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Intelligent Control

A detailed description of the implementation of each sub-system of the user requirement is provided below. This section provides a product-based description of the Intelligent Control design and the functionality inherent in the standard Intelligent Control system.

As a standard project practice, Intelligent Devices produces a detailed Conformance Traceability Matrix as part of the Functional Requirement Specification to demonstrate how the feature set of the Intelligent Control Suite of Products meets user requirements. This detailed engineering document will comment on each clause in the specification, with detailed notes on the conformance of the Intelligent Control products with each detailed requirement.

**Software Architecture**

**Communications**

NTCIP communications are carried out by the NTCIPServer application, which runs on the communication server. This ActiveX EXE application automatically starts when the first client establishes an instance of it via DCOM (Microsoft’s Distributed Component Object Model). This important “behind the scenes” application provides the following services:

- Automatic start up when the first client requires communication.
- Automatic shut down when the last client closes.
- Mutual watchdog of client and server interaction.
- Autonomously reads the database for device, device type, MIB and connection detail for each device.
- Autonomously handles user configurable re-tries and timeouts.
- Autonomously handles multiple bindings for efficient SNMP communications.
- Provides Get, Set, Connect, Status and other methods, properties and events required for real time NTCIP communication.
- Autonomously handles the real-time second-by-second polling of configured devices.
- Autonomously handles the log polling of configured devices.
- Autonomously handles the scheduling of central system events, including sign messages, reports, scenarios, backups and other time based events.
- Raises events in all connected client process of successful events, error events and communication fail events, allowing the GIS Mapping and other displays to provide real-time event driven data displays.

**Database**

- The database provides the location for the tables containing all system information (between 100 and 150 table, depending on the configuration).
- A configuration engine allows the database to be configured for different devices, device types, master tables and connection types and details.
The configuration also allows for the importing of ASN.1 MIB files, which allow Intelligent Control to accept any custom or hybrid device which conforms to the NTCIP standards for communication.

The database is accessed through a DataManager.exe application. The client applications establish references to the Data Manager via DCOM, and the Data Manager in turn connects to the database via OBDC or other MS ADO driver. This means that different databases can be provided by changing the connection in the Data Manager, which does not affect the client or communication applications at all. In this way, the connection to the database is provided without any code changes to Intelligent Control. Currently, Intelligent Control supports SQL Server, Oracle and Microsoft Access (for small applications).

All client processes use native SQL in their requests for recordsets from the Data Manager. This makes the transport of Intelligent Control over different SQL database technologies very simple.

### Client Application and User Interface

#### Security
- Security is built into Intelligent Control at all levels. Before being able to access any system function, the user has to log in with a user name and password.
- Passwords are encrypted for storage in the database.
- An activity timeout logs the operator off if there is no activity for a user definable period and closes any control applications that were left open. This excludes the Map displays, which may be left open, and will respond the event driven data, status and health events issued by the Server. However, while no user is logged on, the navigation and right-click menu items are disabled.
- Access levels are provided for Operator, Maintenance, and Administrator levels. Any number of users may be assigned to each of these levels. User definable access (read-write, read only, or not accessible) can be assigned to any control on all user interface control forms, giving the system administrator very fine control of which level of operator is allowed to see or perform each function.
- The User Name of the current operator is logged with every activity entry in the Activity log table. In this way it is possible to review by report which operator did what, and when.

#### Navigation
- Navigation between functions in Intelligent Control is via menus and mouse clicks, all with short cut key alternatives.

#### User Interface
- All user interfaces are via graphical Windows-style buttons; drop down boxes and other controls. No typing skill is required to operate Intelligent Control. There are no command line instructions or parameters to remember.
On-line context sensitive help is provided. Press F1 anywhere, and applicable help is shown.

Groups
- All devices can be configured into logical groups. These groups of devices can then be controlled based on the security levels as set by an administrator of the system.
- These groups are accessible based on the security level of the user groups that are defined.
- It is possible to assign read/write, read only or not accessible permissions to groups. So, for example, the “North Sign Group” is controlled by the “North Operators”, but only viewable by the “South Operators” and a “South Sign Group” is controlled by the “South Operators”, but only viewable by the “North Operators”.

