Pedistrian dynamics project

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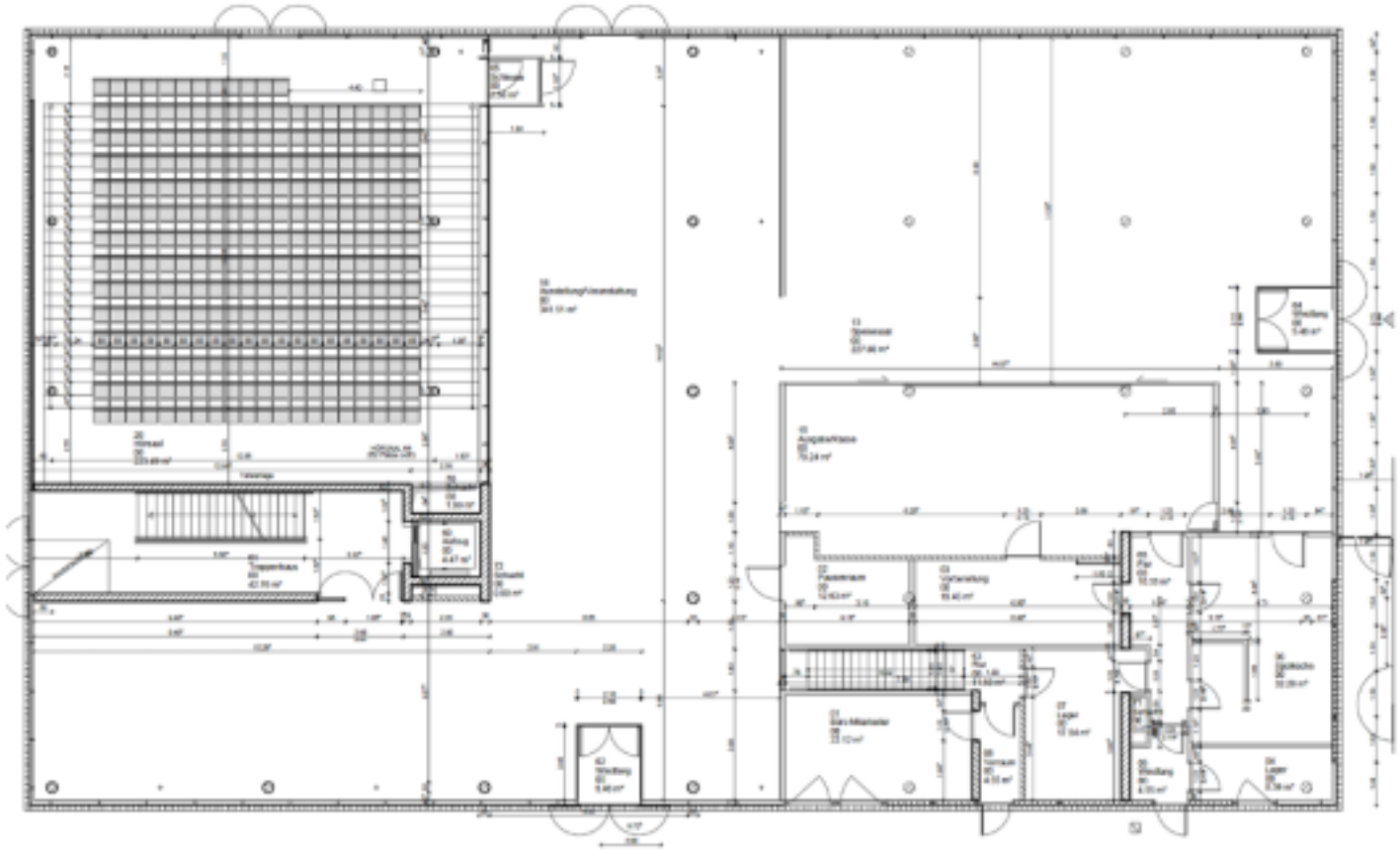
Motivation

The aim of this project is to create, simulate and analyze different evacuation scenarios of the first floor of building HC.



(a) Blueprint of the first floor

Parameters used in simulation

- agents distribution
  - minimum number of agents used in the simulation are 250
  - maximum number of agents used in the simulation are 500
- operational model (Tordeux2015)
  - Model used is a Velocity-based model
  - The model consists of two components: a direction sub-model that combines individual desired moving direction and neighbor's influence to imitate the process of navigating in a two-dimensional space, and an intrinsically collision-free speed sub-model which controls the speed of the agents with respect to the distance to their neighbors.

Two scenarios

First Scenario:

In this scenario, All the doors is open the whole time.

