**TrafficSupervision**

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**Introduction** Road accidents are a frequent problem, caused by the lack of attention of some drivers. This research is shown a solution for the avoidance of such situations. Simulated is a traffic network with the goal to visualize and maximally approximate real situations. Ambulances are analyzed in more detail. For them is designed an algorithm to ensure them a fast and safe route. In ambulances, it is frequent to have an impossibility to get in time due to the lack of a GPS and the busy traffic in the urban environment. The idea is to add automatic barriers, which would carry out additional regulation to the traffic and decrease the number of accidents on the big crossways.

**Research Methodology**

1. Argumentation

The use of barriers and bollards in cities is a method, proven in time, which predisposes for the security of the system. The power supply of the barriers can be solar batteries as an ecological economical renewable source of energy. The bollards themselves are not a huge consumer of energy. The reason for this is that they work only when there is a dangerous situation or a passing ambulance.

1. Traffic lights regimen

In this project, we focus on a network of 2x2 crossways, which is a sufficient size for observation of traffic load, where it is more possible to have a large number of vehicles and respectively to have more accidents. Each crossway has 8 traffic lights. Each of the traffic lights changes its light in the order red-yellow-green-yellow.

1. Path-finding algorithm

For the algorithm, it is necessary to calculate the travel time of the ambulance on a given route using an approximation function. For this purpose we will need the following parameters: d (distance traveled), k (number of cars). Based on these parameters we create a function:  
We get the data from n ambulances:

We minimize the mean squared error by choosing x and y such that the derivatives are 0.

We apply a modified algorithm of Dijkstra. The modification is that we check whether we have already been in a certain state not by checking whether V, d and k are the same with some previous state but only if V is the same. Without this modification the algorithm would require too much processing power and computer memory.

1. Web app

We have developed a web application to enable ambulance drivers to get to the place of the call as quickly as possible. Adding new users is done by the administrator because the usage of it has to be restricted only to the dispatchers and the ambulance drivers. After entering with a username and a password in trafficvisionvarna.ml, the user gets redirected to a page with an interactive map.

**Result and Analysis**

We conducted experiments, detecting the time for which an ambulance gets from a given origin to a given destination with random traffic. The results of the experiments are represented in *Table 2*.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ν | Detected time | Number of experiment | ν | Detected time | Number of experiment |
| 1 | 27,776 | (1) | 2 | 27,776 | (3) |
| 1 | 27,776 | (2) | 2 | 28,203 | (average 2) |
| 1 | 27,808 | (3) | 1 | 31,264 | (1)(with jam) |
| 1 | 27,787 | (average 1) | 1 | 32,288 | (2)(with jam) |
| 2 | 29,024 | (1) | 1 | 31,456 | (3)(with jam) |
| 2 | 27,808 | (2) | 1 | 31,669 | (average) |

*Table 2(\** ν – frequency)

The time for passing through the more loaded route (3)(average) is 14% slower than the route with less loaded traffic (average 1). Similarly, the fact that the time of (average 1) is smaller than the one of (average 2) shows that when there are fewer cars in the network the ambulance moves faster, even if there is not a discrete accumulation of cars.

**Conclusion**

In the current project were described problems, connected with accidents on the roads and slowing the movement of ambulances. The usage of barriers on the crossways and the making of a 3D simulation and web app were motivated.

**Future Work**

In the future, we plan to increase the scale of the network. In case of traffic lights not working and respectively the need for a traffic cop, the bollards will be controlled by the respective regulator with a special device.

**References** Andreas Pell, Andreas Meingast, Oliver Schauer, Trends in Real-time Traffic Simulation, Transportation Research Procedia, Volume 25, 2017, Pages 1477-1484, ISSN 2352-1465, <https://doi.org/10.1016/j.trpro.2017.05.175>.   
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