Scenarios
- “Scenarios” is the description that Intelligent Control uses for logical grouping of actions that must occur at the time of an incident. This logical grouping can have any level of nesting. So, for example, the scenarios Traffic Accident, Congestion, Weather Incident, could be created. Under Traffic Accident, the scenarios Multi Vehicle, Hazardous Material, Minor Single Vehicle North, Minor Single Vehicle South, etc could be created. Under the Hazardous Material scenario, the Device Specific action for the signs could be defined (“Road Closed” on both signs), and point to the Standard Operating Procedure for dealing with a Hazardous material spill. Also defined under this scenario, are further items for activating alarms (presets and video record) for the camera system.

- VMS control
Intelligent Control offers a tightly integrated sign control module, which is key for providing a system that is easy to use. Operator actions are logged in the same activity log, which makes reporting, management and control of the sign function sensible.

Permanent or Changeable messages can be selected to be displayed on a sign. Any scenario can be assigned an Activation Priority, and it can also select whether the system should override (with appropriate warnings and logging) the priority of the existing message. This provides a mechanism for keeping the display of emergency messages from being overwritten by routine messages.

A facility does exist in Intelligent Control (called the Amber Alert) where free form text can be entered by the operator, and with a single button click, be downloaded to the signs and immediately displayed. This is a powerful feature that can be disabled for operators, or completely disabled if not required. Also, powerful features of Sequences (building messages from pre-approved phrases) as well as checking messages against
Approved/Disapproved lists, make sign control easy for operators of lower skill levels.

- **Camera Control**
  Intelligent Control has an integrated Video over IP (VoIP) capability that makes video available on the user interface, by double clicking on a camera icon. Using ActiveX technology, this means that any vendor of camera encoder can be used. An intuitive integrated variable speed Pan/Tilt/Zoom control is provided, by using the mouse pointer as a joystick over the video picture. This has proven effective in the control of high latency video systems.
  A video browser is also provided, where multiple cameras can be configured (quad, nine, video wall, etc) into named views so that multiple cameras can be presented on a monitor.

- **Standard Operating Procedure (SOP) Instructions**
  Intelligent Control provides, within the existing application, an extensive advisory to the operator of actions to be carried out in the event of an incident. This feature allows free text for the Operator Instructions, but also allows smart tags to be attached to the instructions for notifications. The notifications tag points to a separate location (for example, Police telephone number) so that the telephone number needs only to be updated in one place, and all SOP instructions that include the requirement to notify the Police will automatically be updated when displayed. A check box is provided for indicating Notification and Action completion, and a facility for entering a free text response is also provided.

**Displays (Bitmap Display)**

- Provided with Intelligent Control is the integrated Intelligent Control Mapping Module. This module can include a bitmap display or, optionally, a spatial GIS Display (see point below).
- Any bitmap file can be used as the background for the map display. Any number of displays can be created.
- Each device type (sign, sensor, etc.) is assigned a user-definable icon.
- During configuration, an icon for each device is placed on the map by the user and will remain in that position unless manually moved by the operator.
- For sensors, signs, ramp meters, weather stations and any other device, polling intervals can be specified (or disabled) so that the device will refresh the information on the display automatically. For signs, this is pixel based WYSIWYG display (of adjustable size), and for sensors this is a small window of speed, volume and occupancy for the enabled zones (lanes) for that sensor device. For Weather Stations, as standard a small window is displayed with the selected current weather information.
- The “tool tip” feature provides details of the device when the mouse pointer is held over the icon or link.
Right-click on an icon causes a context sensitive pop-up menu to display. 
- For sign type devices, this menu allows the operator to choose to:
  - retrieve the current message that is on the sign and display it in WYSIWYG format.
  - open the sign control form to change the message on the sign.
- For sensor type devices, the menu allows to operator to view the current sensor data, or historical sensor data.
- For weather station type devices, the menu allows the operator to view the current weather data, or historical weather data.
- For Ramp Meters, the menu allows the operator to refresh the status, or go to the Upload Download form.