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
 <JPScore project="JPS-Project" version="0.8">
    <events update_frequency="2" update_radius="100" agents_color_by_knowledge="true">
        <event time="0" state="open" id="0" />
        <event time="0" state="open" id="1" />
        <event time="0" state="open" id="2" />
        <event time="0" state="open" id="3" />
        <event time="0" state="open" id="4" />
        <event time="0" state="open" id="5" />
        <event time="0" state="open" id="6" />
        <event time="0" state="open" id="7" />
        <event time="0" state="open" id="8" />
        <event time="0" state="open" id="9" />
        <event time="0" state="open" id="10" />
        <event time="0" state="open" id="11" />
        <event time="0" state="open" id="12" />
        <event time="0" state="open" id="13" />
        <event time="0" state="open" id="14" />
        <event time="0" state="open" id="15" />
        <event time="0" state="open" id="16" />
        <event time="0" state="open" id="17" />
        <event time="0" state="open" id="18" />
        <event time="0" state="open" id="19" />
        <event time="0" state="open" id="20" />
        <event time="0" state="open" id="21" />
        <event time="0" state="open" id="22" />
        <event time="0" state="open" id="23" />
        <event time="0" state="open" id="24" />
        <event time="0" state="open" id="25" />
        <event time="0" state="open" id="26" />
        <event time="0" state="open" id="27" />
        <event time="0" state="open" id="28" />
        <event time="0" state="open" id="29" />
    </events>
</JPScore>
```

Basic two scenarios

Second Scenario:

In this one, I closed specific doors after 10 secs (mainly the offices and kitchen) and the Mensa after 25 secs

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
 <JPScore project="JPS-Project" version="0.8">
    <events update_frequency="2" update_radius="100" agents_color_by_knowledge="true">
        <event time="25" state="close" id="0" />
        <event time="0" state="open" id="1" />
        <event time="0" state="open" id="2" />
        <event time="10" state="close" id="3" />
        <event time="0" state="open" id="4" />
        <event time="0" state="open" id="5" />
        <event time="0" state="open" id="6" />
        <event time="10" state="close" id="8" />
        <event time="10" state="close" id="7" />
        <event time="0" state="open" id="9" />
        <event time="0" state="open" id="10" />
        <event time="10" state="close" id="11" />
        <event time="10" state="close" id="12" />
        <event time="0" state="open" id="13" />
        <event time="10" state="close" id="14" />
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        <event time="0" state="open" id="19" />
        <event time="0" state="open" id="20" />
        <event time="10" state="close" id="21" />
        <event time="0" state="open" id="22" />
        <event time="0" state="open" id="23" />
        <event time="10" state="open" id="24" />
        <event time="0" state="open" id="25" />
        <event time="0" state="open" id="26" />
        <event time="0" state="open" id="27" />
        <event time="0" state="open" id="28" />
        <event time="0" state="open" id="29" />
    </events>
</JPScore>
```

Simulations

Constant values

I used the same values in every simulation of:

