

## EXPERIMENTAL ASSESSMENT OF A SELF-ADAPTIVE INTELLIGENT TRANSPORTATION SYSTEM

### Goal of the project

At present, all attempts to optimize traffic flow completely ignore the fact that traffic has a predominant social footprint and would therefore potentially benefit from using specific tools to better understand its dynamics and predict its patterns (and thus introduce intelligence). We therefore aim towards designing a distributed, hierarchical, self-adaptive decision-making that would respond quickly to traffic changes based on optimization carried over communities and superior estimation of its patterns.

### Short description of the project

Our systems will: provide local optimizations, allow traffic lights to be networked, and provide global optimizations of traffic flow using decentralized, distributed control.

### Project implemented by

Politehnica University of Timisoara

### Implementation period

Oct. 2017 – Dec. 2018

### Main activities

- Collecting data for urban traffic flow by using semi-permanent sensors
- Modelling existing transport infrastructure with respect to measured traffic values
- Software implementation of algorithms described in Cristian Cosariu's PhD thesis
- Porting the bio-inspired algorithm corresponding to a single node to an embedded platform for implementation on a traffic controller
- Comparative simulation with a before-after analysis of the main quality indicators of the traffic
- High-level description for the architecture and communication framework for adjacent intersections
- Validation by simulation with special tools for the described protocol
- Extensive testing of the embedded platform under realistic operating conditions to achieve 1 year availability
- Participation to at least 2 international conferences

### Results

- Development and online publication of the project's website
- Procurement of hardware and software required for the implementation of the project
- Technical documents with actual traffic values for road segments
- Architectural diagrams and specifications of proposed protocol with validation through simulation
- Source code and standard description of proposed methodology, available online on the project's website

#### Conference papers:

1. Gabriel Baban, Alexandru Iovanovici, Cristian Cosariu, Lucian Prodan.. Determination of the Critical Congestion Point in Urban Traffic Networks: A Case Study. 2017 IEEE 14th International Scientific Conference on Informatics, Poprad, Slovak Republic, November 14 - 16, 2017, doi 10.1109/informatics.2017.8327215.
2. Gabriel Baban, Alexandru Iovanovici, Cristian Cosariu, Lucian Prodan.. High Betweenness Nodes and Crowded Intersections: An Experimental Assessment by Means of Simulation. IEEE 12th International Symposium on Applied Computational Intelligence and Informatics (SACI 2018), May 17-19, 2018, Timisoara, Romania.

## Applicability and transferability of the results

Our algorithm quickly reacts to traffic dynamics based on local heuristics. Real traffic situations simulated using the Vissim software showed a decrease in waiting times and queue lengths at local intersection level. The algorithm can be mapped efficiently onto embedded devices, current TRL-3 standing.

Our SIGS methodology recreates the road network by changing lane directions by using genetic algorithms and also has a current TRL-3 standing.

Intersections will exchange local traffic values and allow genetic algorithms to provide optimizations, which brings this at TRL-2. This will provide distributed, self-adaptive optimization of traffic.

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## Research centre

- Politehnica university of Timisoara, Faculty of Automation and Computing
- Research Center in Computer and Information Technology (CCCTI)
- Advanced Computing Systems and Architectures Laboratory

## Research team

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