Spatial displays (GIS Display)
- This mapping module allows any number of map views, aerial photographs or graphical displays to be loaded.
- Map Data is rendered at view time from ESRI Shape files, from the GIS data server over the network. Thus data will be automatically updated on the displays when a new read is added to the underlying data.
- Layers are assembled into Layer Groups.
- Zoom based detail is provided, with additional detail being provided when the operator zooms in (or less when the operator zooms out)
- User definable colors, fonts, symbols etc make for a completely configurable map display.
- Each device type (sign, sensor, etc) is assigned a user-definable icon.
- During configuration, an icon for each device is placed on the map, and its attributes are recorded in the database. Each device is therefore geo-located.
- For sensors, signs, ramp meters, weather stations and any other device, polling intervals can be specified (or disabled) so that the device will refresh the information on the spatial display automatically. For signs, this is pixel based WYSIWYG display (of adjustable size), and for sensors this is a small window of speed, volume and occupancy for the enabled zones (lanes) for that sensor device. For Weather Stations, as standard a small window is displayed with the selected current weather information.
- For any mobile device with GPS capabilities, the device’s latitude and longitude can be polled and tracked. The device will be automatically relocated when polled based on its true geo-location. The ‘trail’ of the device is also tracked with Intelligent Control’s ‘breadcumbing’ feature that will show, not only where the device is currently by moving the icon to the current position, but leave a visual trail of where the device has been. A device can be manually moved from its current location, but the true location will be marked visually on the map using the ‘rubberbanding’ feature. In this way, a device with GPS capabilities can show the history of its movement and the true location, as well as be placed in a more convenient place on the map for viewing purposes.
The Links module provides a colored overlay of a section of roadway, that changes color based on the value of the underlying sensor data (e.g. green for clear, amber for congested, red for very congested, etc).

The “tool tip” feature provides details of the device when the mouse pointer is held over the icon or link.

A zoom facility is provided to allow the operator to navigate to an area of greater detail. This detailed map can provide additional icons for the area under consideration, including the ability to create zoom based detail of both the GIS data as well as the device that will display more (or less) detail of the area as defined by the user. Pan facility is also provided.

Right-click on an icon causes a context sensitive pop-up menu to display.

- For sign type devices, this menu allows the operator to choose to:
  - retrieve the current message that is on the sign and display it in WYSIWYG format.
  - open the sign control form to change the message on the sign.

- For sensor type devices, the menu allows the operator to view the current sensor data, or historical sensor data. Real-time graphs of the sensor data can be displayed that depict the speed, volume and occupancy for the area being monitored by the device.

- For weather station type devices, the menu allows the operator to view the current weather data, or historical weather data.

- For Ramp Meters, the menu allows the operator to refresh the status, or go to the Upload Download form.

Sign Control

The sign control dialog allows the operator (subject to the Access Levels permitted by the administrator) to carry out a comprehensive range of sign control activities.

- This includes creating new messages, sending and retrieving selected messages, managing message priority, blanking the display, and previewing the current or a selected message.

- Messages can, optionally, be sent to a Message Queue and displayed on the respective signs automatically based on the priority and duration of the message(s). The queue can be monitored and overridden based on the access levels of the operator.

- Message sequences are a powerful feature that allows the operator to construct multi-page messages without the need to spell or to type the messages, by selecting pre-approved words and phrases.

- New messages are created in a WYSIWYG message editor, so the operator can see exactly how the message will appear on the sign.

- Provision is also made for the Scheduling of messages. This will cause a selected message (or a sequence of messages, including blank) to appear at predetermined times. This can be done via the local scheduler (where the schedule is downloaded to the sign) or via the Central Scheduler, where the central server will change the message on the sign when
applicable.

Traffic Sensors
- Intelligent Control provides a current status and historical report of sensor information. This data is logged at user configurable intervals into the database.
- The data collected from the Traffic Sensors can be displayed visually using the Line Graph or Scatter Graph displays. These displays will show in real-time the speed, volume and occupancy of the area being monitored by the device.

Weather Information
- Intelligent Control provides a current status and historical report of weather information, if connected to a NTCIP weather device.
- Current weather condition display can be configured to suit the actual instrumentation deployed on the Weather device.
- Reporting of historical data can be viewed through the report writer.
- Real-time data, from the device, can be factored into any incident algorithm, or travel time algorithm, through the Intelligent Incident module.

