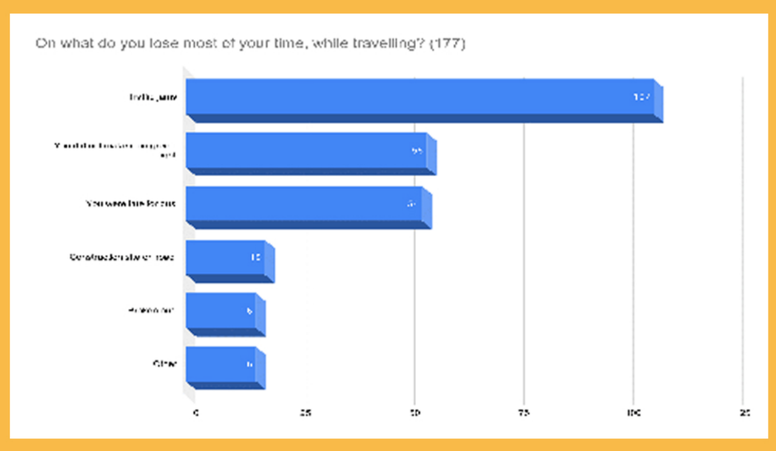
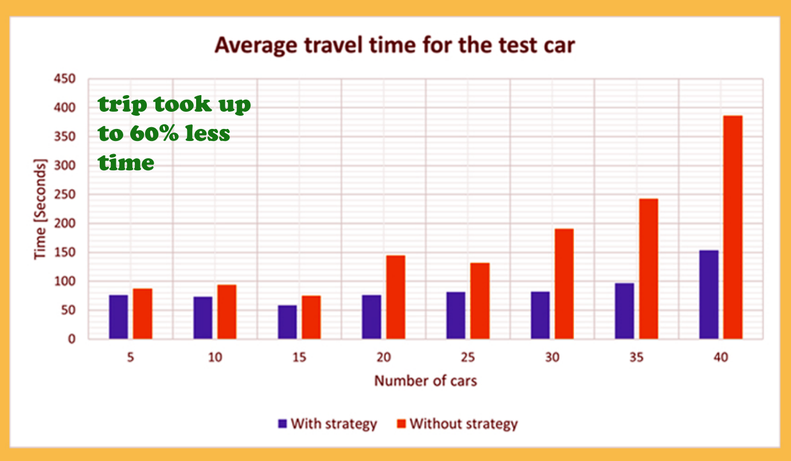
Modelling and optimizing multimodal city traffic using an agent platform

Katsiaryna Stankevich, Robert Pniewski, Przemysław Wiczołek
thesis supervisor: Prof. Maria Ganzha, Ph.D., D.Sc.

Urbanisation is the driving force for the incessant vehicular transport intensification in urban agglomerations. There are therefore more and more metropolitan areas in imminent need of innovative traffic management solutions. The survey has been conducted among the Internet users -- road accidents, bus crashes, and primarily traffic jams are becoming essentially cumbersome.



This thesis presents a model of a multi-functional city traffic simulator based on software agents. The proposed application solves the main problems owing to effective strategies, which improve travelling around urban areas.



WITHOUT STRATEGY

1. Travellers and vehicles inform LightManagers about approaching/being at the crossroad.
2. LightManagers change the crossroad lights periodically over a predefined constant timespan.
3. LightManager informs the traffic participants about the right to passage.
4. Traffic participant confirms passing through the crossroad, thus is removed from the queue.