- Distribution of agents (seed)
- Operational method
- The geometry

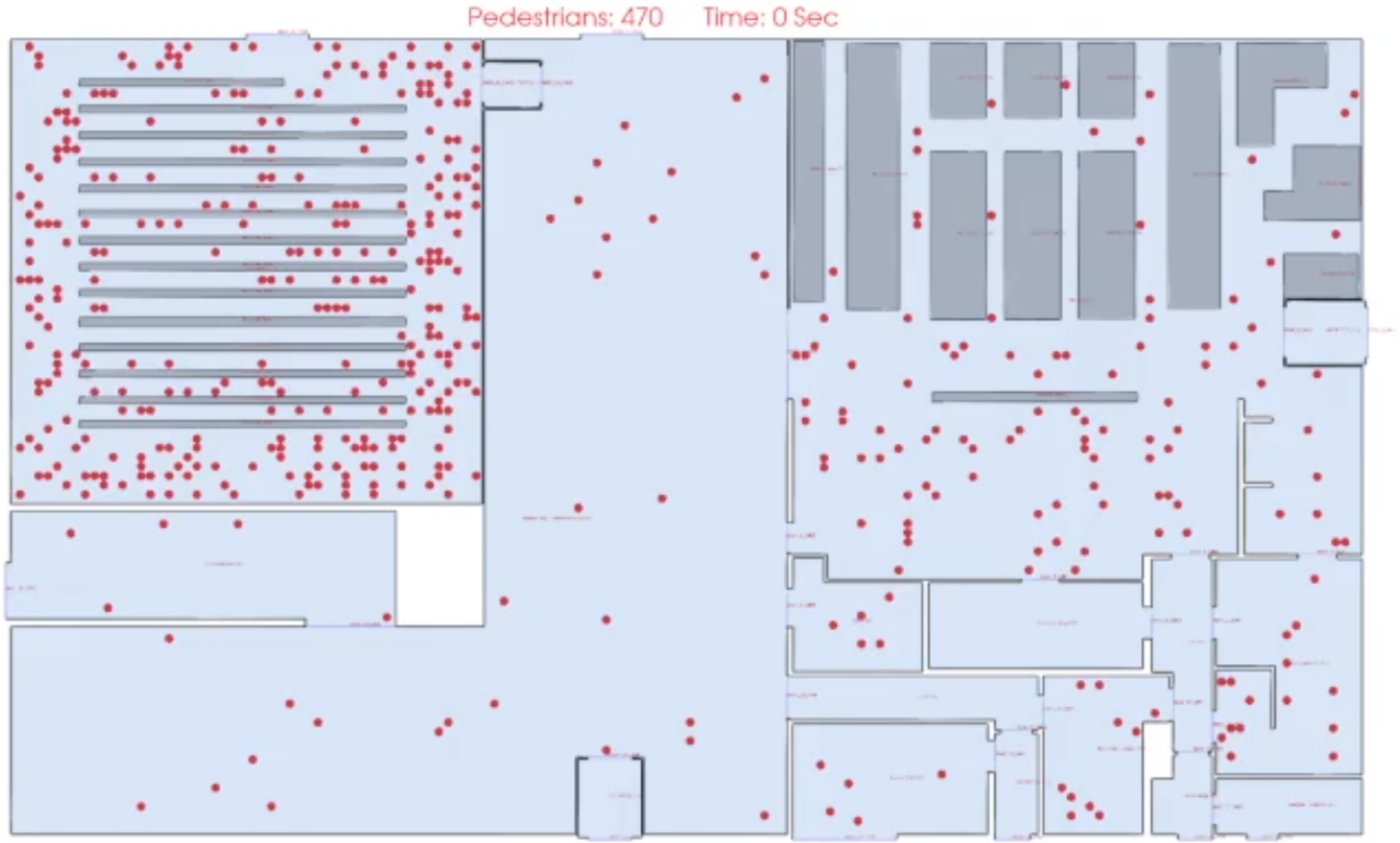
variable values

the variables in the simulations are:

- number of agents
- changing the goal of the agents

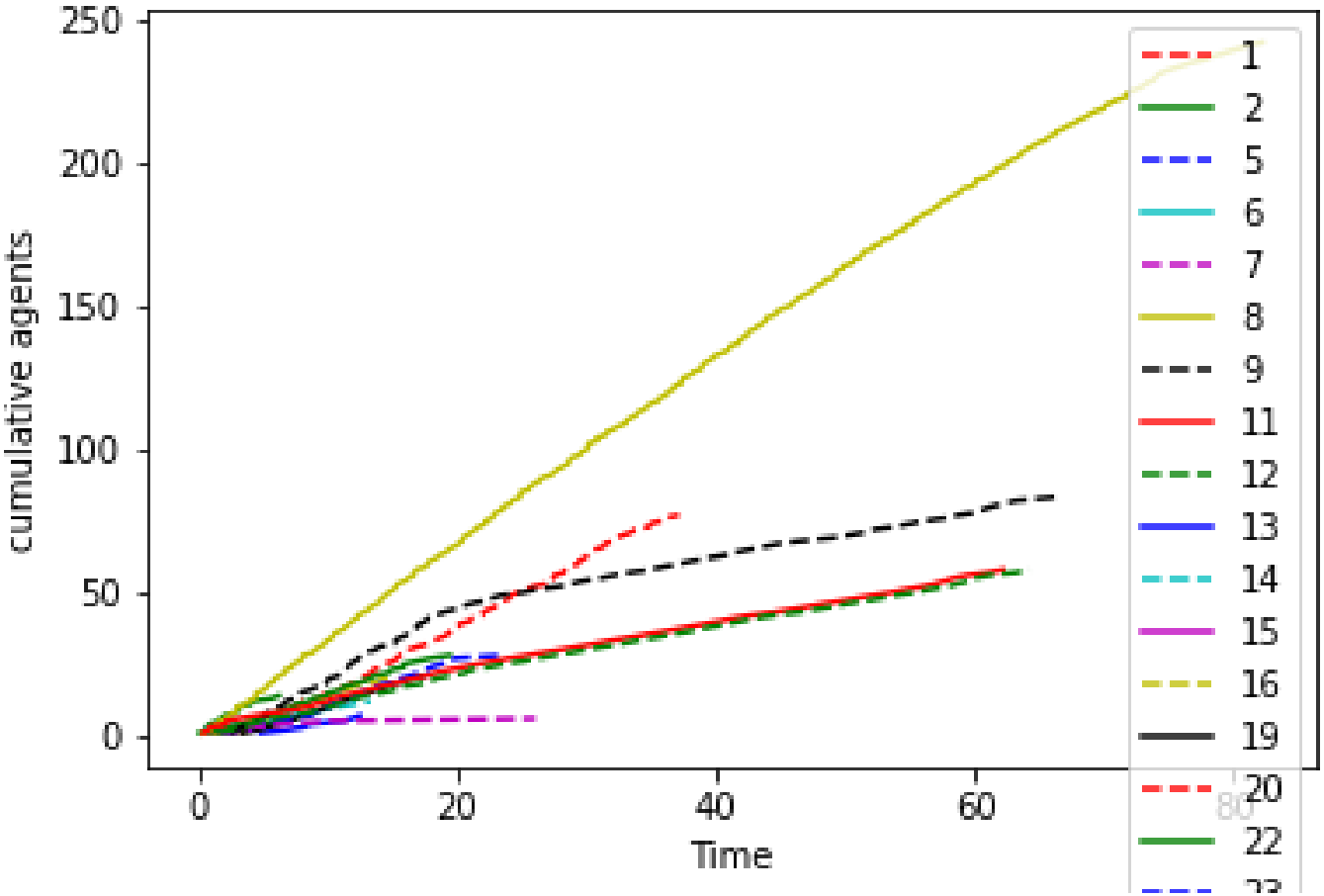
First Simulation

Consider that there is lecture in the main lecture hall (300 agent)and Mensa is fairly busy (100 agent). The evacuation took 82 seconds.



