TECHBRIEF

Open Source Surrogate Safety Assessment Model, 2017
Enhancement and Update: SSAM v3.0

OBJECTIVE

This TechBrief describes the development of an open source surrogate safety assessment model (SSAM) software with improved safety measures, 3D conflict graphics, and advanced computing enhancements.

INTRODUCTION

The ETFOMM (Enhanced Transportation Flow Open Source Microscopic Model) Cloud Service (ECS) is a software product sponsored by the U.S. Department of Transportation in conjunction with the “Microscopic Traffic Simulation Models and Software—An Open Source Approach” project. ETFOMM’s primary components are the core microscopic traffic Simulation Engine (ESE), a graphical user input editor (ETEditor), a 3D traffic visualization tool (ETAnimator), and a database in cloud service environment. Moreover, the SSAM is being converted into open source software, enhanced, and integrated as part of ESE.

SSAM is a popular safety tool box that utilizes the microscopic traffic simulation vehicle trajectories to generate safety performance measures such as:

- Minimum time to collision (TTC).
- Minimum post-encroachment time (PET).
- Initial deceleration rate (DR).
- Maximum speed (MaxS).
- Maximum relative speed difference (DeltaS).
- Location of the conflict event (CLSP, CLEP).
- Maximum “post collision” DeltaV (MaxDeltaV).

These safety performance measures are shown on a vehicle trajectory plot, graphing time vs. distance in figure 1.

OPEN SOURCE SSAM FEATURES

Integrated with ETFOMM

Vehicle trajectories from ETFOMM are collected and converted into SSAM input files; the trajectories are then analyzed by the SSAM program.

Re-implemented in C++

The SSAM algorithm source code was reprogramed from Java to C++ and restructured to separate declaration and definition of classes. Referenced Java libraries are replaced with C++ libraries, and memory management modules were added. The C++ version of SSAM has reduced analysis time up to 50 percent.

Parallel Computing

The C++ source code was designed to facilitate parallel computing by using OpenMP directives. The new parallel computing capabilities decreases the computation time up to 90 percent. Table 1 shows the analysis time improvement.
Table 1. Computation Time Improvement with Updated SSAM Software

| Vehicle Trajectory Records Used in Comparison | Improvement (percent) *
<table>
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<tr>
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<tbody>
<tr>
<td>119,458</td>
<td>90.63</td>
</tr>
<tr>
<td>656,710</td>
<td>88.91</td>
</tr>
<tr>
<td>694,527</td>
<td>88.45</td>
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<tr>
<td>67,472,183</td>
<td>87.69</td>
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</tbody>
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*Percent improvement represents the improvement of computation time from the original SSAM 2.16 in Java to the new parallel implementation in C++.

New Features in SSAMs

- Bar chart, heat map, and contour map to illustrate conflicts.
- Zooming capability in the conflict map.
- Multiple PET (mPET), add multiple TTC (mTTC), and probability of unsuccessful evasive action P(UEA).
- API functions for data input, safety measure exporting, and interfacing with traffic simulation software.

OPEN-SOURCE SOURCE CODE DOWNLOAD

- http://www.itsforge.net/ssam
- http://www.sourceforge.net/etfomm
- http://www.etfomm.org

REFERENCES


3D Conflict Map

The conflict map from the original SSAM was converted from 2D Java graphics into a 3D display, programmed using OpenSceneGraph library based on OpenGL. Conflict points are illustrated on detailed intersections generated from the ETFOMM Intersection Model. An optional image can be imported as the background map, as shown in figure 2.

Figure 2. SSAM 3D Conflict Map.