OpenTMS
ADVANCED TRAFFIC MANAGEMENT SYSTEM
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OVERVIEW

OpenTMS is a modular and extensible Advanced Traffic Management System (ATMS) built on an open, web-enabled architecture. OpenTMS supports a wide variety of GIS mapping engines and relational databases, easily integrates ITS field devices, external systems and data feeds, and facilitates the addition of new features and components with minimal changes to the core framework.

The modular architecture and flexible framework of OpenTMS makes it fast and easy to configure and deploy a solution to meet your operational needs. OpenTMS contains functionality to support real-time traffic management and operations with

- Modules to command and control ITS field devices
- Complete incident and special event management subsystems
- System administration tool for managing ITS devices, system configurations, and user permissions and roles
- Configurable travel time engine
- Customizable mapping interface
- Reporting tool
- Data Gateway middleware solution to enable interoperability and external system interfaces with partner systems, including 911/CAD and 511/Traveler Information Systems
MODULAR, OPEN ARCHITECTURE

The modular architecture of OpenTMS is especially appropriate for agencies that operate several Traffic Management Centers (TMC), each with different ITS needs. OpenTMS can be deployed in different configurations to provide users with custom experiences while supporting integration and data sharing between each TMC. The figure below illustrates the package of modules that are available in OpenTMS.

- **Base System**—The set of base modules to support all OpenTMS implementations. This includes graphical user interface for workstations and mobile devices, system settings, call log, contact lists, and reporting. In addition, the external interfaces support integration with business partner systems and third-party data providers. Common integrations include 911/CAD, RITIS, 511 IVR/web/mobile, probe data providers, social media, and the National Weather Service.

- **Traffic Management**—Modules that support transportation systems management and operations including incident detection, incident management, planned event management, and travel times.

- **ITS Device**—Modules to support the command and control of ITS field devices.
BASE SYSTEM

Features

• The graphical user interface consists of a GIS map, mapping tools, management of map layers, legend of icons, and menus that are accessed via desktop or tablet

• Customizable desktop with multiple windows and/or tabs in order to better perform duties or multitask

• Integrated components to view the status of covered roadways, control ITS devices, and manage critical data

DESKTOP APPLICATION (BROWSER-BASED) & TABLET VIEW

OpenTMS is a fully web-enabled application that performs in all standard browsers on both desktop and mobile devices. The graphical user interface (GUI) provides the user the ability to view configured devices on a map with their latest status, click on devices from the map to view device specific data, and access modules, along with their devices from a menu and/or lists.
GIS AND MAPPING
The Maps module is the primary interface for the OpenTMS system. From a single view, an operator assesses the status of ITS field devices and manages critical events.

Features

- Interactive display of roadway networks and current status of ITS devices, events, travel speeds, road restrictions, road conditions, etc.
- Easily configurable to accommodate commercial or proprietary mapping data
- Easy to add and configure map layers
- Accommodates full GIS or schematic representations
- Interchangeable icons
- Runs on both workstations and tablets

REPORTING
OpenTMS comes bundled with Jasper Reports, a robust open-source reporting tool that makes it easy to create, archive, and share reports. Jasper Reports allows users to generate reports in several formats, simplifying the process of creating standard reports and providing ad hoc reporting capability to operators and maintenance staff.

Features

- Integrated into OpenTMS
- Configure reports on the fly
- Export to several formats (doc, pdf, xls, xml)
- Includes library of basic reports
- Device inventory and status
- Incident tracking
- Operator performance
**CONTACT LIST**

The Contact List module enables users to manage frequently used points of contact (individuals or organizations/businesses).

**Features**
- Select a contact for more information including phone numbers, email, and their availability
- Contacts are filtered based on operational area or organization for improved navigation
- Names will appear as last name first and will be automatically sorted alphabetically

**CALL LOG**

The Call Log module delivers a streamlined interface for users to log incoming and outgoing phone calls.