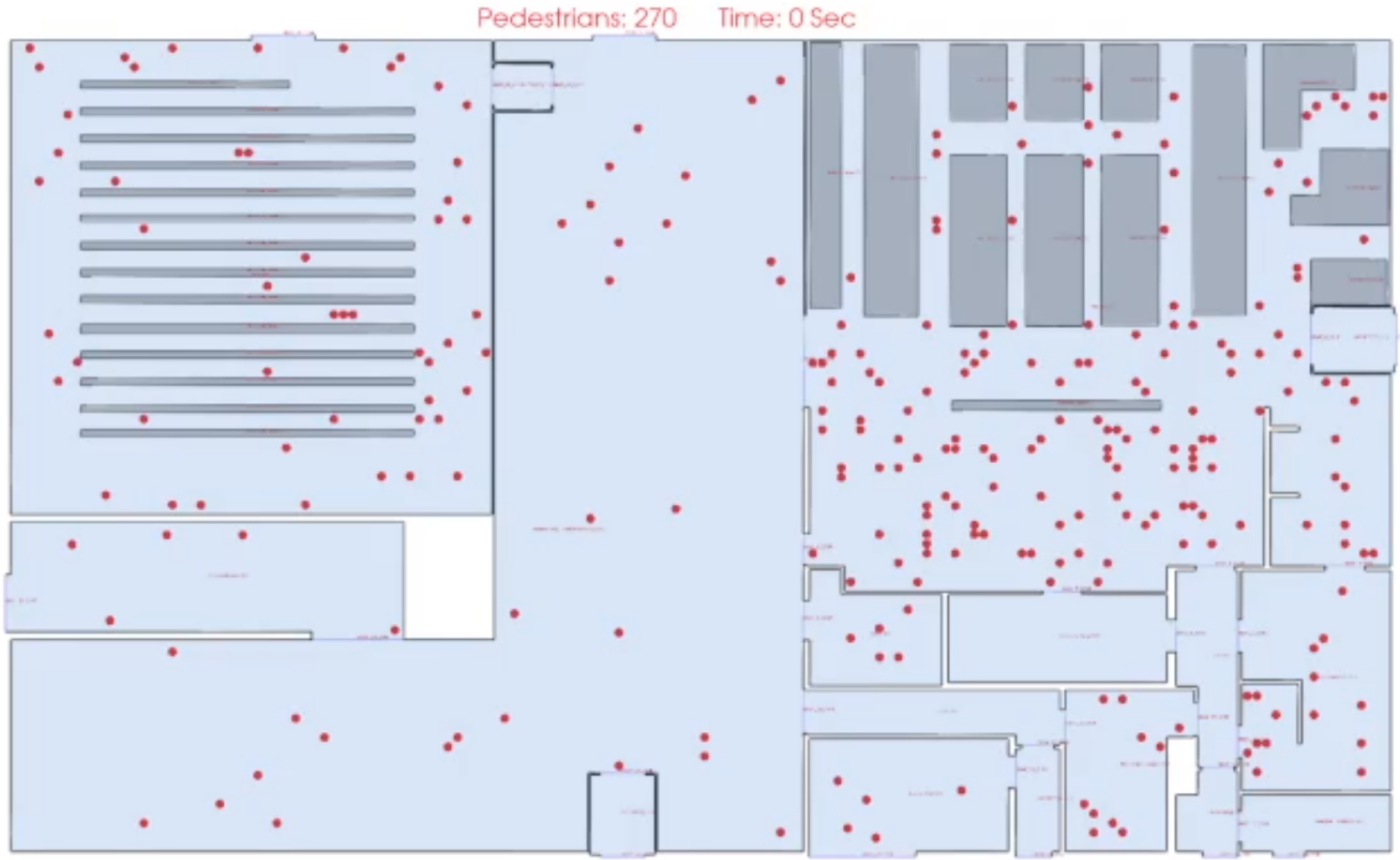
Analysis of the exits data

from this graph between the cumulative number of agents & time, that only the lecture hall taking around 20 seconds more.



