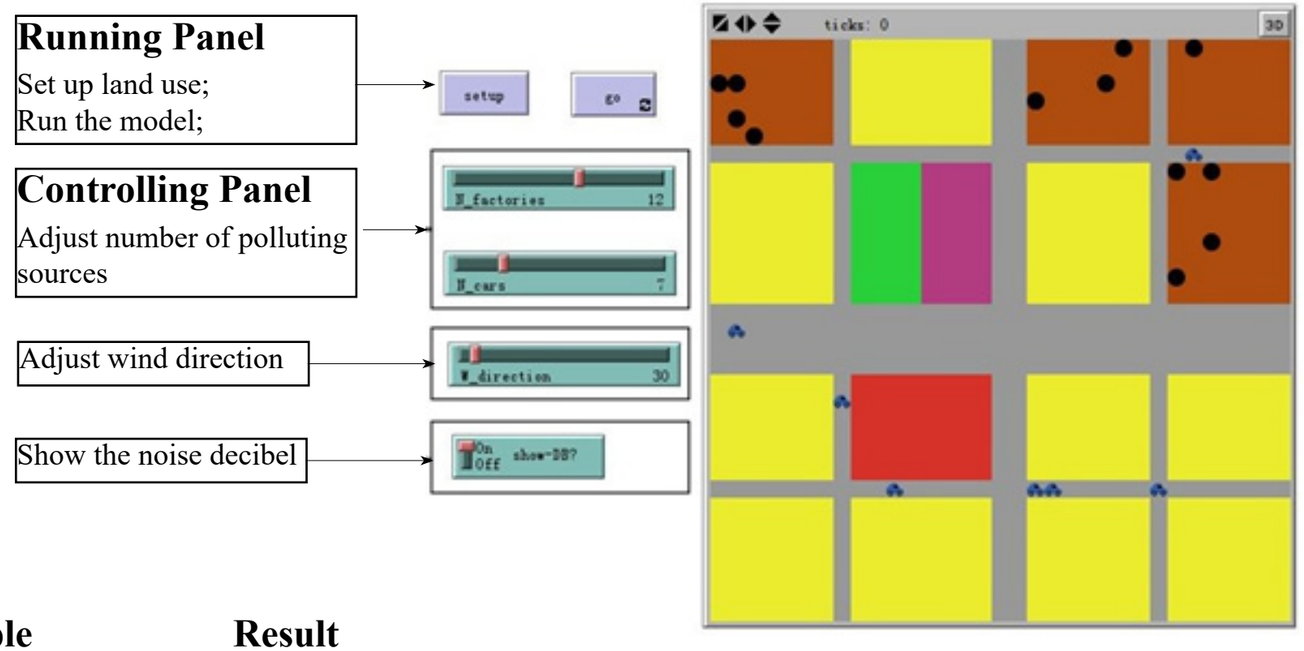
Programming is a useful tool in urban planning. It can predict performance of the plan by modelling different scenarios. The result can help planners modifying the existing plans. NetLogo is a multi-agency programming modelling environment. In the following two programs, NetLogo is used to model urban issues by setting different agencies in a certain land use. By writing command to agencies, it can simulate urban mechanism in different prospectives, such as traffic and pollution.

Program1. Urban Pollutions Modelling

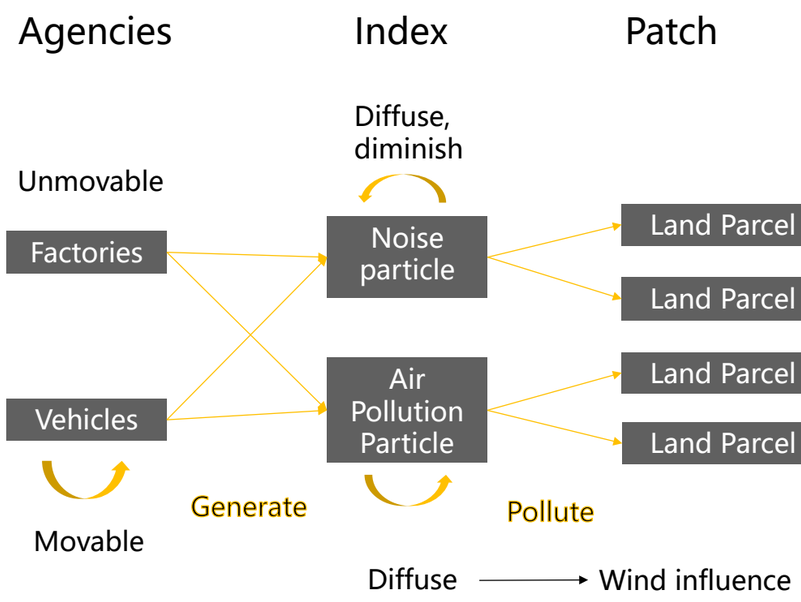
In this program, urban pollutions include two kinds, the air pollution and noise pollution, which come from two main sources, automobiles and factories.

