Programa de Pós-Graduação em Computação Aplicada
Instituto Nacional de Pesquisas Espaciais (INPE)

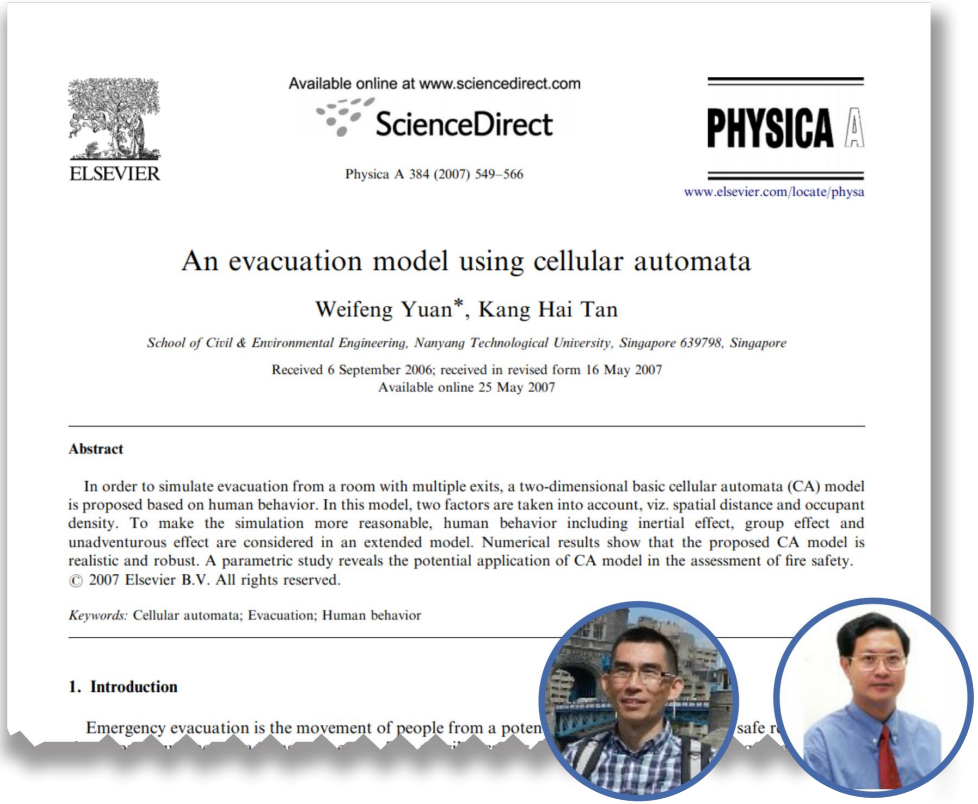
CAP 241 - Linguagens Formais e Automata

An evacuation model using cellular automata

Adaptação Autômatos Celulares com Software TerraME

Adriano Pereira Almeida
Helvécio Bezerra Leal Neto

INTRODUCTION



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An evacuation model using cellular automata

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Received 6 September 2006; received in revised form 16 May 2007
Available online 25 May 2007

Abstract

In order to simulate evacuation from a room with multiple exits, a two-dimensional basic cellular automata (CA) model is proposed based on human behavior. In this model, two factors are taken into account, viz. spatial distance and occupant density. To make the simulation more reasonable, human behavior including inertial effect, group effect and unadventurous effect are considered in an extended model. Numerical results show that the proposed CA model is realistic and robust. A parametric study reveals the potential application of CA model in the assessment of fire safety.

Keywords: Cellular automata; Evacuation; Human behavior

1. Introduction

Emergency evacuation is the movement of people from a poten

safe r

EVACUATION

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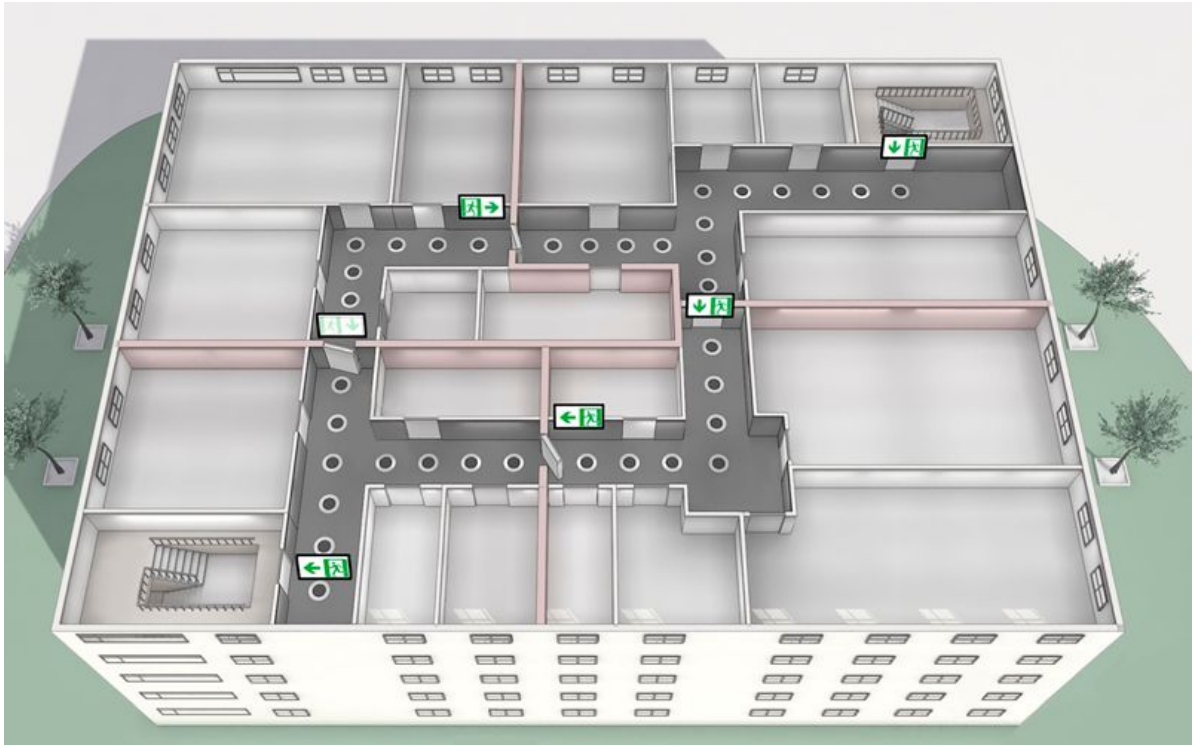
EVACUATION