**Features**
- Track a new call entry when a call is received
- Operational area will default to the operational area of the user creating the entry
- Tracks nature of call and enters a description
- Details updated using the activity log
OPENTMS—ADVANCED TRAFFIC MANAGEMENT SYSTEM

SYSTEM SETTINGS

The System Settings module is built on an interface for the configuration of users, devices, and system parameters, providing the administrator with the tools necessary to organize the system.

- Easy-to-use menu to quickly switch between administrative functions
- Detailed administrative functions for installed modules
- Configurable control access to system functions using multiple security levels
- Automatic system updates for new modules and changes to current modules
- Multiple levels of user security

CENTER TO CENTER

The Center to Center module within permits one TMC to pass control or take control of another TMC. It is common within state transportation agencies to have multiple TMCs. There is often a hierarchical relationship between TMCs, whereby a statewide or regional TMC operates 24x7x365 and takes over operations (after hours or weekends) from smaller TMCs that do not operate 24x7.

- One TMC can actively grant control to a second TMC – transferring operational responsibility from one center to another
- A TMC that has previously given control to another TMC can take back control
- One TMC requests to take control of some or all of the operations from another TMC
- A TMC that has been granted control can relinquish control
OPENTMS—ADVANCED TRAFFIC MANAGEMENT SYSTEM

WEB SERVICE API

The OpenTMS server can be accessed through a Web Service API based on the REST model. Clients use the RESTful API’s to programmatically perform server operations.

REST is a lightweight alternative to SOAP Web Services.

DATA GATEWAY

The Data Gateway provides a robust and highly scalable architecture that facilitates data sharing between different systems. The Data Gateway allows applications to share data by means of its publish-subscribe architecture. The simplicity of this infrastructure adds a very high degree of flexibility by enabling Open Roads to integrate diverse applications and systems in a low-risk, cost-efficient manner. Within the Data Gateway, data is normalized to common ITS standard formats, allowing the free exchange of data across diverse applications and platforms.

Features

- **Publish**: Providing external parties with access to data feeds from OpenTMS. Incidents, planned events, road conditions, and DMS data feeds are commonly disseminated for integration with 511IVR, 511WEB and mobile services
- **Subscribe**: Enabling OpenTMS to ingest data feed from third parties and external systems. The National Weather Service is an example of an external data service in which OpenTMS can pull data
- **Integrate**: Two-way data sharing with external systems
- **Extensible**: Quickly create cost-effective system interface for data sharing

Features

- REST service is platform-independent, language-independent, and standards-based (runs on top of HTTP).
- REST design operations are self-contained, and each request carries with it (transfers) all the information (state) that the server needs in order to complete it.
TRAFFIC MANAGEMENT

TRAVEL TIMES

The Travel Times module integrates data from a variety of sources to calculate and distribute travel time data. Travel times are posted on message signs, integrated into traveler information websites and mobile apps, and shared with stakeholders and business partners.

Features

- Create, track, and manage travel time segments
- Data collected from vehicle probe data providers, roadway sensors, vehicle detection stations, and external systems
- Travel time data is archived and used to create historical baselines
- Export and share travel time data
- Create and configure travel time segments that are associated with one or more message signs
Alert Management module processes and assesses data generated by OpenTMS and applies business rules to determine when an operator needs to be informed of a possible anomaly in traffic conditions. Alerts are generated based on data received from external sources or from ITS devices internal to OpenTMS.

Features:

- Identify issues of interest by monitoring internal and external data
  - **Internal**: Sensors, Call Boxes, Weather stations
  - **External**: Integration with 911/CAD systems
- Business rules engine for configuring alerts
- Convert alerts into new incidents or associate with existing incidents
VIDEO ANALYTICS

The Video Analytics module provides video-based data collection and incident detection. Video stream analyzers collect real-time traffic data, including speeds, travel times, occupancy, and vehicle classification, that is processed by OpenTMS and fused with data collected from other sources. The Alert Management module notifies users of incidents that are detected by the video stream analyzers. The system may be configured to look for a variety of anomalies including stopped vehicles, slowed traffic, wrong-way vehicles, debris on the roadway, and presence of pedestrians or animals in the roadway.

