Integrating Tools for Urban traffic control with CAV

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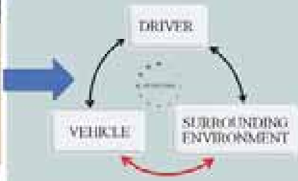
Introduction and Motivation

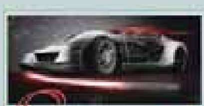
the transition is characterizing the vehicle development



- Virtual testing a classic tool
  - Safety ensured
  - High number of tests possible
  - but…

RESEARCH GOAL: Integrate tools in order to develop a unique holistic framework allowing to test effectively

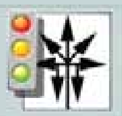
THE FIRST REALESE



VI-CarRealTime

- Vehicle dynamics software.
- Standard tool in many OEM and Tier1 companies

- SUMo: microscopic simulator.
- Open, simple, widely used in research
- TraciMatlab package



MATLAB SIMULINK

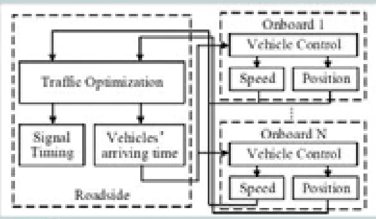
COMPONENTS

WORKFLOW

- Categorization of studies for CAV-based traffic control
  - driver guidance
  - actuated (adaptive) signal control
  - advanced signal control
  - signal-vehicle coupled control (SVCC)

WARM — UP EXPERIMENTS

METHODOLOGY OVERVIEW



Scenario 0

Centralized vs Distributed Urban Traffic Control

Scenario 1

Distributed UTC
ELS Algorithm – [Estimation of Location and Speed of unequipped vehicles]

Tested GLOSA Algorithm Overflow

Scenario 2

GLOSA – Green Light Optimized Speed Advisory

Scenario 3

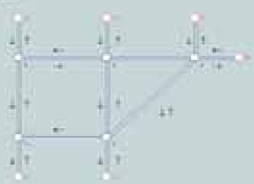
Distributed UTC
ELS Algorithm – [Estimation of Location and Speed of unequipped vehicles]
GLOSA – Green Light Optimized Speed Advisory

Simulation Scenarios: Results

Case study

SUMO – TraCI API/Matlab
External features incorporation

- 6 od pairs
- 5 internal nodes
- 5 bidirectional (internal) links
- 1 unidirectional (internal) link
- 6 external (bidirectional) connecting links



Scenario 0
Distributed UTC – Max Pressure (MP) Algorithm

•does not require knowledge of global network inflow
•adjusts local green splits based upon both upstream and downstream local queue length measurements at each intersection
•Traffic Flow Model: rolling horizon

Scenario 2 – GLOSA

- PI: fuel consumption and emissions
- Baseline: No GLOSA – Fixed Time UTC

Scenario 1 – Distributed UTC + **ELS Algorithm**

- Baseline: Adaptive Signal Control (ASC)
- CAV penetration rate: 50%

Algorithm	Number of stops	Total Delay [PCU-h/h]
ASC	158	38.12
D – UTC (MP)	122	29.73
Improvement (%)	30%	28%

Scenario 3a – Distributed UTC + ELS Algorithm + GLOSA

- Baseline: Adaptive Signal Control (ASC)
- CAV penetration rate: 50%

Algorithm	Number of stops	Total Delay [PCU-h/h]
ASC	158	38.12
D – UTC (MP)	58	21.25
Improvement (%)	62%	45%

Scenario 3b – Distributed UTC + ELS Algorithm + GLOSA

- Baseline: Adaptive Signal Control (ASC)
- CAV penetration rate: 50%

Algorithm	Number of stops	Total Delay [PCU-h/h]
ASC	391	97.32
D – UTC (MP)	265	62.23
Improvement (%)	48%	43%

Conclusions and Rsearch perspectives

Improvement [%]		
Scenario	Number of stops	Total Delay [PCU-h/h]
1	30%	28%
3a	61%	45%
3b	48%	43%

- ELS algorithm improvement
- AV rerouting and departure time optimization
- Vehicle guidance - the vehicle fuel model
- CV penetration rate
- AV different levels of automation
- A real scale application