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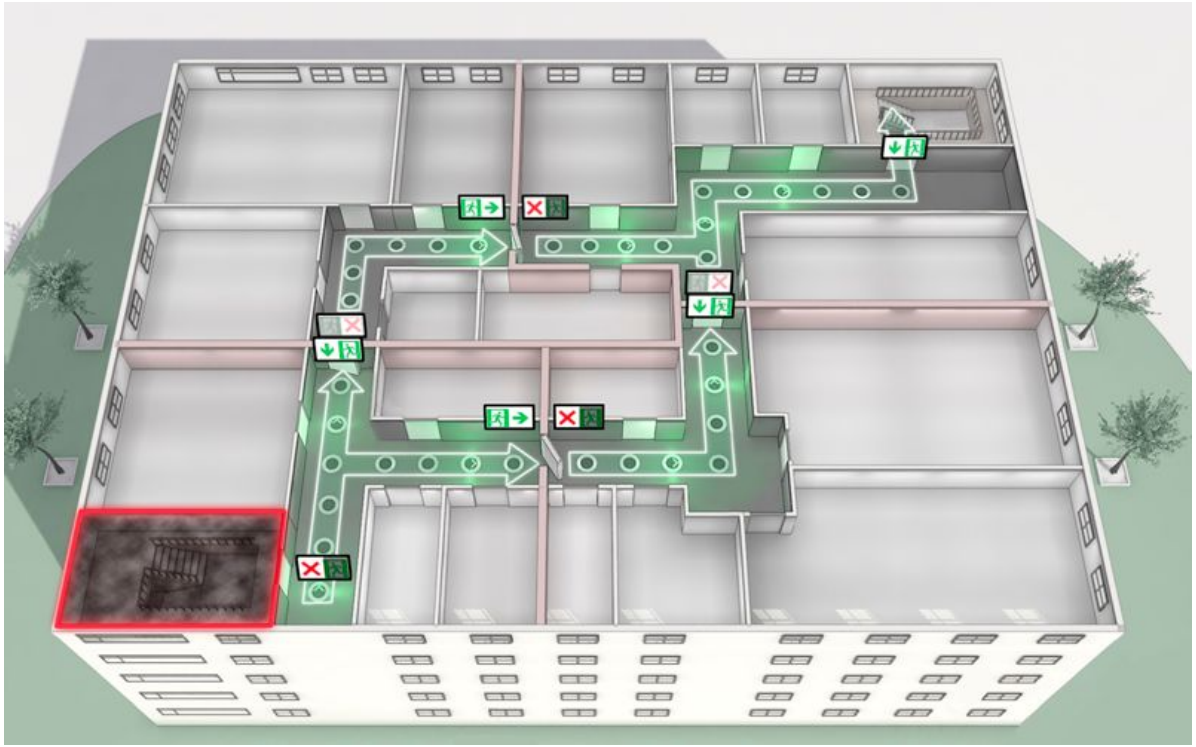

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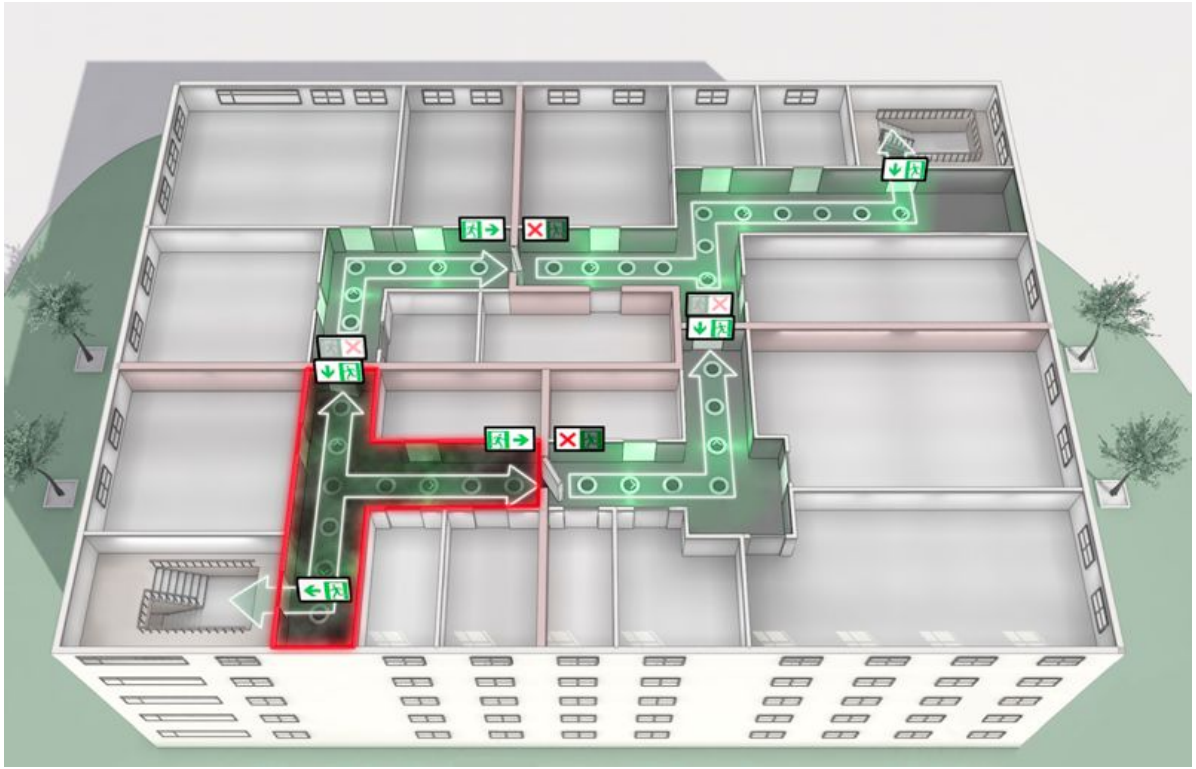