Logging and Reporting
- Intelligent Control supports the logging of all operator activity, for audit trail and diagnostic purposes. This logging function can be in summary (default) or extended mode (for diagnostics).
- Alarms are provided to the operator when the log table is 90% full so that backups can be verified before the log is overwritten.
- A number of standard reports are made available with Intelligent Control. However, due to the open nature of the database any custom reports can be written with Microsoft Access Report Writer, Crystal Reports or any third party report writer. Data may also be exported to Excel or Access for further processing and manipulation, without any software changes to Intelligent Control.
- Intelligent Control as standard supports the NTCIP Global Reporting conformance group. This means that the value in ANY object in the field can be measured against a threshold, and recorded when the threshold is exceeded. Modes are also provided to periodically record object values at a user definable period, into various user definable classes. Configuration by Intelligent Control of the Traffic Monitoring and Weather Monitoring devices to use this conformance group causes the device to locally store data in circular data logs. Intelligent Control can retrieve, sort, filter and interpret the data from these logs, and erase them in the field device after they have been successfully downloaded into the database.
Traffic Responsiveness

- Intelligent Devices has a very powerful general solution to the requirement to make a traffic system adapt to events, as a module in Intelligent Control.
- This included alerts, incident detection, incident response advisory, alert levels, incident detection, travel time prediction, impact prediction, etc.
- Intelligent Control uses Microsoft Excel’s very powerful OLE Automation Server interface to allow a conventional Excel spreadsheet to be the vehicle to carry out any user definable actions.
- The Excel spreadsheet is read by Intelligent Control. The “Configuration” workbook within the Traffic Responsiveness spreadsheet contains a list of devices and objects for which data is required, and a period of how often the information is required. Intelligent Control then connects to each applicable device in turn, and retrieves the data requested, and writes the data and the status back into the spreadsheet.
- A Recalculate is triggered in the spreadsheet, which causes all cells that contain formula to be recalculated based on any data in the spreadsheet. This means that cells can contain data from the field; time/day/date information; very complicated arithmetic operators (all supported by Excel); timers; and any algorithm required.
- Modification is easy, as no code is changed to achieve different functions. All that needs to change is that the spreadsheet needs to be modified.
- Any of the standard Excel tools for reporting, filtering, hiding, charts and graphs can be used to display the data in a user definable format.
- Simulation of new algorithms is easy. The input polling function and/or the output action function in Intelligent Control can be turned off, and the input cells manipulated by hand, to determine the effect. Likewise real input data can be used with simulated output actions, to see what the effect will be.
- Multiple spreadsheets can be used. These are opened in turn, so that the simulation of new algorithms can be carried out alongside the execution of existing algorithms.
- The output functions of the spreadsheet can be to SET an object in a device to a value; DISPLAY a message on a sign; trigger a ALARM on a camera; display a Standard Operation Procedure (SOP) on the client terminal, SET a plan in a Traffic Controller or Ramp Meter, or trigger a SCENARIO, which in turn can do all the foregoing actions. The status of the actions is displayed on the Intelligent Control user interface, and logged into the database.
- This module can be used to “prove” algorithms and functionality, prior to being incorporated into the Intelligent Incident module.

Status Display

- The status display provides a “tree view” method of navigating into the connected devices on the system, and to determine the status of the
device. The operator can also, using the right click menu, navigate to context sensitive control screens, as well as take devices on/off line.
  - The status display provides a very intuitive method of “drilling down” into device details, and monitoring of Status and Health.
  - Sensitive consistent color coding make it easy to see which devices are offline, or in an alarm state. Right click menus then allow the user to intuitively navigate from status, into control, to change a message, or drill down into further detail.

Upload Download
  - A general “spreadsheet” style user configurable Upload Download manager has been provided in Intelligent Control. This means user interfaces, configurable to ANY customer requirement, for getting data to and/or from a field controller can be provided, without writing ANY code.
  - This user interface is typically used to set data into traffic controllers, ramp meters, and any other NTCIP device.
  - Custom objects are supported by configuring them in the Upload Download manager.
  - Examples of the uses of the Upload Download form would include:
    - Ramp Meter Control – Use this form to set up the Objects to be polled to monitor the traffic flow, to set up a schedule or to set the rates desired for traffic responsiveness or as fixed rates.
    - Sign Control – Include all your custom objects on this form to allow tracking of any user-specific items.
    - Intersection Controllers – Designing a spreadsheet style grid will allow operators to monitor traffic flow at the intersection, timing of the lights as well as any communication failures at the intersection.