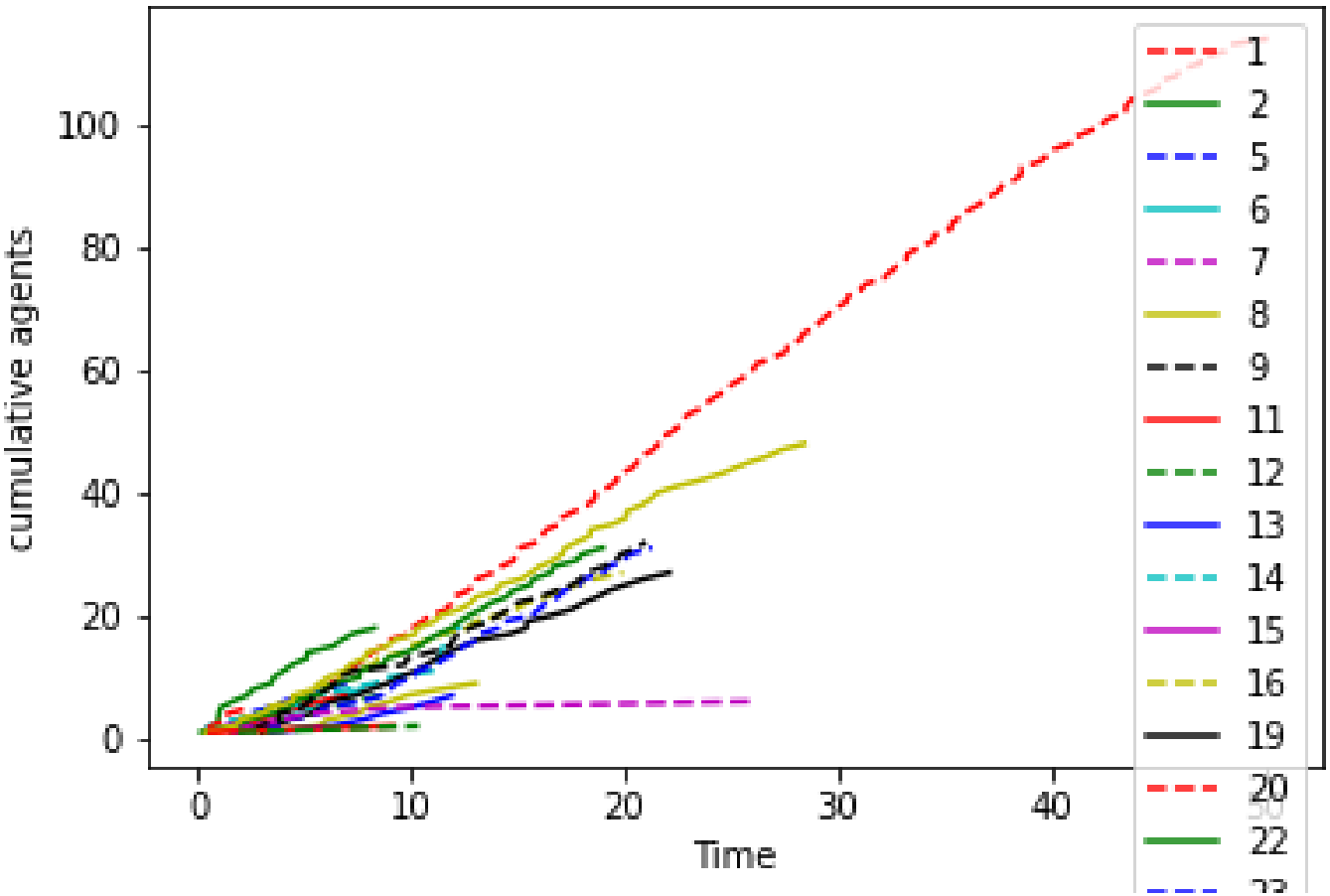
Second Simulation

Consider that there is no lecture in the main lecture hall (30 agent)and Mensa is crowded (150 agent). The evacuation took 50 seconds.



Analysis of the exits data

in this case the Mensa evacuation taking around 20 more seconds than the other rooms.