The core step of this model is how the polluting parcels diffuse and influence the land. For the noise diffusion, it follows the concentric model; as the radius increases, the noise radiation decreases. For air pollution, the diffusion is highly influenced by the wind direction. The pollution diffused faster downwind while slower upwind.

The result of noises and air pollution are visualized in different ways. For air pollution, it is reflected by the land color. The darker the color, the more polluted the land is. The noises are shown as the numbers on the land.



Concept



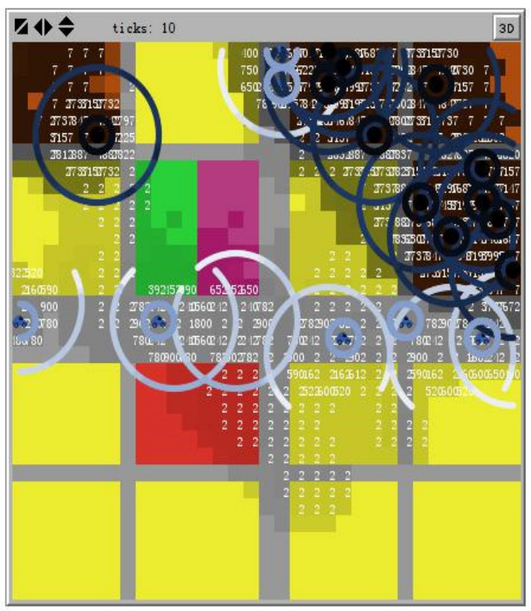
Code Sample

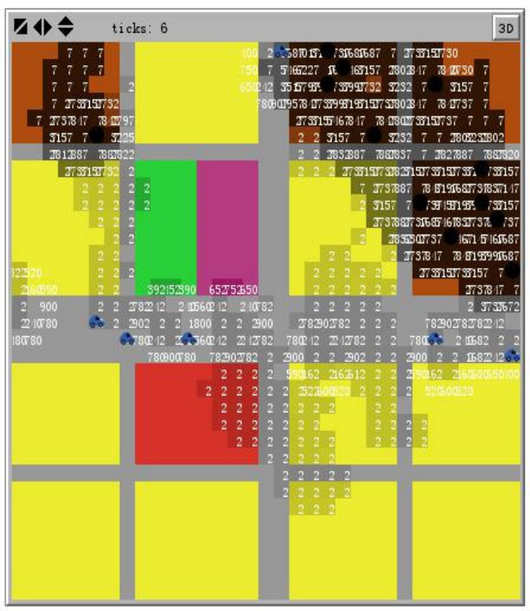
```
to-report DB-here [ids-to-exclude]
  set total-DB 0
    let wave-ids-here [ wave-id ] of wave-quanta-here
    foreach wave-ids-here [
      ask wave-quanta-here [set DB-of-each-quantum DB]
      set total-DB total-DB + DB-of-each-quantum
    ]
  set x total-DB + pollution
  report x
end

to crt-wave;;create sound wave
  let j 0
  let num-wave-quanta 180.0 ;;180 dots per wave
  hatch-wave-quanta num-wave-quanta
    [set color yellow
    set size 1
    set j j + 1
    set DB initial-wave-DB-car
    set wave-id next-wave-id
    set heading j * ( 360.0 / num-wave-quanta );;each dot
  ]
  set next-wave-id next-wave-id + 1;;foreach command cann
end

to crt-wave-factories;;create sound wave
  let j 0
  let num-wave-quanta 180.0 ;;180 dots per wave
  hatch-wave-quanta num-wave-quanta
    [set color yellow
    set size 1
    set j j + 1
    set DB initial-wave-DB-factories
    set wave-id next-wave-id
    set heading j * ( 360.0 / num-wave-quanta );;each dot
  ]
  set next-wave-id next-wave-id + 1;;foreach command cann
end
```

Result





Program2. Road Network Capacity Modelling

In Program 2, network capacity was simulated to test whether road LOS is proper under a certain land use and population distribution. This program can be exploded into four steps. First, build the road network and land use pattern; second, generate the agency(people) with orientation and destination on each parcel; third, move the agency from their orientation to destination in shortest pathway and leave a mark on the passing roads. Fourth, add up all the marks to get the overall traffic on each road.

The road capacity will be visualized by different width lines. the thicker the line is, the less capacity it has, which means it need more lanes to avoid congestion.

