Integrated Adaptive Traffic Signal Control with Real-Time Decision Support

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Introduction

This paper presents the development of a new integrated adaptive signal control decision support system (ACDSS) and its planned implementation for two New York City arterials.

Featuring ***mixed control objectives*** for both under and oversaturated traffic, the system integrates a *Just-in-Time* (JIT) microscopic traffic simulation framework, enabling the operator to supervise, review, and interact with signal operations in real-time by verifying algorithm-optimized strategies against other alternatives.

This operator-in-the-loop element is viewed as important for achieving robust and reliable operations especially for congested conditions, where the boundaries of different control objectives are hardly definite.

In addition to the **operator-in-the-loop** mode, the new system also supports ***autonomous*** **signal optimization** *without* operator interactions.

Integral to the ACDSS development is the design of SOAP web service based communication channels for retrieving traffic data, transmitting optimized signal plans real-time, and interfacing with the control infrastructure.

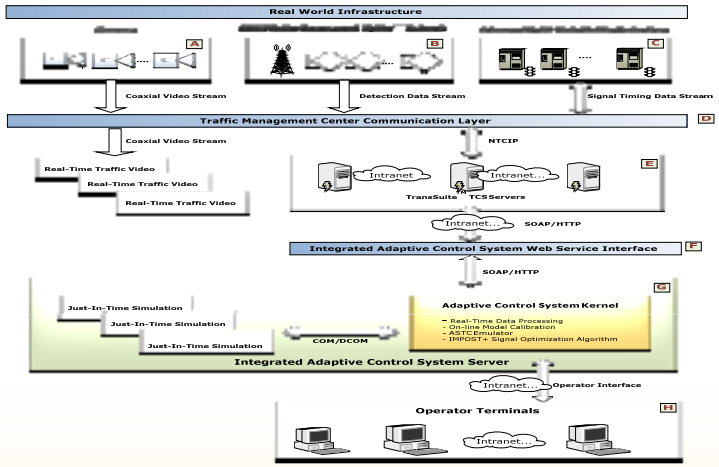

FIGURE 1 Integrated Adaptive Control Systems with Decision Support: System Context.

Methodology

Service-oriented, component based software architecture

- Multi-tier system with disaggregated modules;
- Manageable maintenance and upgrade.

Web service based real-time data streaming

- Information exchanged in XML syntax;
- Renders salability and expandability of the system;
- Allows future inclusion of new data types, e.g., , travel time data from ETC tag readers, and other data from future VII systems.

Mixed-objective adaptive control algorithm

- Target both over- and under- saturated traffic;
- Computationally efficient for real-time application;
- Currently IMPOST+ algorithm;
- Enhanced from IMPOST algorithm;
- Can plug-in other adaptive algorithms.

Data processing for sparsely detectorized network

- Raw detector data are processed in real-time to infer turning movements and predict future volume;
- Spatial and temporal dependencies of the network topology taken into account;
- No need to deploy stop bar sensor at every approach.

Just-In-Time Side-by-Side (SxS) simulation for real-time comparisons and visualization

- Simulation scenarios generated "on-the-fly";
- Side-by-side (SxS) simulations w/ different control alternatives;
- MOEs;
- Plug-and-play interface for multiple micro-simulators, e.g., Aimsun, VISSIM.

FIGURE 2. Master User Interface

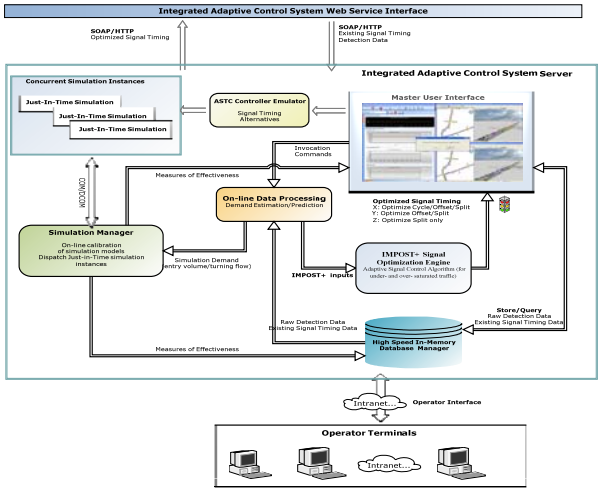

FIGURE 3 Integrated Adaptive Control System with Decision Support: Flow Diagram.

Field Implementation

Currently with needed segments of the NYC ITS infrastructure being finalized (controllers, detectors, communications and software deployment), the ACDSS is entering field trials on Victory Blvd in Staten Island (4 intersections), and later on a segment of Route 9A (22 intersections) in Manhattan.

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