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 Timișoara

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.

Financed through/by

UEFISCDI PN-III-P2-2.1-PED-2016-1518, nr. 221PED/2017

Research centre

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

Research team

Lucian PRODAN,
Alexandru IOVANOVICI,
Cristian COSARIU,
Mihai UDRESCU,
Alexandru TOPIRCEANU,
Iosif SZEIDERt,
Flavius OPRITOIU,
Gabriel BABAN,
Dacian AVRAMONI

Contact information

Assoc. Prof. Lucian PRODAN, PhD
Faculty of Automation and Computing
Department of Computer and Software Engineering
Address: 2 Vasile Parvan, RO-300223 Timisoara
Phone: (+40) 256 403 278
E-mail: lucian.prodan@upt.ro
Web: wikitrafic.cs.upt.ro