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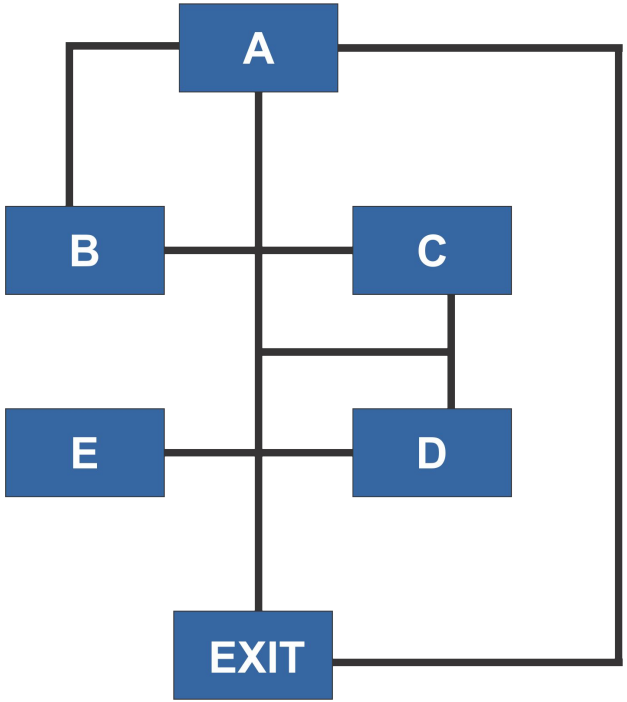
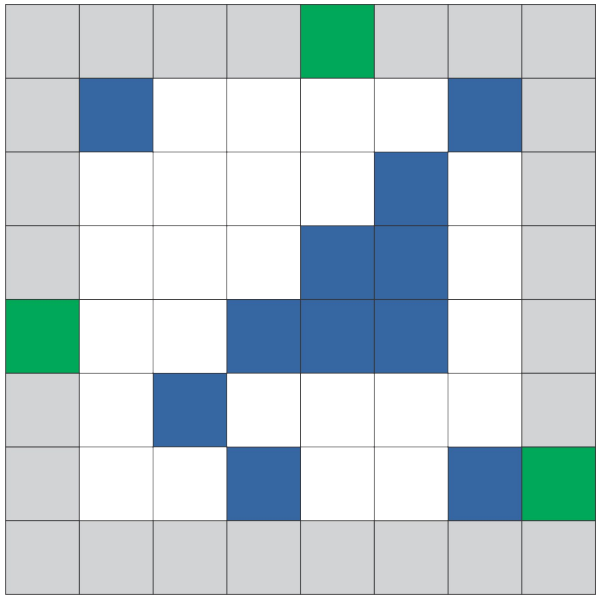
EVACUATION