Features

• Visual Alert notification upon Incident Detection
• CCTV integration for video recording and playback
• Video Wall Support
INCIDENT MANAGEMENT

The Incident Management (IM) module enables operators to manage the full lifecycle of incidents from verification through response and closing. An intuitive workflow makes it easy to quickly enter data and disseminate information to key stakeholders and the traveling public. OpenTMS includes an automated incident response system that incorporates a real-time business rules engine to prescribe response plans based on an agency’s operating procedures. A Traveler Information/511 component automatically generates messages to be disseminated via 511 IVR, web, mobile apps and social media. Response plans also include automated notifications which can be configured to identify and notify key stakeholders via email, pager, and subscription services.

Features

- OpenTMS supports both manual and automated detection of incidents
- Automated response plans
- Rules-based decision support system
- Graphical incident timeline
- Analysis and performance monitoring tools
- Automatic dissemination to 511 telephony, websites, mobile devices, and social media
PLANNED EVENTS

The Planned Events module enables agencies to schedule and manage events. Activities are managed as a hierarchical relationship of projects, events, and closures, allowing users to easily manage both large complex construction activities and simple one-time events.

Features

- Manage ITS device plans
- Automatic event scheduling:
  - Time-of-day
  - Recurring
  - One-time
- User initiated on-demand activation
ACTIVE TRAFFIC MANAGEMENT

The Active Traffic Management module provides the ability to manage ATM corridors though a customized dashboard interface. Using a real-time ‘birds eye’ view of the ATM area, operators can monitor congestion and modify the signage throughout the corridor to improve mobility.

Features

• Real time management of traffic flow
• Manage congestion and delays
• Manage road space
TRAVELER INFORMATION

With the Traveler Information module, operators report incidents, planned events, road conditions and weight restrictions to the public, keeping drivers informed to improve traffic flow. TMCs provide on-demand traveler services information, including descriptions of destinations and services, route guidance, and accurate traffic and weather conditions tailored specifically to the needs of their customers. The Traveler Information module delivers information to the public through various media including 511, VMS, HAR and private sources.

Features

- Standardized data feeds to easily integrate traveler information services:
  - Traveler Information Websites
  - Mobile apps
  - Integration with Social Media
EMERGENCY MESSAGING

Emergency Messaging posts special messages to highlight major events and issue significant alerts to the 511 system and social media users. Only one emergency message can be posted to an alert at a time. Adding the ability to post multiple alert message on statewide and highway broadcast alerts will result in modifications to the 511 website, IVR, and mobile apps.

Features

- List View for creating broadcast messages and activating and deactivating broadcast alerts
- Message Details provide the ability to enter message details that will be disseminated to the public
- Activity logs are auto generated and document the changes and actions taken on a Floodgate alert
INTEGRATED CORRIDOR MANAGEMENT

The Integrated Corridor Management (ICM) module connects data from freeways, arterials, and transits allowing operators to manage real-time congestion and enhance traveler mobility. Current and historical data from all available sources is used to assess network conditions and alert operators of abnormal conditions. A decision support system embedded in OpenTMS recommends appropriate traffic management and traveler information strategies across all modes.

Features

• Create and configure corridors of interest and define principal freeway, arterial, and transit segments
• Automated detection of abnormal conditions with alerts and notifications to operators and key stakeholders
• Configurable algorithms and heuristics to analyze archived data for calculating historical data and for determining qualitative measures of travel conditions across each corridor segment
• Geographical representation of recommended response plans showing active devices and their recommended messages for operators to visually assess whether or not to activate
• Sharing data and control strategies with partner agencies and stakeholders
TRUCK PARKING MONITORING

The Truck Parking Monitoring module enables operators to monitor the status of parking lots that have been instrumented with single space monitoring devices. In-ground sensors monitor the length of stay within each parking space and transmit data back to the TMC, where operators actively assess and manage the parking capacity as well as truck operations.