Intelligent Intersection
Intelligent Intersection provides integrated traffic control through the NTCIP protocol. Complete system control and monitoring is achieved through real time graphical displays, database interface and reports. Intelligent Intersection also provides for centralized event scheduling, event monitoring and system performance monitoring.

When used as part of Intelligent Control Suite, Intelligent Intersection completes the most comprehensive ITS solution available.

Graphical Displays
  - Intelligent Intersection supports either ESRI GIS or bitmap display formats at the system level and bitmap displays at the intersection level. The system map allows the user to zoom in or out to any specified area of the map with the click of a mouse. Zoom level detail is set by the user, for example to the highest level displaying a controller as being on line to the closest in level displaying a complete intersection display for a specific intersection. A controller ‘front panel display’ displays active inputs, outputs, plan in effect, alarms and active timers.
Intelligent Intersection’s map editor allows for the creation and editing of intersection displays through dragging and dropping icons onto a bitmap background. A library of device icons is provided as are intersection background bitmaps. Any bitmap editor can be used to create backgrounds. Custom icons can be created through any icon editor.

**Database Interface**

- Intelligent Intersection allows for the complete editing and up-load / download of device databases from one screen. Data is validated as it is entered and is up-loaded or downloaded on an individual OID, conformance group or groups or complete database basis.
- Custom database forms are created using Block Builder and Form Builder functions within Intelligent Control.

**Reports**

- Intelligent Intersection provides comprehensive reporting capability including a database print, event logs, pattern change logs, detector logs and user access logs. Intelligent Intersection also provides the ability to create custom reports of any parameter within a controller database.

**Scheduling**

- Intelligent Intersection provides a NTCIP conformant schedule that allows for scheduling of time implemented commands (TICs).

**Open Architecture**

- Intelligent Intersection’s open architecture provides the ability for multiple user defined operations to be implemented. Examples of such operations are the ability to create custom reports, exporting and importing data in Microsoft database format and implementing traffic responsive operations.

**Event / System Performance Monitoring**

- As Intelligent Intersection polls each field controller, it will flag events and alarms and alert operators. It is also possible to initiate a Standard Operating Procedure within Intelligent Incident allowing for automated reporting of events.

**Intelligent Incident**

Intelligent Incident is a companion application to Intelligent Control. This client-side application uses the same server components and database as Intelligent Control, and so fits hand-in-hand with Intelligent Control to manage Incidents and other “advanced” process that fit outside the normal command, control and monitoring applications of Intelligent Control.
**Incident Table**

- The Incident Table is the key element of the Intelligent Incident application. This table contains the details of the unconfirmed incidents, the current confirmed incidents, the incident type, the incident impact, the expected duration, and the historical cleared incidents.
- The incident table is populated (i.e. new incidents inserted) from a number of sources. These sources include manual incidents via operator input (such as telephone, radio, video surveillance and other sources), automatic incidents from Incident Detection, scheduled incidents from the Central Scheduler, and any other third party source of Incidents.
- The Incident Table component will raise an incident event in connected clients, to alert the operator that a new unconfirmed incident has occurred. The operator may view the details of the incident, and change the incident status to confirmed, pending, cleared and closed as appropriate, with annotations as applicable. All this functionality is subject to operator permissions, as defined in the Access Level module of Intelligent Control.
- The change in status of any item in the Incident Table will also cause an event to be raised by either the Communication Server, or the Data Manager component, as applicable. This will result in all the visual displays, and operator interfaces, displaying the latest incident information on a system-wide event driven basis.
- A user interface, with multiple tabs, is provided to manage the Incident table. In this way, the incident manager can validate incidents, check on overdue incidence clearance, and all other factors relating to managing the current incident table. Duplicate incidents can be combined during the validation process.
- The events raised by the Data Manager when changes occur to the Incident Table cause the Incident Operator User interface to refresh the data in the Incident Operator user interface, to ensure that all operators are dealing with the latest incident data.
- An administration user interface is provided to configure the selections available to the Incident Manager. This includes the configuration of the following parameters
  - Incident Categories (e.g. road closure, construction, roadway incident). Categories are tied to Icons for display on the spatial display.
  - Incident Type for each of the Incident Categories (e.g. for roadway incident, this may Stall, Collision, Road Kill, etc)
  - Incident Impact (Low, Medium, High) which can be used to color Icon borders accordingly, and provide ToolTip text accordingly.
  - Incident Source. This contains a combination of selections and free text areas where the source of the incident can be captured, and traceability established to the source data for the incident.
  - Incident Status. (e.g. unconfirmed, confirmed, expired, cleared and closed).
- Incident Location & Location Description: This is the GIS coordinates of the Incident coupled with text description of the location of the Incident.
- Incident Description: A description of the incident, from a selected list of descriptions of free text, as the Administrator elects to configure.
- Incident Disposition & Annotation: A description of how the incident was closed, and any other pertinent details.
- Incident Planned Duration. This enables the operator to disposition a planned activity, and only receive an alarm if the incident has not been closed before the planned duration expired.