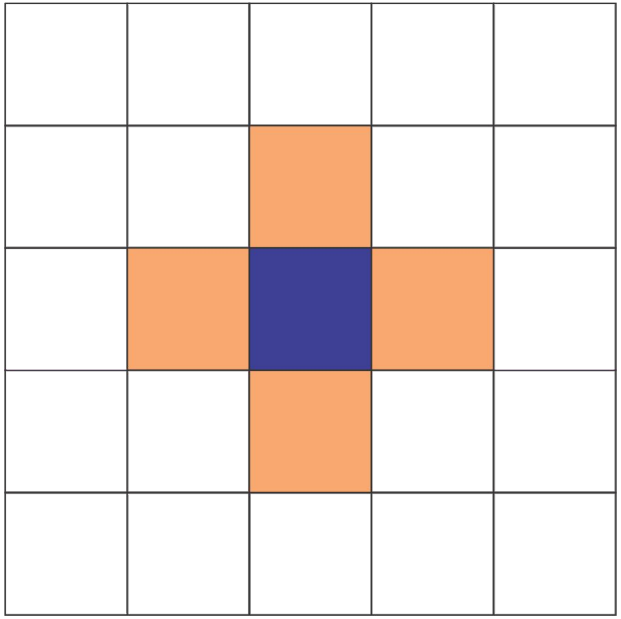
Flow-Based Model
Agent-Based Model

EVACUATION

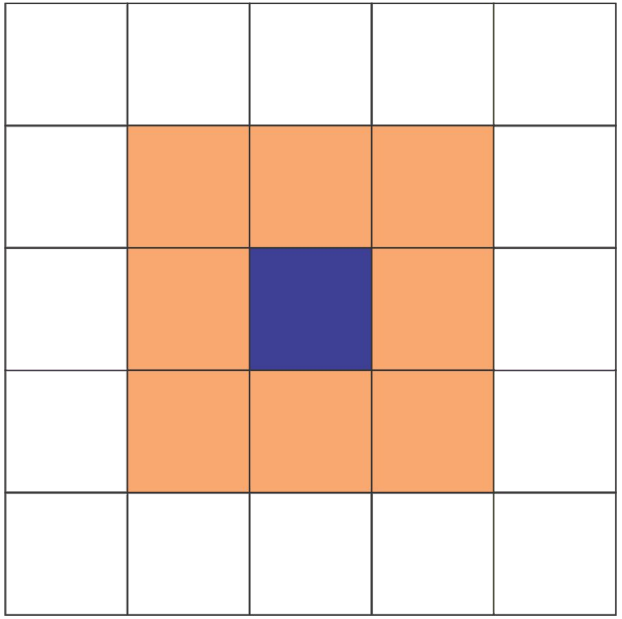


Cellular Automata

CELLULAR AUTOMATA

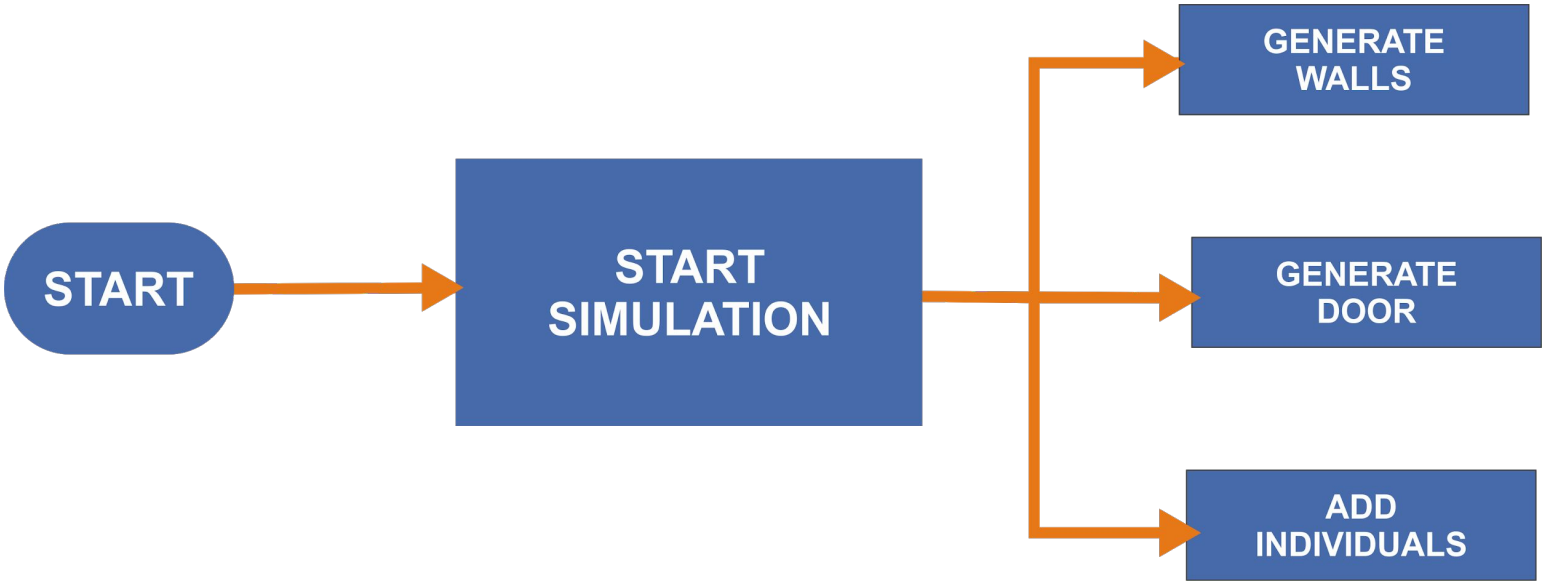


Von Neumann
Neighbourhood



Moore
Neighbourhood

DEVELOPED MODEL - FLOW



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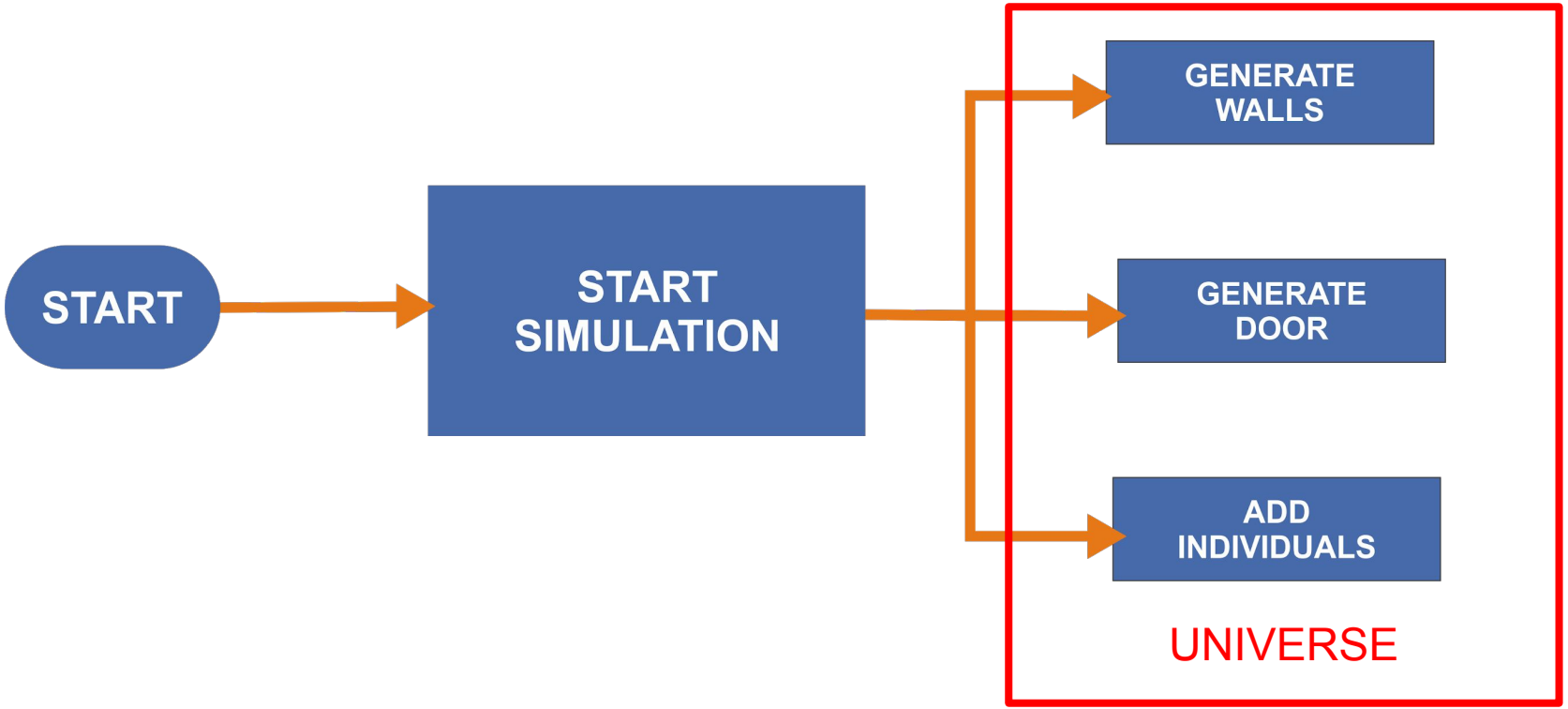
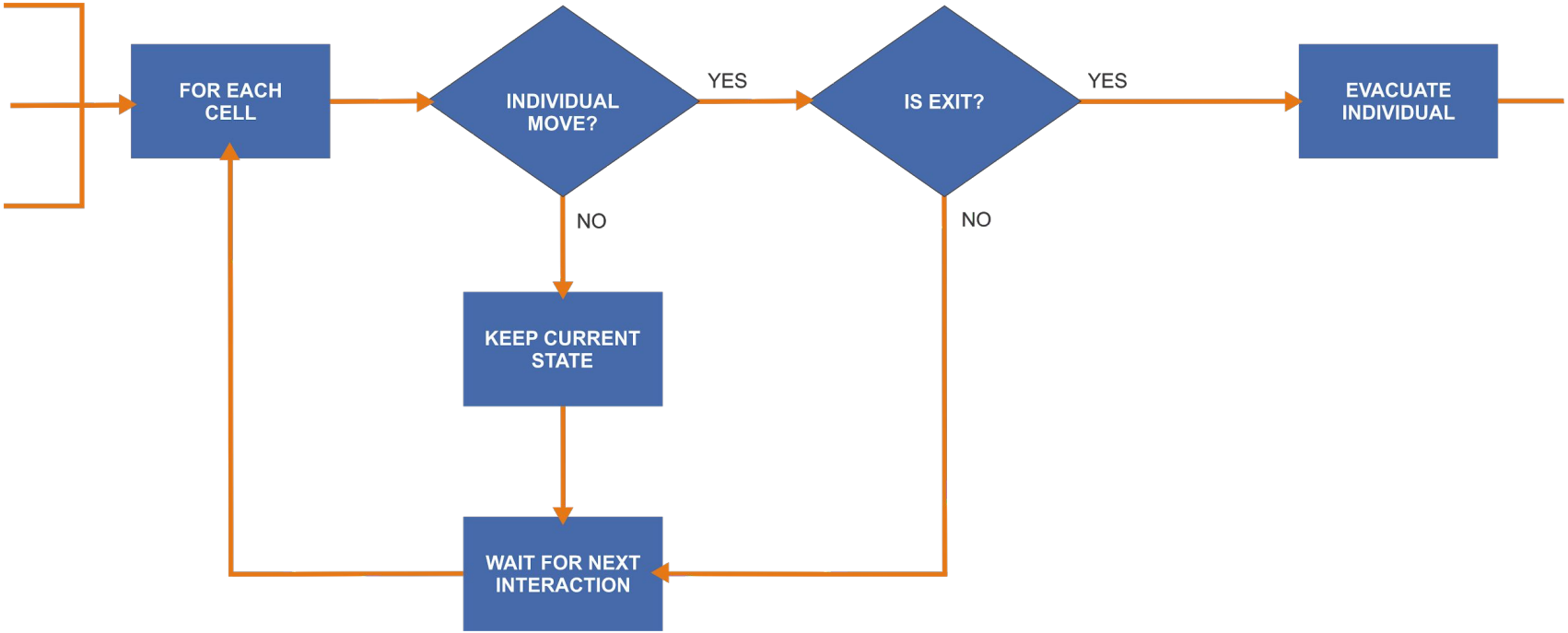
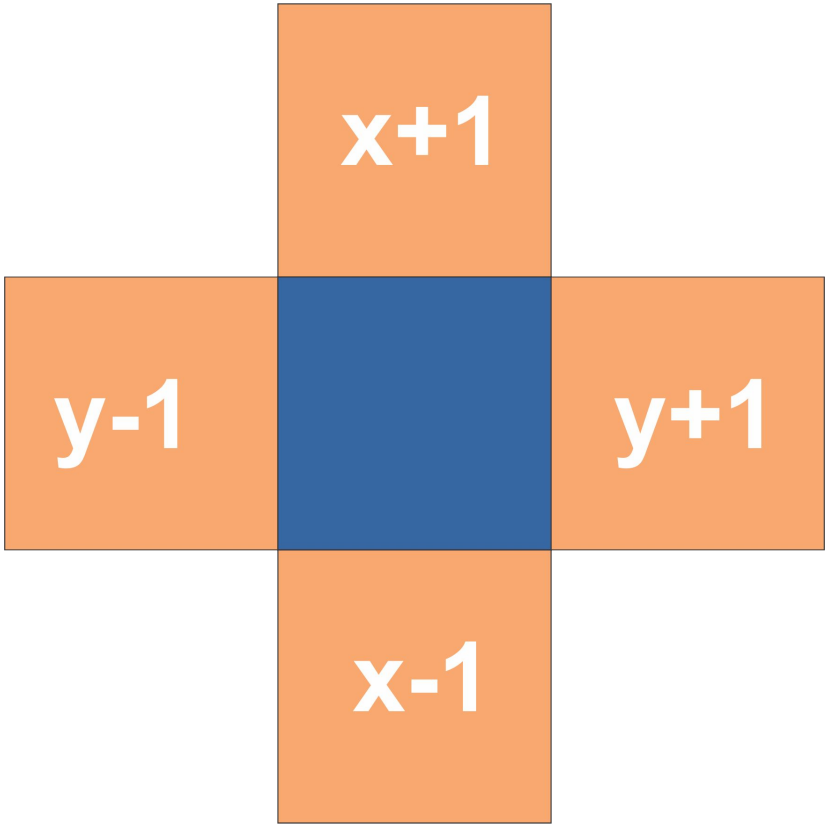


