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REPORT FOR MULTI AGENT SYSTEMS

Public Transport Mobility Simulation



Réalisé

Par

Dhia Aderssa

Omar M'rad

Riadh Rabti

Encadrant : M.Mahdi Zargayouna

M2 SYSTEME INTELLIGENTS ET APPLICATIONS

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1 General presentation of the project

1.1 Academic context :

As part of the course entitled “Multi Agent systems“, we are divided into groups of three in order to implement what we have learned throughout this course through a project. This year’s project entitled “Public transport mobility simulation”.

1.2 Project Context :

“Public transport mobility simulation” is a simulation where the goal is to design and implement a multi-agent system that simulates the movements of passengers and public transport vehicles in a city. The city is characterized by its road network and bus stops, and passengers have specific origins and destinations within the city. The simulation also includes predefined timetables for public transport vehicles.

2 Project objectives

Create an application that :

- System Parameter Definition : Clearly define and document the parameters that govern the system, including passenger characteristics, vehicle capacities, walking speeds, and any other relevant factors that influence the simulation.
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- City Representation : Develop an accurate representation of the city, utilizing a suitable data structure such as a grid, to model the road network, locations of bus stops, and other features integral to the transportation infrastructure.
- Public Transport Vehicle Modeling : Model the behavior of public transport vehicles, specifying their routes, timetables, capacities, and any other relevant attributes. Consider factors like speed, boarding/alighting times, and adherence to schedules.
- Passenger and Vehicle Movements : Define the behaviors of passengers and vehicles as agents within the system. Detail how passengers decide between walking and using public transport based on travel time and convenience. Specify the movements of public transport vehicles, including stops and starts.

3 Project decomposition

The project is divided into main phases , the first one is creating the agents and the environment in general with the different components interacting with each each other to complete the objective. The second phase , we will introduce disturbances (such as road blocks etc) in order to test how the systems will deal with these newly added obstacles

3.1 Project architecture :

3.1.1 The city component

the city (e.g. grid) , This component focuses on the development of a representation of the city using an appropriate data structure, such as a grid. Algorithms will be created to initialize the city representation based on the defined parameters. The city representation will include the road network, locations of bus stops, and other features crucial for simulating transportation within the city.

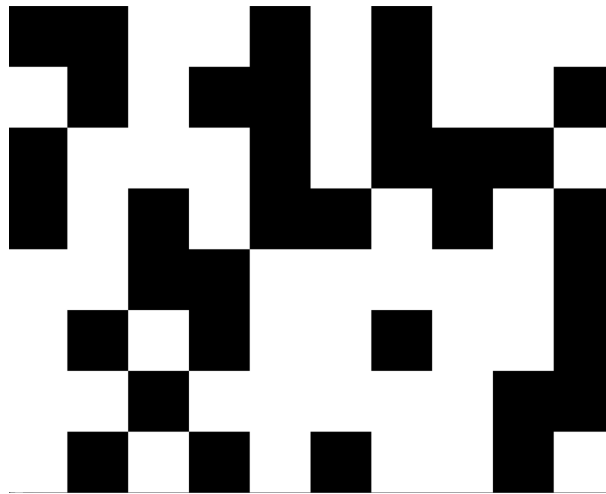


FIGURE 1 – Grid

3.1.2 PublicTransportVehicle

The Public transport Vehicles is a key component of the system , where it interacts with all the different agents and follows the system rules to help reach the predefined goal .it has different scenarios depending on the the state of the other agents .