Features
• Shown on the GIS map with selectable sites to view the raw count data and associated sign(s)
• The associated sign allows the operator to override the state of the sign in a situation where the system deviates from normal operational state
• Any alerts that are generated via the Parking Monitoring module will be shown on the operator UI signaling a potential issue may exist
VEHICLE TRACKING AND DISPATCHING

Service Patrols provide motorist assistance and support incident and emergency management. The Vehicle Tracking and Dispatching module provides an interface to dispatch drivers to incidents, provide driver check-in/check-out, and track details of service patrol calls. Combined with GPS based updates of service vehicle locations, the Service Patrol module provides complete end to end management of the Service Patrol process.

Features

- Easily dispatch drivers to incidents via list or map view.
- Track details of each dispatch via Service Patrol Log entry.
- Visually track driver availability based on current status (available, in route, on scene).
- GPS based updates of actual driver location.
- Track individual vehicle mileage via check-in/check-out process.
ROAD CONDITIONS

The Road Conditions module provides an interface for a user to report and describe the current state of the driving conditions along major roads. This includes surface conditions, atmospheric conditions, visibility, and subjective evaluations of conditions.

Features

- Road conditions network are grouped into a multi-level hierarchy of entities which users manage stations and roadway segments
- Road conditions will have statuses associated with them that are based on the last time conditions have been updated and when the conditions will expire
- View the activity of one or more road condition events within a list view
ITS DEVICES

MESSAGE SIGN
The Message Sign module enables TMC operators to post messages that offer travelers timely and pertinent information regarding current traffic conditions, alternate routes, and travel time. The Message Sign module provides functionality to post messages, create and manage message libraries, monitor the status of the signs, and capture all interactions.

Features
- Immediate confirmation of when a sent message is displayed on the sign
- Robust message libraries with keyword search, ability to add, copy, edit, delete, or preview library messages
- Full and common control of many different brands of both fixed and portable sign boards
- Dynamically move mobile sign icons on map and new location displays on all workstations.
- Device testing and diagnostics
- Graphic message integration
TRAFFIC SENSORS

The Traffic Sensor module collects and distributes traffic conditions and vehicle classification data. OpenTMS supports a wide variety of manufacturers including Peek, Siemens, Wavetronix, EIS, and Econolite.

Features

- Enables users to monitor traffic flow across the network by graphically displaying volume, flow, occupancy, and speed for each sensor station
- Views can be set up for individual zones or for the entire sensor station by direction
- Enables users to perform comparisons with historical readings of the sensor stations
- Real-time tabular display of the last polled values by lane; real-time comparison of historical vs. real-time values; and real-time, color-coded congestion/occupancy and speed maps with tool tips
ENVIRONMENTAL SENSORS

The Environmental Sensors module delivers a view of weather and road conditions based on sensor data obtained from roadside weather stations. Alarms are issued when preset sensor thresholds are crossed and warn the operator of hazardous weather conditions that could warrant action. Operators view video from cameras mounted at the weather station to confirm conditions such as fog, rain, snow, or ice.

Features

- Monitor weather sensor readings, battery voltage, status, and health of deployed stations
- Tabular display of most recent sensor readings
- Graphical display of sensor readings at six operator selected time intervals
- Alerts sent to preconfigured pager and email addresses when a configured threshold is crossed
- Real-time map display of the weather stations within the system, with standard tool tips

![Image of Environmental Sensors Module]

![Graphical display of sensor readings]

![Real-time map display of weather stations]
HIGHWAY ADVISORY RADIO
The Highway Advisory Radio (HAR) module grants direct access and control to the transmitter and beacons. It supports both Text-to-Speech capability, as well as manual voice recording.

