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Development of TMC Simulator for Operator Training

Project

TMC Simulator for Operator Training, 2006

Organization

California ATMS Testbed

University of California Irvine

California Polytechnic State

University San Luis Obispo

Caltrans

Sector

Traffic Operation

Objective

Duplicate the standardized California TMC systems in an off-line environment where TMC operators can be trained to enhance their skills.

Highlights

- Emulate typical functionalities in a Caltrans TMC
- Replicate the flow of data and information that flow in and out of the TMC
- Model controllable incidents and diversion
- Interface Paramics with a typical Caltrans TMC

Contact Point

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The purpose of the project is to develop an off-line Traffic Management Center (TMC) simulation environment in which TMC operators can be trained to enhance their skills using various pre-defined incident scenarios.

The primary objectives of a TMC are to detect and verify incidents and then take appropriate actions to avoid and relieve traffic congestion. A typical TMC in California utilizes an integrated traffic management system platform, named Advanced Transportation Management System (ATMS), to access all Intelligent Transportation Systems (ITS) elements within the district or region. ATMS is able to display real-time traffic data collected from vehicle detection stations and the corresponding traffic conditions on a map-based display. ATMS also provides the control of all Changeable Message Signs (CMSs), which allow operators to post traffic management messages, and all CCTV cameras, which allow TMC staff to monitor traffic and incidents. TMC staff also utilizes the California Highway Patrol (CHP) Computer Aided Dispatch (CAD) system to learn of emerging incidents and track their status as this system provides a direct reflection of incidents in the field. The image to the left shows the TMC in District 12 of California Department of Transportation (Caltrans).

Figure 1. Caltrans District 12 TMC

Using the cutting-edge microscopic simulation modelling techniques and a comprehensive simulation management scheme, a TMC simulator was developed and made operational at the California Advanced Transportation Management Systems (ATMS) Testbed, located at University of California Irvine (UCI). The simulator is designed to duplicate the standardized TMC software systems and data feeds found in California TMCs in an off-line environment, where TMC operators can be trained to enhance their skills using various pre-defined incident scenarios.

The basic function of TMC simulator is to display traffic data from Paramics instead of the real world on ATMS. This requires the establishment of a “virtual” connection between ATMS and Caltrans field traffic system that includes vehicle detector stations, CMS, and CCTV camera stations in microscopic traffic simulation via the powerful Application Programming Interaces (API) of Paramics. The most complicated function is the connection with detector data, which was implemented via “Reverse engineering” the detector data collection and communication with TMC in the real world. Every 30 sec, detector data are collected, aggregated, packed up based on the Semi-Actuated Traffic Metering System (SATMS) protocol, polled out based on Front End Processor (FEP) protocol, and transmitted to ATMS for display via Remote Procedure Call (RPC).

In TMC simulator, a simulation manager controls the whole process of TMC simulation based on incident scenarios and students’ response to incidents. Controllable incidents and diversion are emulated through API programming in Paramics. An incident plugin was developed to emulate user-defined incidents, which may occur at any time with various severity, duration and impacts. Additionally, a diversion plugin was developed to emulate vehicles’ diversion to another route at a given diversion rate.

TMC simulator provides an interactive environment where actions students take to manage an incident affect the simulated traffic in the system and students see the results of their activity.

Below is an introduction of the operator training process using the TMC simulator. The study site is located in City of Irvine, Orange County, California, which Includes three freeways, 18-mile I-5, 12-mile I-405, and 10-mile SR-55 (i.e. the triangle area as shown in Figure 2).

(1) During simulation, aggregated loop detector data are continuously collected from Paramics every 30 sec and then sent to ATMS to display. At the beginning of simulation, there is no congestion and thus green colors are shown for all detectors on ATMS.