Threshold and Calculation Processing
- Intelligent Incident includes the Microsoft Excel OLE algorithm processing engine described in Intelligent Control above. This environment is ideal for incident detection, pattern matching and travel time calculation where real-time second-by-second response is not required. It is also ideal for prototyping and testing new algorithms.
- Intelligent Incident maintains a reference to the communications server. This means that events, with the applicable data, are raised in this module for both Log Polling as well as Real-Time polling activities. This means that Incident Detection can be performed real-time on second-by-second data (e.g. presence detection sensors), as well as accumulated period-based speed, volume and occupancy data.
- The processing in Intelligent Incident can result in Output Actions, similar to output actions from the Central Scheduler. These output actions can include adding incidents to the Incident Table, putting messages on signs, triggering Standard Operating Procedures, triggering Camera Presets.
- Two special case processing procedures are provided, in addition to the general case processing by the Excel OLE engine, as follows.
  - Incident Detection/Congestion detection. Limits may be set up for congestion cases (free, mild, severe and very congested). The output of the limit tests (which can be performed periodically (user defined period) or on an event basis) are then used to set the color of the Links displays on the Spatial Displays. In this way, the color segments on the roadway display always reflect the correct status of congestion of the roadway, as well as trigger Incidents, and SOP’s, when incident thresholds are exceeded.
  - Travel Time Calculation: The weighted average transit time for speed detectors are used to calculate travel times for Link Segments, and Links. The resulting message of travel time is compared to the current sign message. If different, the new travel time message is sent to the sign. This is all subject to the priority of the currently displayed message being less than the travel time message; else the display of the travel time message is inhibited.
The travel time message can be configured to limit times to speed limit rides, as well as avoid excessive travel time displays.

Intelligent Maintenance

Intelligent Maintenance is an add on companion application to Intelligent Control that provides management of the system maintenance, as detailed below:

- Additional database tables, linked to the device table, provide information on manufacturer, model numbers, references to documentation, and reference to maintenance instructions. This capability provided linkage to the documentation from the original equipment supplier.
- Each maintenance activity is an entry in the Maintenance Table. The status of each entry is kept (e.g. scheduled, hold, in process, completed), and can be managed through the Maintenance Management form.
- Virtual devices (e.g. System Database, communication system, etc.) can be created in the maintenance system, so that maintenance activities can be managed for these kinds of virtual devices that do not correspond with an actual field device.
- Maintenance management is provided in the following areas
  - Routine or Scheduled maintenance. Maintenance activities can be scheduled for each device on a periodic basis. This information is captured by Device Type, and can be modified on a Device Category, Device Type or Device basis, providing a combination of ease-of-entry, as well as flexible control. Scheduled maintenance will cause an entry to be added to the Maintenance Table, when a maintenance activity becomes due.
  - Remedial Maintenance. These maintenance activities are related to “fixing” items which have been reported defective by either the operator, or a system service. For example, if the system has been so configured, a device going “off-line” due to missing a certain number of polls, will cause an entry to be automatically added into the Maintenance Table.
  - Maintenance Alarms. The system can be configured so that new activities (whether manual or maintenance) when added to the maintenance table, will cause an alarm on the operator terminals, and/or send e-mails/pager notification to the responsible maintenance personnel.
  - Maintenance Manager. This user interface provides an entry into the Maintenance Table. The status of maintenance can be displayed, as well as maintenance activity entered and edited. The audit trail of maintenance activity can be viewed, and maintenance summarized by date and/or Device Type and/or Device. The Maintenance Table can be selectively printed in the form of Work Orders, for execution by maintenance personnel.
- Intelligent Maintenance uses similar input screens to Intelligent Control. This means that training requirements are minimal for users of Intelligent Control. The security modules, as well as Access Level, mean that changes to security or Access Levels are automatically inherited by Intelligent Maintenance.
• Devices inherit the geo-location of the Device from Intelligent Control. This means that they are displayed on the GIS map in Intelligent Maintenance, and that the user can “drill down” into the Maintenance Table, and maintenance activities, from the GIS user interface.
Intelligent Control – Screenshot Sample Selection