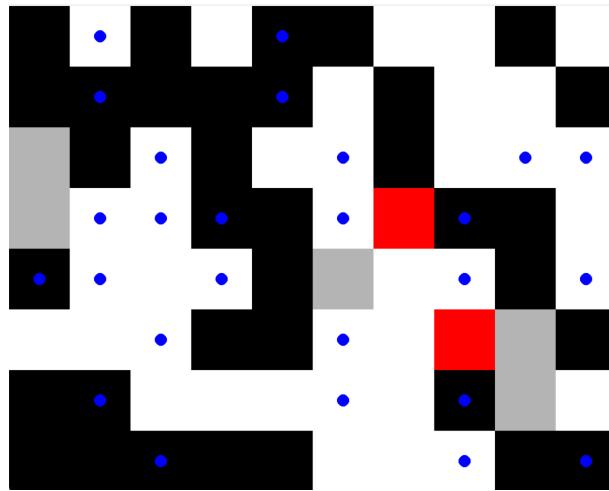


FIGURE 2 – Public transport vehicle (in red)

3.1.3 Passengers

Passengers are the key agents around which the systems evolves , it has an objective to reach and it needs to interact with its environment in order to reach that objective in the most efficient way .

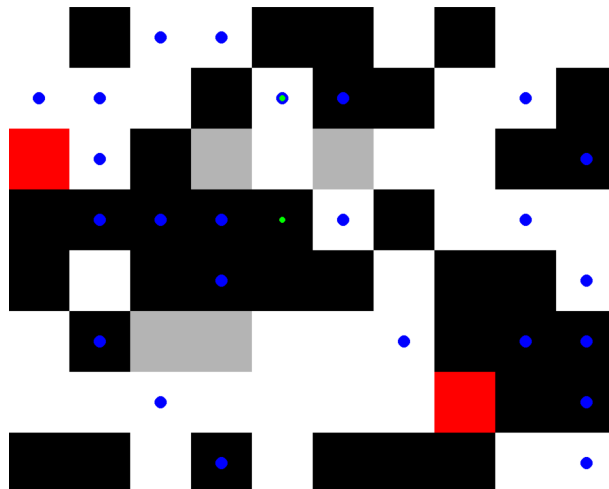


FIGURE 3 – Passngers (in green)

4 User manual /Minimal scenario

4.1 User Manual

In this part , we chose a clear graphic interface that will allow us to follow the different movements and actions of agents easily . In the next part we will run simulations of the system in order to take into consideration all scenarios possible.

4.2 Minimal Scenario

- Press the run simulation,please note that each simulation has its own random variables therefore each one is independent and cannot be replicated .
- We have two Passengers with different destinations each simulation , with their goal being to follow the best and fastest path to that destination while interacting with their environment.
- we have also added two buses , who will have random paths through the roads that the are present on the grid , once a bus arrives at a bus stop , if there is no passenger it will continue on its original path else the passenger will board the bus in that case , the bus will change its destination to the the one of the passengers aboard . please note that if a bus encounters an obstacle it will try to find an alternative path

5 Challenges encountered

- Choice of the language of programming
- The choice of architecture of the project
- The choice of Tools and IDE best suitable for the job
- The choice of a Graphic interface and modifying to suit the specific use cases of the project
- Integrating the components (obstacles , passengers , buses) and agents in the same environment and ensuring their communication.

6 Tools

6.1 Python IDLE

Python IDLE (Integrated Development and Learning Environment) is an integrated development environment for Python programming. It is included with the standard installation of Python and provides a convenient and interactive environment for writing, testing, and debugging Python code. IDLE is designed to be simple and easy to use, making it suitable for beginners as well as experienced developers.



6.2 Github

is a platform and cloud-based service for software development and version control, allowing developers to store and manage their code . We used Github as a version control that allowed us to parallele and distribute tasks and facilitated merging the different versions and features .



7 Axes of improvemet

- Introducing a reinforcement learning component to help it learn and make better choices.
- Add more visibility to public transport vehicles to detect obstacles earlier and adjust course .
- Improve collision detection and avoidance systems to handle complex scenarios, including interactions with pedestrians, cyclists, and unconventional road users.



8 Conclusion and Perspectives

The evolution of technology has allowed for breakthroughs in all aspects of human life .This has allowed for many needs to be fulfilled including those in the Public transport field where we hope that through our project all the parties involved can benefit. We hope with ever-evolving technologies that numerous features can be added and more impact can be made .