DEVELOPED MODEL - FLOW



DEVELOPED MODEL - FLOW

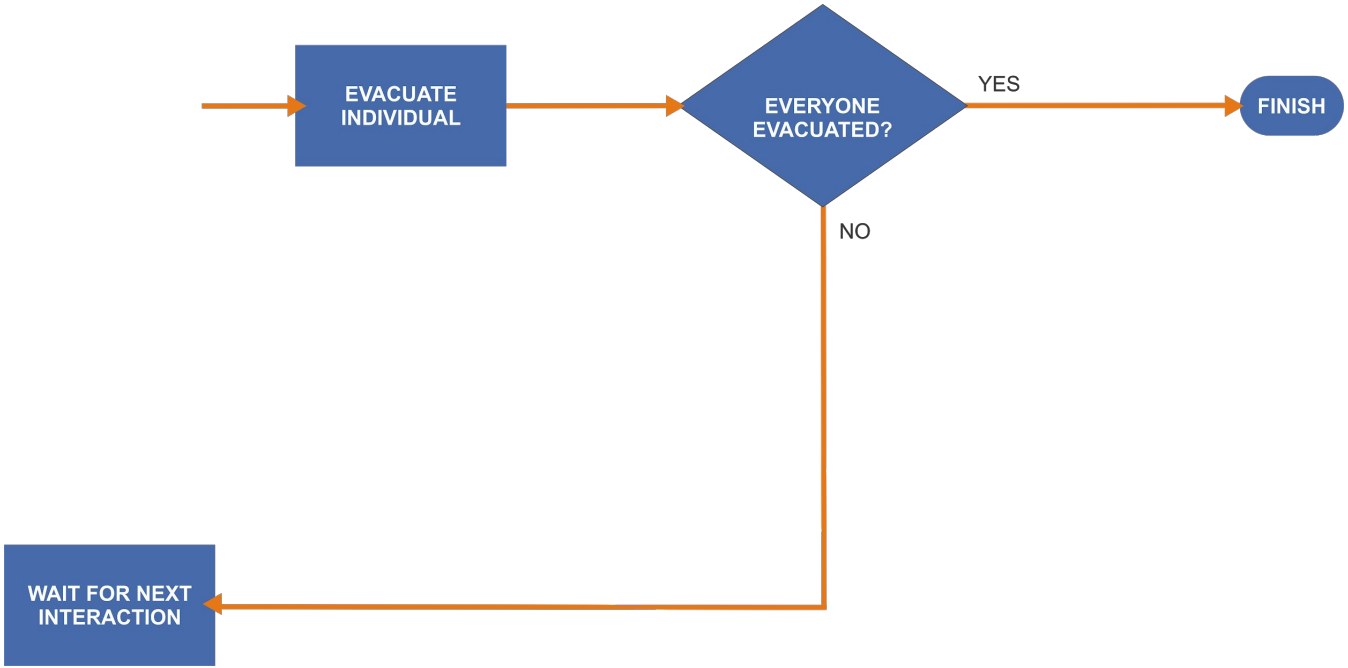


main_function:

```
1 if xp>xd and valid(P[xp-1][yp]),
2 then:
3 move(P[xp][yp], P[xp-1][yp])
4
5 if xp<xd and valid(P[xp+1][yp]),
6 then:
7 move(P[xp][yp], P[xp+1][yp])
8
9 if yp>yd and valid(P[xp][yp-1]),
10 then:
11 move(P[xp][yp], P[xp][yp-1]).
12
13 if yp<yd and valid(P[xp][yp+1]),
14 then:
15 move(P[xp][yp], P[xp][yp+1]).
```