Log On and Security

- Access to all functionality controlled through User Name and Password
- Tool bar of allowed features, and menus, appear after log on.
- Additional users can be added, edited, and access levels assigned.
Sign Control

- Easy access to pre-programmed and saved messages
- Easy to use message editor for normal operator message entry.
- WYSIWYG display. The operator enters messages exactly as they will appear on the screen.
- Advanced message editor for operators who wish to use advanced features

- Sequences offer the user the ability to create messages, from pre-prepared list of phrases. These list of approved words and phrases allow the administrator to restrict the operator from miss-spelt messages.
- Scheduling allows the operator to download schedules into the sign.
- Quick Schedules provides an easy to use interface for typical scheduling requirements.
- Detailed schedule allows for advanced scheduling should more complex schedules be required.

- The User logs allows views and filtering of User actions.
- Filters may be applied by date (using the drop down calendars shown), by user, or by device, or by a combination of these filters.
- Map Display can show the location of signs on the map
- Map views can be saved
- The sign can be configured to display as an icon (where there are many signs on a map view), or as a WYSIWYG display of the actual message on the sign (as shown)
- Communication failures (as shown) and Alarms can be configured to show icons to indicate the state of communications and the health of the sign.

Several sensors can be displayed and monitored at the same time using the Sensor View:
- Scenarios enable planned operator responses
- Messages may be sent to a number of signs
- One-click AMBER Alerts can be sent to pre-selected signs

- Navigation to devices is available from the Status display.
- Control which signs are online/offline.
- Monitor connections and polling activity.
- Drill down to review activity and communication logs
- Monitor system and device reliability
- Add, edit delete devices

- Add, edit and delete connections

- Select from a variety of connection types (Ethernet, dial up, etc)
Intelligent Incident – Screenshot Sample Selection

Log On and Security

Each incident is categorized and these categories are user-configurable.
Categories are classified by the Type of Incident and these are also user-configurable.

Incidents can be added manually as shown below as well as ‘automatically’ through the Central Scheduler or automated from other sources:
Double-clicking on any incident will bring up the detail screen where the status can be changed, comments can be added and progress can be monitored.

Incidents are shown in tabular grid formats and can be easily displayed, filtered and edited.
Intelligent Maintenance – Screenshot Sample Selection

Like Intelligent Incident, Intelligent Maintenance events can be categorized and typed with all categories and types being user-configurable.

Equipment models, locations and document resources are configurable as well.
The map view clearly shows locations where maintenance events have occurred and locations can be added as needed.

Double-clicking on a maintenance icon displays the detail that can be viewed and edited.
All maintenance issues are organized in tabular grid formats for easy viewing, filtering and editing.
Intelligent Intersection – Screenshot Sample Selection

System Display Map

All system devices can be displayed on the system map.
**Intelligent Intersection**

**Intersection Map Configuration**

Intersection displays are configured based upon zoom level by “drag and drop” of intersection elements.
**Intelligent Intersection**

Intersection Database editor

Intersection data is entered, modified, uploaded and downloaded from the database editor.

![Intersection Database Editor](image-url)
Intelligent Control Feature Set

Intelligent Control Suite of Products on Display

The Control Room