RESEARCH NOTES



Development of the Capability-enhanced PARAMICS Simulation Environment (ATMS TESTBED PHASE III FINAL REPORT)

Why was this Research Undertaken?

Micro-simulation modeling is an increasingly popular and effective tool for analyzing a wide variety of dynamical problems, which are not amendable to study by other means. As a suite of ITS-capable. user-programmable, highperformance microscopic traffic simulation package, PARAMICS offers very plausible detailed modeling for many components of an 'ideal' simulator. It has become a widely used microscopic simulation model in the US (especially in California). Its typical applications are the evaluation of different traffic control and management strategies. To be qualified as an appropriate simulator for these studies, Paramics should have the capabilities to model the realworld traffic condition and various operational strategies. However, PARAMICS does have some functional deficiencies. For example, Paramics can basically model the fixed-time signal control but not the commonly used actuated signal control. Using the powerful Application Programming Interface (API) programming ability of Paramics, this project aimed to complement its functionality in signal control and enhance its capabilities in the modeling of ITS strategies.

For more in depth discussion and technical analysis, refer to <u>TTR3-12 (Testbed Technical Report)</u>.

What was done?

This project developed a capability-enhanced PARAMICS simulation environment through integrating ten plug-in modules implemented in Paramics API. These ten plug-ins include the following:

- Actuated signal timing plan
- Multiple actuated signal timing plan
- Actuated signal coordination
- Detector data aggregator
- Ramp metering control

- On-ramp queue override control
- ALINEA, BOTTLENECK, and SWARM ramp metering control, and
- Freeway MOE (Measure of Effectiveness)

They complemented the current Paramics simulation model and enhanced its functionalities.

What can be concluded from the Research?

Our tests using the capability-enhanced PARAMICS simulation environment show that the commercial PARAMICS model functionalities can be effectively complemented and enhanced through API programming. The enhanced PARAMICS simulation can better model and evaluate ITS.

Our experiences also show that API can be used to access the core models of a microsimulator and potentially, researchers can use commercial micro-simulators as a shell for testing their own models and algorithms. Since other commercial micro-simulators, such as VISSIM and AIMSUN 2, also provide users with their own API functions, users can replicate our methods to enhance their capabilities.

What do the Researchers recommend?

These developed plugins need to be continuously maintained because the upgrade to a new version of Paramics may cause them to work abnormally. This is because these plugins were developed based on the core models of Paramics, which may be changed or modified in a new version. Our current capability enhancements of Paramics only cover some aspects of the microscopic simulator. More efforts are expected in order to make the enhanced PARAMICS better fit to more ITS-related studies. The ten developed plugins have been released to Caltrans for use. Since the current plugins are developed for the research purposes, extra development for userfriendly graphical interfaces may be needed.

Implementation Strategies

The product of this research is TTR3-12 that can be utilized as a user manual to make use of all the API plug-ins that have been developed. It should be noted that continuation of the Testbed contract is necessary to make sure the developed plug-ins are updated continuously to obtain maximum benefit.

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