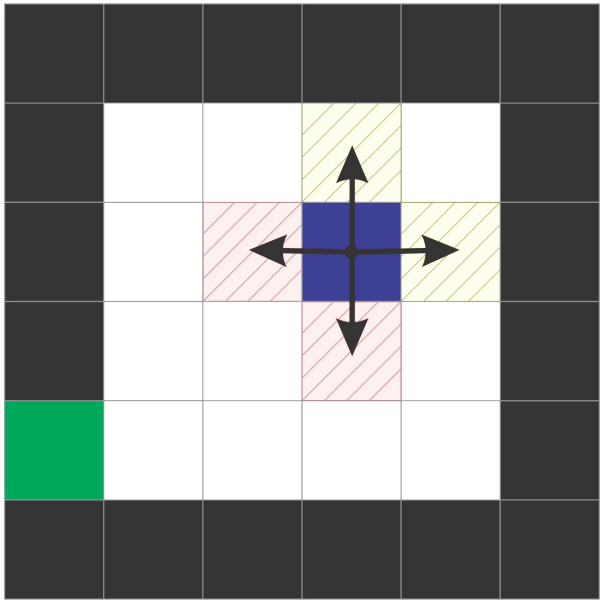
Algorithm: **xp** and **xy** are the coordinate indices of the person, and **xd** and **yd** are the coordinates of the door.

DEVELOPED MODEL - FLOW

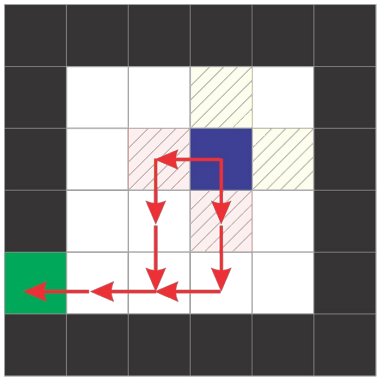
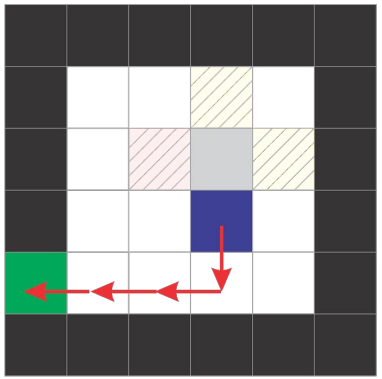
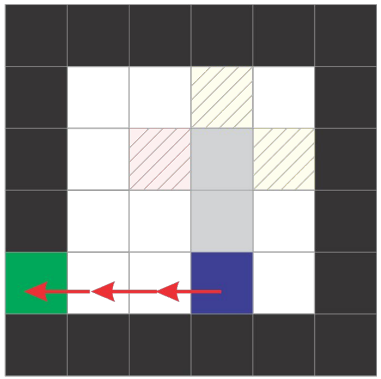
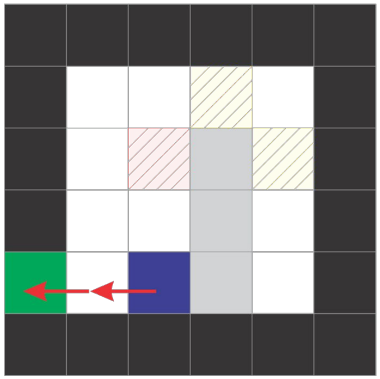
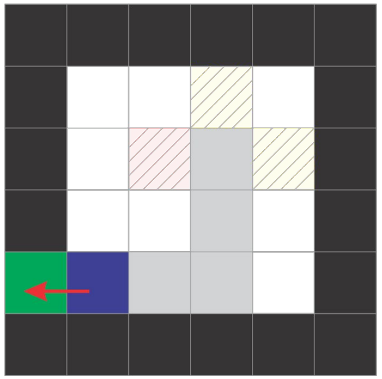
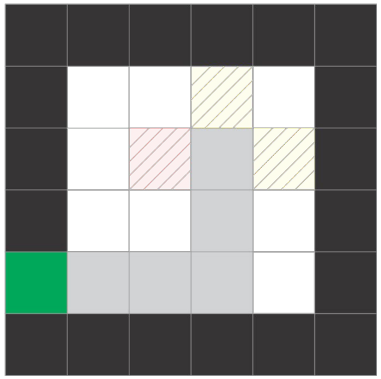