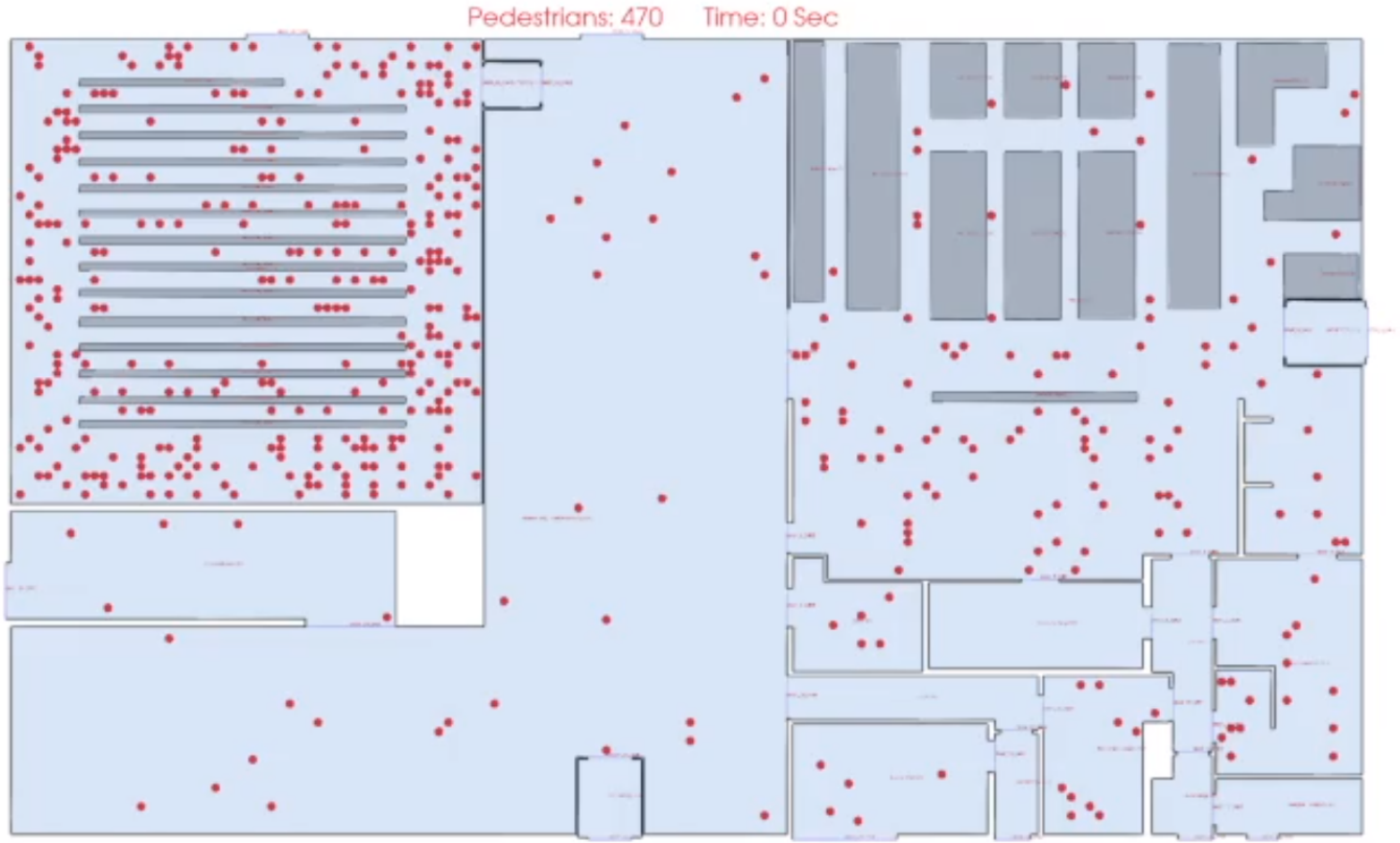
Goal

from the first two simulations, we found that only one room affecting the whole simulation time.
As a solution, we had to distribute the agents on the two doors available in the room to decrease the evacuation time and avoid the bottleneck near the exit door.