WITH STRATEGY

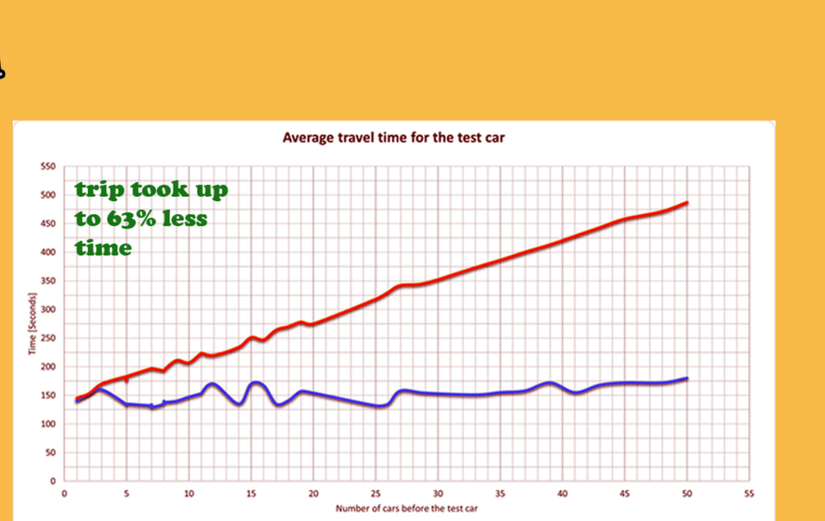
1. Travellers and vehicles inform LightManagers about approaching/being at the crossroad.
2. LightManagers make decision whether to prolong green light based on the Traveller and Car queue sizes.
3. LightManager informs the traffic participants about the right to passage.
4. Traffic participant confirms passing through the crossroad, thus is removed from the queue.

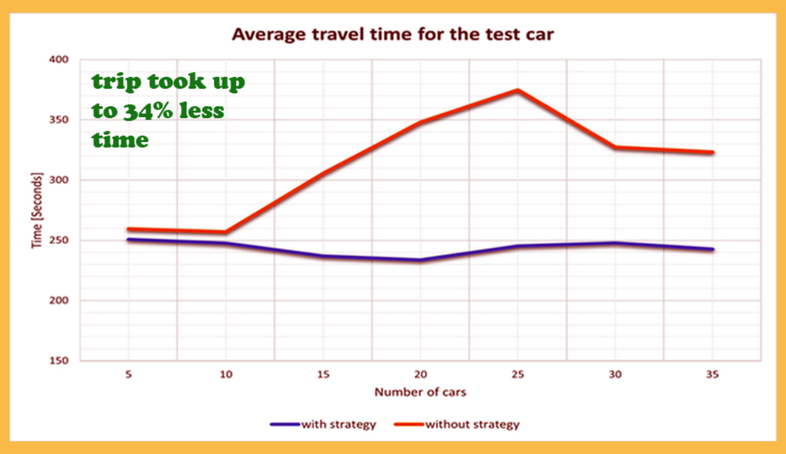
WITHOUT STRATEGY

1. Each Car is periodically informed about current construction sites and accidents.
2. In case of trouble point on the route, the Car ignores it and changes route only upon seeing it.
3. Trouble point visibility threshold indicates how far from the trouble point the Car is going to notice it.

WITH STRATEGY

1. Each Car is periodically informed about current construction sites and accidents.
2. In case of trouble point on the route, the Car instantly calculates a new route to evade the point.
3. Threshold until route change indicates how far away from the current Car position the new route is going to start.





WITHOUT STRATEGY

1. The Traveller enters the Bus.
2. The Traveller rides the Bus - in case of a Bus crash, the Traveller leaves the damaged Bus.
3. Traveller does not perform any calculations.
4. Traveller continues the journey by another Bus.

WITH STRATEGY

1. The Traveller enters the Bus.
2. The Traveller rides the Bus - in case of a Bus crash, the Traveller leaves the damaged Bus.
3. Traveller performs calculations whether it is faster to travel by Bike from now on or to take another Bus.
4. Traveller continues the journey either by another Bus or by Bike based on calculations.

City traffic simulations have been conducted involving the strategies, as well as without them. All the outcomes have been put together. Achieved results are positive -- each of the strategies effectively decreases the overall travel time of the city traffic participants.