BASIC MODEL

- Universe
- Person
- Current State
- Spatial Distance
- Wall
- Exit



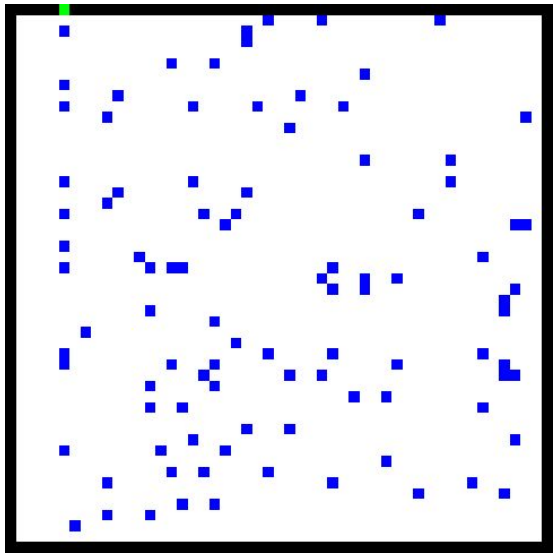
BASIC MODEL

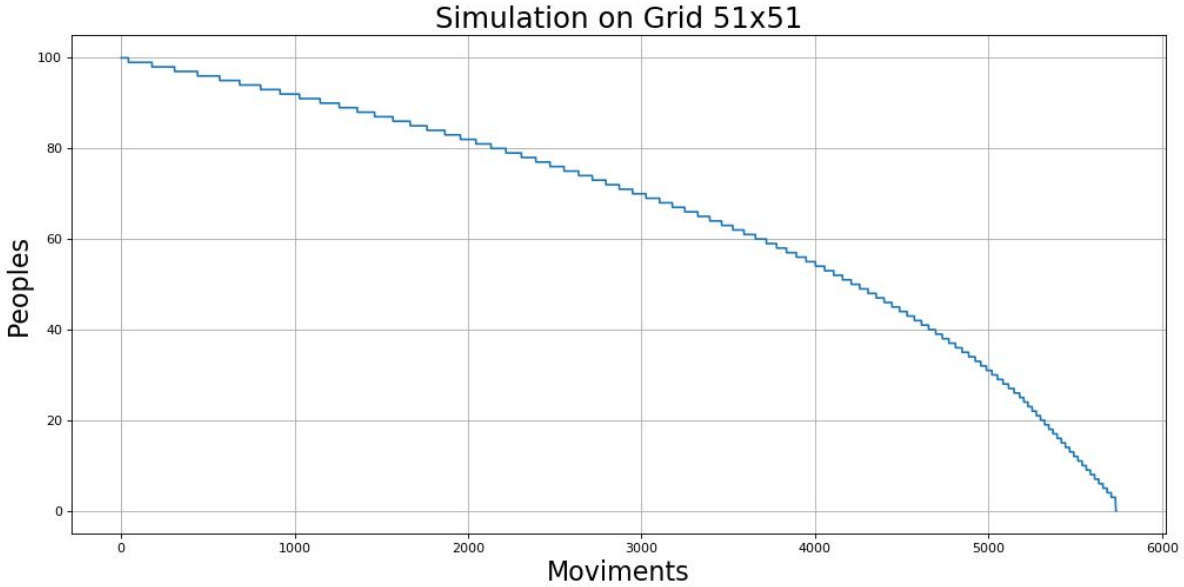







Support Technologies

RESULTS

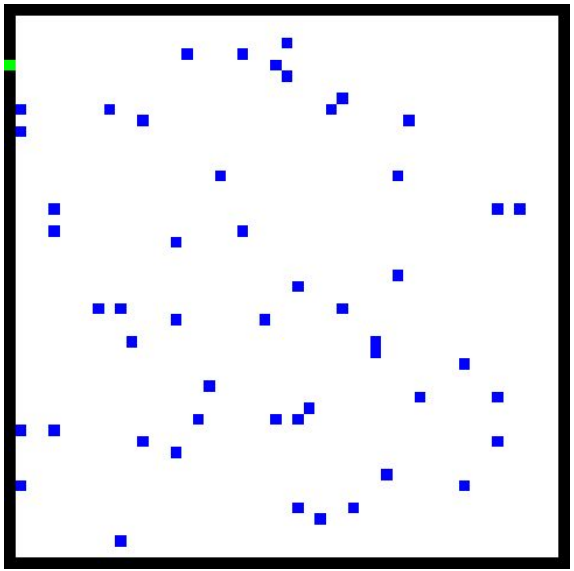
Simulation of Evacuation with 100 Peoples

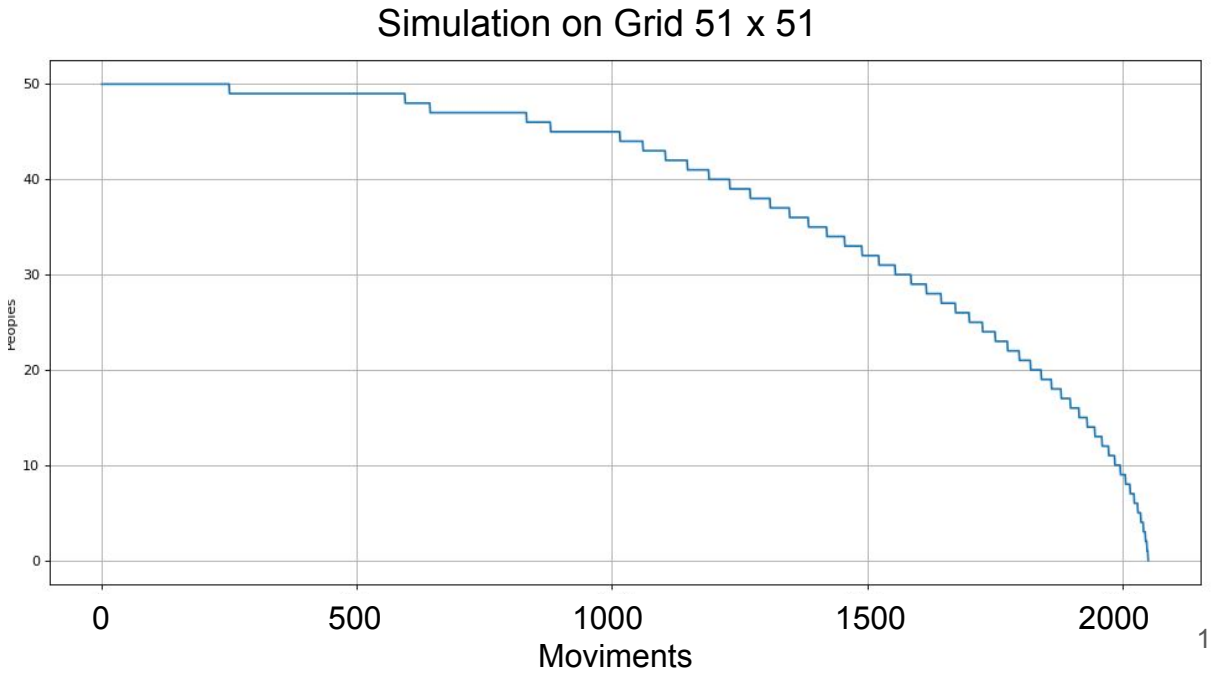




RESULTS

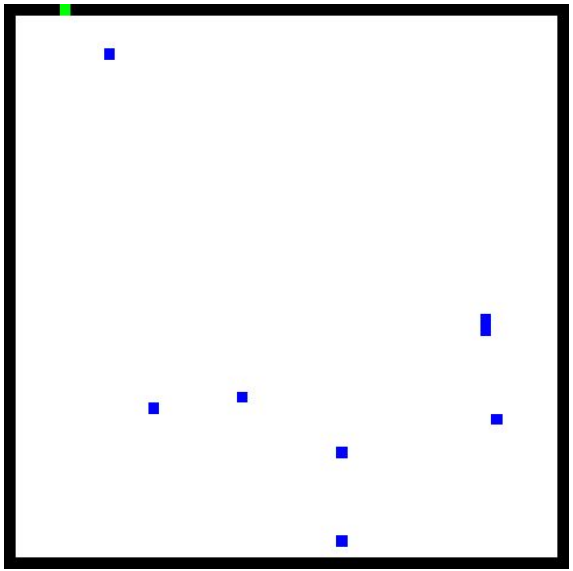
Simulation of Evacuation with 50 Peoples