Features
- Playback of recorded messages
- Direct access to other agencies (e.g. tourism) during non-critical message transmissions
- Automatic interruption of other agencies’ messages for vital traffic information
- A comprehensive configurable message library, including an automated spell checker
- Status logs showing communications state, device state, and using agency
- Logs of all messages displayed or distributed on HAR along with the time on/off and user that initiated the request
FEATURES

- Allows streaming video to be viewed via the web browser
- Powerful video content analysis for detecting moving or stopped objects
- Full PTZ control
- Create and manage camera presets and tours
- Support for video wall and video switching
- Recording and archiving

VIDEO

The Video module includes the unique capability to control and manipulate common TMC video walls directly from an operator workstation. It features a simple-to-use, “click-and-drag” graphical user interface (GUI) for the pan, tilt, zoom, focus, and iris control of each CCTV camera. Additionally, OpenTMS offers multiple options for mass distribution of CCTV video to public websites, and local media outlets.
CALL-BOX

The Call-Box module integrates call-boxes and alerts operators when a user attempts to initiate an emergency phone call. The alert will contain the information necessary for operators to respond to the emergency in a timely fashion.

Features

- List view of all call boxes and their status
- Integrated with Alerts module to notify operator of incoming calls
- Automatically associate nearest cameras
GATE CONTROL

The Gate Control module offers remote monitoring and control of automated barrier gates used to restrict traffic on freeway ramps, reversible/HOT/HOV lanes, bridge and tunnel entrances, railroad crossings, and parking facilities. The Gate Control module is highly configurable, enabling users to group two or more gates into a single control sequence, associate and control nearby message signs and cameras, and define automated notifications. System administration and performance monitoring is supported through comprehensive activity logging and detailed reporting.

Features

- Automatically detects field hardware failures and notifies operators
- Gate icons reflect gate open and closed state
- Software interlocking prevents gates from being opened in conflicting directions
- Gate control is integrated with cameras and message signs
- Cameras are used to provide the operator with a view to visually verify that the area is clear
- A simple wizard guides the operator through the gate opening and closing process along the roadway
- Simulator available to facilitate operator training

![Gate Control Module Image]
LANE CONTROL

Lane Control Signals (LCS) are installed on freeways in several major metropolitan areas in the United States. Consisting simply of overhead lane specific signals, denoting a red “X” if travel in the lane is prohibited or a green arrow if travel is permitted, these signals symbolically display the current status of each freeway lane. This informs motorists of the condition of the lanes downstream so that they may take appropriate action.

Features

- Command individual LCS
- Execute schedules for usage of shoulder lanes during pre-determined times
- Execute LCS commands to respond to heavy congestion and incidents
RAMP METER

The Ramp Metering module regulates ramp traffic flow using schedules during normal periods of congestion, or reacts to an unexpected event such as an incident or special event using select ramp meters. Using a library of timing plans, operators may alter and download an updated timing plan at individual ramp meters. OpenTMS then manages the selected timing plan for the controller. In addition to the default timing plan, the operator is able to select an alternative plan during specified time periods.

Features

- Ability to manually schedule individual ramp meter activation or deactivation
- Multiple ramp meter selection for easy and quick activation or deactivation
- Timing plan management
- Status logs showing communication status, state, and control mode for each ramp meter
- Event logs detailing actions taken on the ramp meter
- Ability to view current state of ramp meter and generate summary of ramp meter state
- Traffic sensor data reported by the ramp meter
**VARIABLE SPEED LIMIT SIGN**

The Variable Speed Limit (VSL) module utilizes the built-in GIS map to target specific high traffic corridors, helping operators monitor and control variable speed limit sign devices throughout the operation area. Built on the same principles as the Dynamic Message Sign module, it allows the operator to assume complete control of every configurable aspect available. Regardless of sign make, style, or design, the system provides an optimized user interface.

**Features**

- Status Log and Message Log
- Full suite of test diagnostics (when supported by the vendor)
- Real-time status of every VSL sign controller in the system
- A built-in graph system facilitates a quick look at different intervals of time to see what changes have been made
- Sign device status, diagnostics, and user notes can all be quickly inspected for the utmost control and monitoring
- Error or malfunction checks using the built-in diagnostics utilities to run pixel or device tests
LEADING THE WAY

Q-Free Open Roads delivers innovative software applications and business solutions to support real-time transportation systems management and operations.

INCREASING MOBILITY AND TRAVEL EFFICIENCY

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