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<JPScore project="JPS-Project" version="0.8">
  <goals>
    <goal id="0" final="true" caption="goal1">
      <polygon>
        <vertex px="30" py="38.9" />
        <vertex px="33" py="38.9" />
        <vertex px="33" py="40.5" />
        <vertex px="30" py="40.5" />
        <vertex px="30" py="38.9" />
      </polygon>
    </goal>
  </goals>
</JPScore>
```

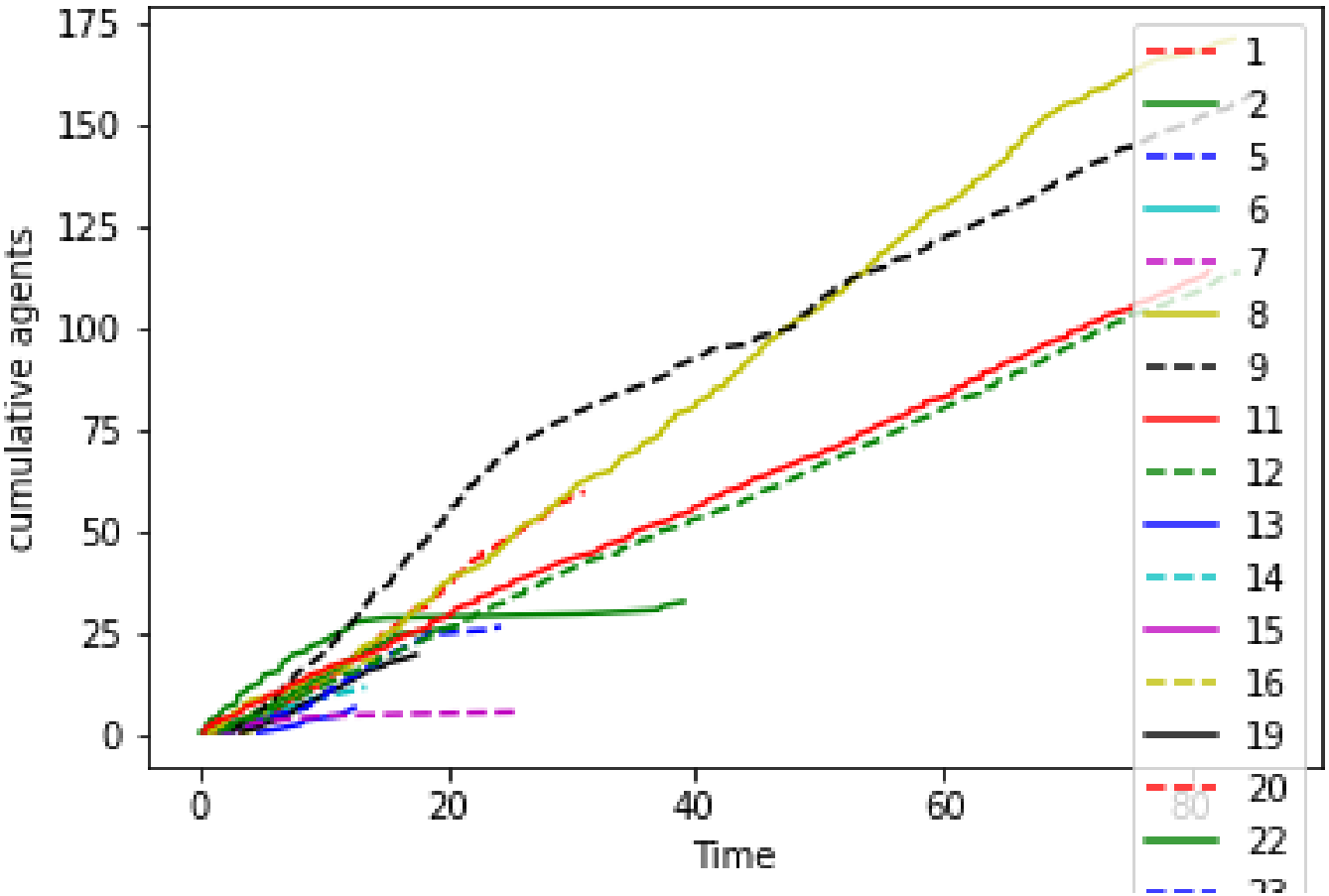
Third Simulation

Its similar to the first simulation but this time with two groups in the lecture hall (100 and 200 agents). to use the doors available in the lecture room.it took 86 seconds.



Analysis of the exits data

it took almost the same time, but more distributed on the exit doors

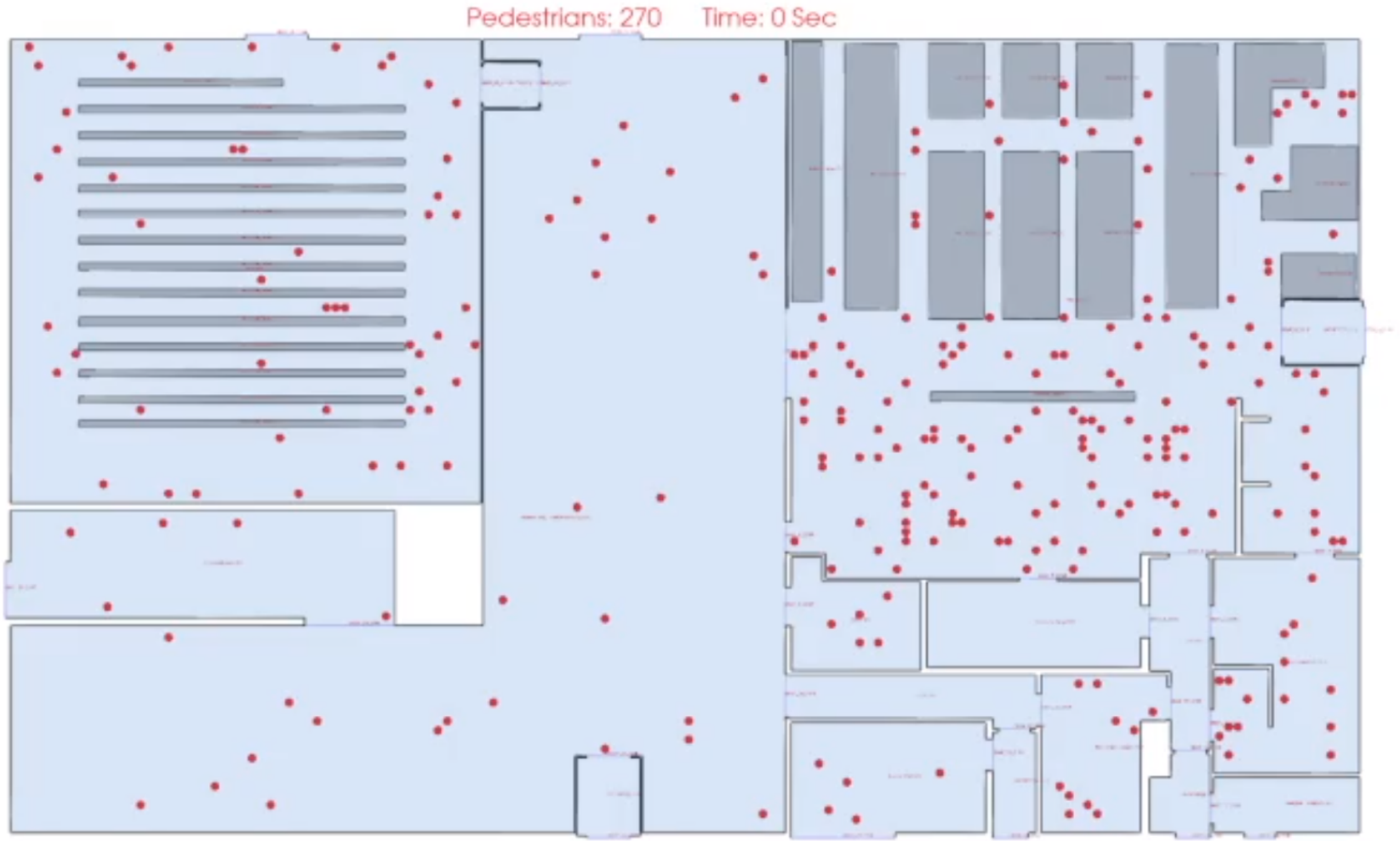


Fourth Simulation

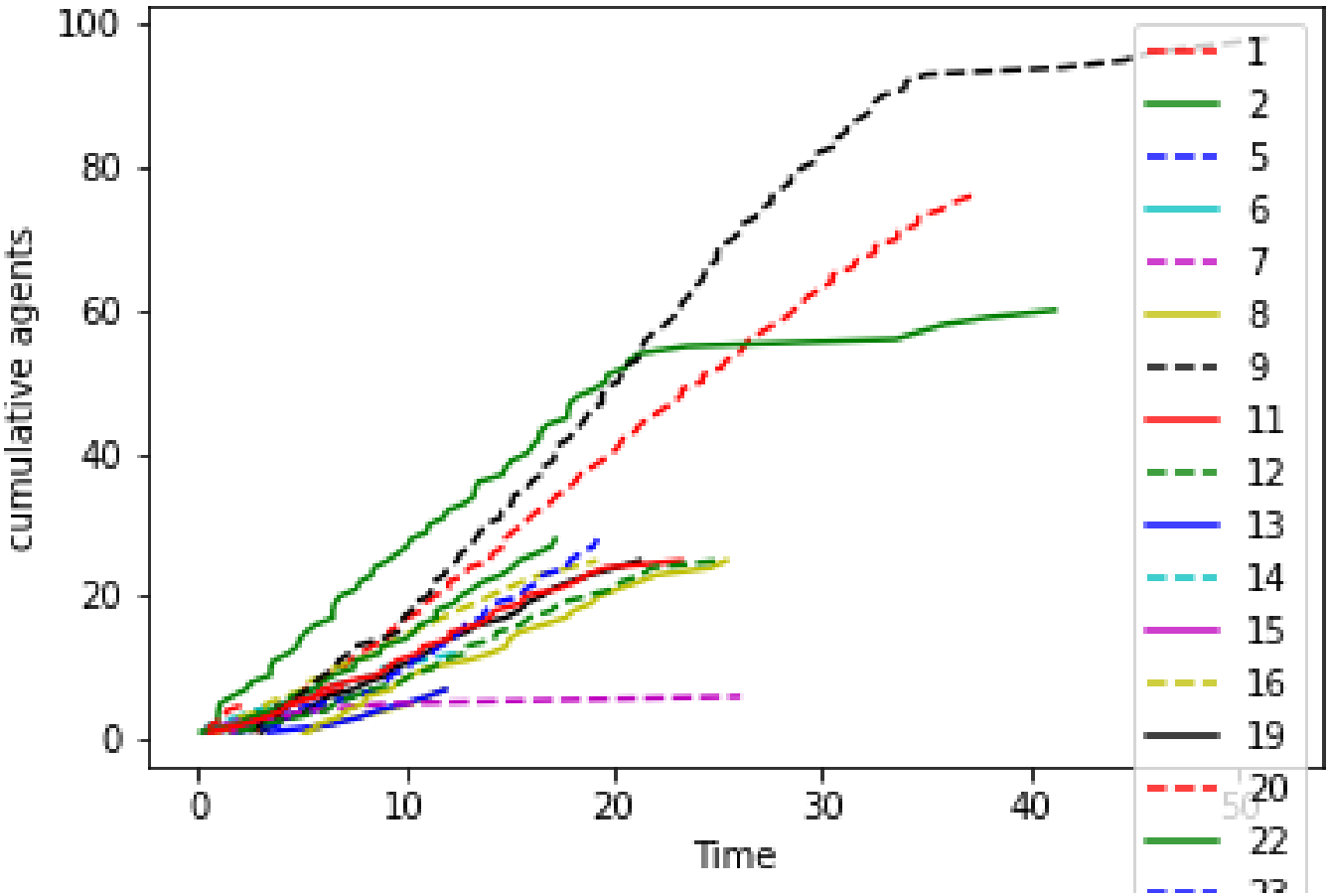
its similar to the Second simulation but this time with two groups in the Mensa (100 agents and 50 agents). to use the doors available in the lecture room.

Fourth Simulation

Let's see the video



Analysis of the exits data



GitHub link

Repository link

Thanks!