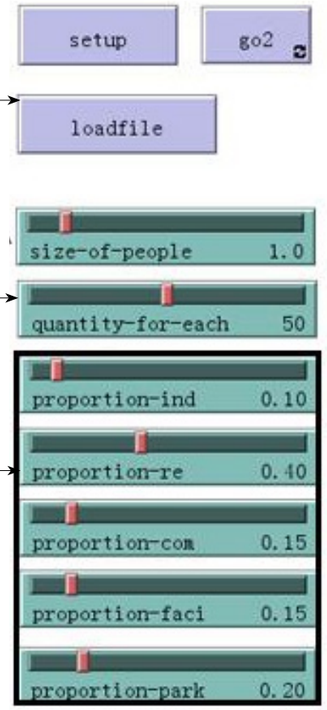
Running Panel

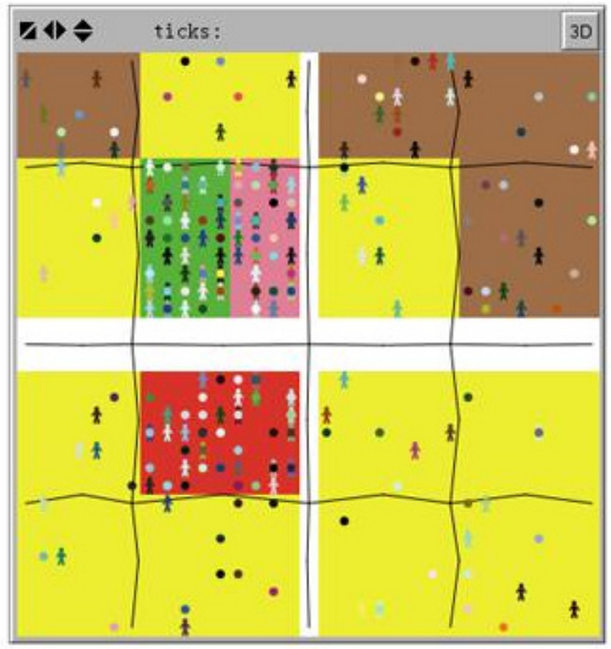
Set up land use and road network;
Load the population file;
Run the model;

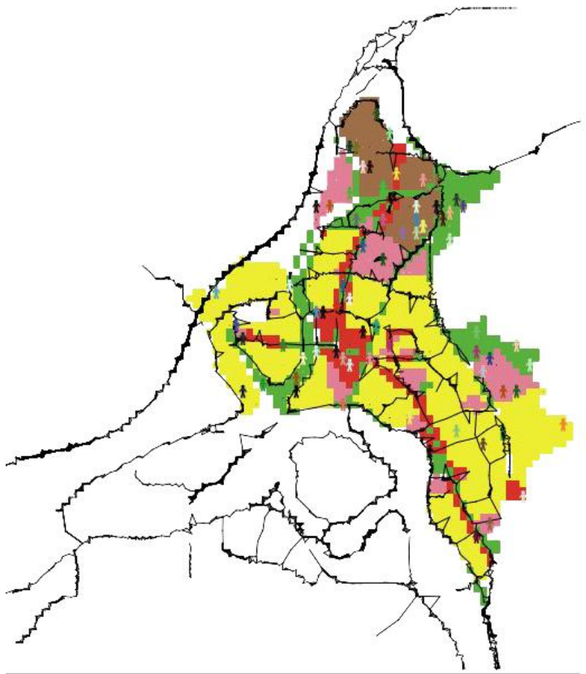
Controlling Panel

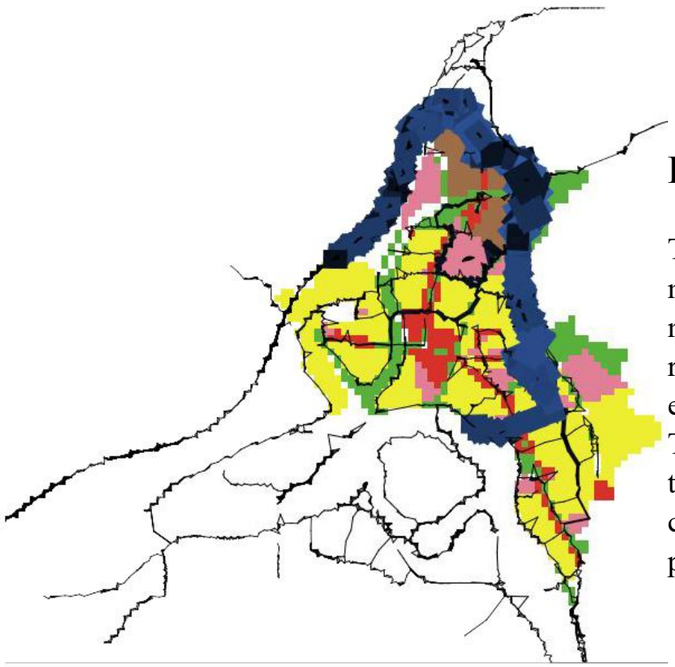
Adjust total population;

Adjust the proportation of people in one parcel who will go to a certain land use;









Real Project Simulation

To test the universality of this model, we applied it into a real master plan. The result shows that ring roads at the west, north and east has higher traffic pressure. Thus, the road level can be raised to avoid congestion. Besides, it can applied mixed land use to provide nearer job opportunities.