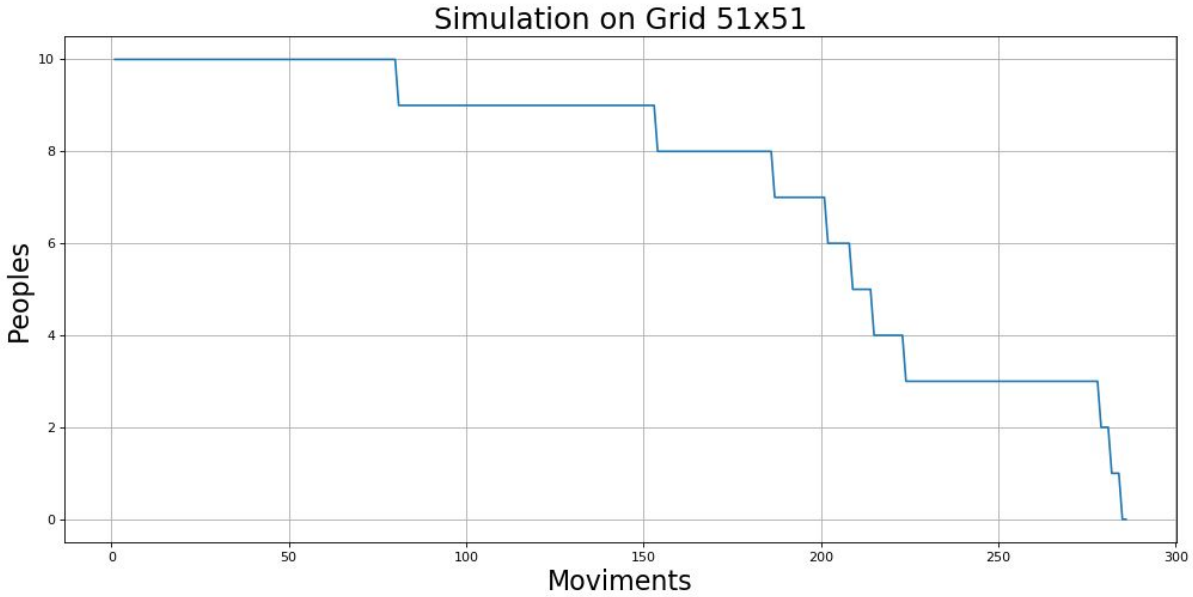




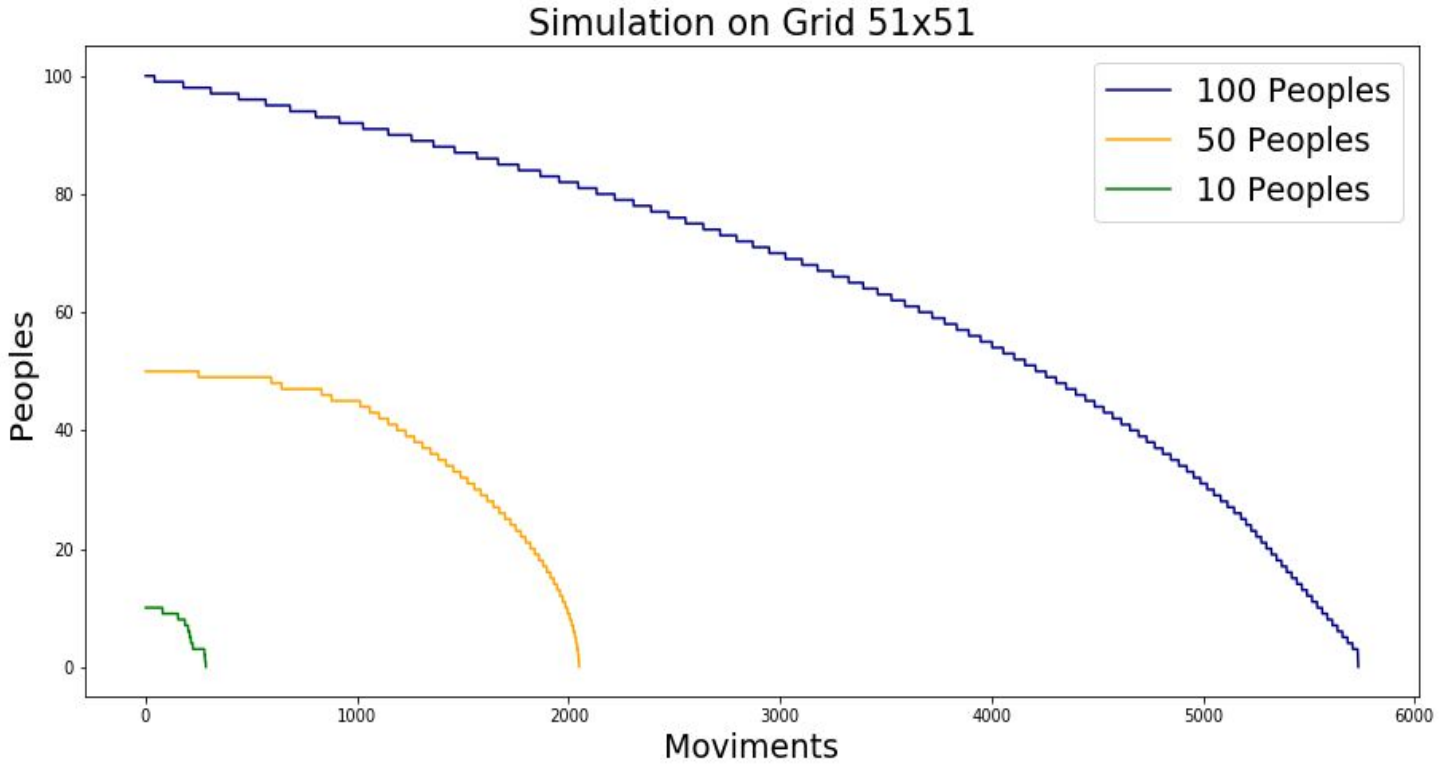
RESULTS

Simulation of Evacuation with 10 Peoples





RESULTS


Simulation on Grid 51x51
100 Peoples
50 Peoples
10 Peoples
Peoples
Moviments
0
20
40
60
80
100
0
1000
2000
3000
4000
5000
6000

CONCLUSIONS

PAPPER CONTRIBUTION

STRATEGIES

EVACUATION

TERRAME

FUTURE WORK

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CAP 241 - Linguagens Formais e Automata

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