

# Intelligent Parking Guidance System Specification

## 1. Software

- a) Intelligent Parking Guidance Control System will have the ability to be installed as a stand-alone system or in a client server environment whereby multiple users can log in across a network and depending on their access level, either view information, do configuration changes or print reports.
- b) Intelligent Parking Guidance System will be based on an open standards platform such as NTCIP. This is to ensure longevity and ongoing support of the system.
- c) IPGS will be a fully soft configurable and allow future system expansion, such as the addition of more parking zones, sensors or variable message signs, as well as the addition of entire new parking areas, merely through system configuration. No hard coding or source code changes should be necessary.
- d) IPGS will as a minimum run on an SQL database.
- e) The Software will operate on a Windows 2003 Server Operating System or later.

## 2. User Interface

The IPGS shall support the display of information as Map Displays. This support of Map Display shall include the following:

- a) The ability to access the client supplied files for Map background, including aerial photographs.
- b) All Devices shall be geo-located. The appearance of devices on a particular map view shall be controlled by a combination of zoom control and map display.
- c) When a Device is moved on a map display (perhaps for aesthetic reasons, to make an area of the map less crowded) the Device shall indicate its actual geo-location with a line (a "rubber band") from the Device icon to the actual geo-location.
- d) The overall "look and feel" of the Map Display interface shall make it possible for an operator to navigate around the maps, and select devices, based on their position, and then navigate to that device using right-click menus or similar.
- e) The map display shall include the capability for showing levels of parking availability, congestion, and sign display with graphical widgets that respond to real time data returned from field devices, including traffic and parking sensors.
- f) The Map view should replicate the actual top view on the parking area. This should include an accurate view of the Bay layouts so as to help the operator recognise the exact area he or she is looking at.
- g) The Map view should be an accurate real time representation of the parking area. Giving a real time over view of the current parking status in the facility. Each Parking bay should have a colour indicator which represent real in real time the status of the sensor monitoring that's specific parking bay in the parking facility. E.g. a green dot in the parking bay will represent an open bay. A green and blue dot in the parking bay will represent an open disabled Bay. Conversely a red dot will denote an occupied bay and a blue and red dot will denote an occupied disabled bay.
- h) All bay sensor states will be capable of being shown real time on the user interface in the appropriate colour. This will include a sensor failure being depicted as a gray dot in the respective bay on the user interface.
- i) The Central Control System will have a dashboard view which is fully configurable to show the overall parking status in all parking areas as well as 24 hour parking trends. This Dashboard will be configurable to show multiple parking areas if necessary. The Dashboard will also give an overview of the overall system health and status which

will include the current status as well as the status for the past 30 days.

### **3. Access levels and security**

The IPGS shall support multi-level User Level security levels, as follows:

- a) A User Name and Password shall be required before being able to access any IPGS function
- b) The password shall be encrypted in the database.
- c) It shall be possible for an administrator to see which users are logged on to IPGS, and on which computers (client workstations) they are logged on.
- d) It shall be possible for an administrator to force a log off of any IPGS user. An inactivity timer shall cause an inactive user to be logged off after a Configurable time.

### **4. Communication**

The client will be using a variety of communication sub-systems to monitor and control the ITS devices contemplated. These include wireless, network, and serial connections. The IPGS shall support as a minimum the following communication channels:

- a) Ethernet connections, using both TCP/IP and UDP/IP transport, including support for wireless modems
- b) Serial connections, using PMPP transport.
- c) Ethernet connections, with PMPP serial embedded within either TCP/IP or UDP/IP.
- d) The IPGS shall maintain communication statistics for each device, so that the number of dropped packets and other communication errors can be readily determined.
- e) The communication parameters shall be settable in the software for time to establish a connection; time for a device to reply, and the number of re-tries the server makes before raising a timeout error. These parameters shall be individually adjustable for each communication channel.
- f) It shall be possible to establish log polling to each device, with the following parameters configurable:
  - a. The frequency of polling shall be adjustable between 1 minute and 24 hours. It shall also be possible to disable log polling of selected devices.
  - b. The user, for each device type, shall be able to select which NTCIP objects are to be included in each log poll.
  - c. The system shall log the results of each poll in the database, where it shall be available for inspection and report.
  - d. As part of the polling process, it shall be possible to cause the IPGS to synchronize the time in the device controller to the server time of the IPGS.
- g) It shall be possible to establish real-time polling to each device, with the following parameters configurable:
  - a. The frequency of polling shall be adjustable between 1 second and 60 minutes.
  - b. The user, for each device type, shall be able to select which NTCIP objects are to be included in each real time poll.
  - c. It shall be possible to configure NTCIP SNMP (Dynamic Objects) for real time polling, and the IPGS shall automatically manage the refresh of these objects to ensure correct SNMP operation.

Thresholds shall be measured as to whether a level or limit has been either exceeded or fell below a certain point. These thresholds shall be configurable by using:

- a. Comparative measures such as greater than, less than or equal to, as well as comparing two values.
- b. Binary comparatives

## **5. Alarms**

Alarms shall have the ability to notify users if the system is not operating properly when the status is measured. The alarms feature should be extensive and include such items as:

- a) User defined parameters that alarms will use to trigger and display for the operator when an alarm threshold is reached. For example: low battery voltage warning for installations with backup power systems, sensor failure, parking full, etc.
- b) A diagnostic display (grid) shall be opened for each sign showing current failures and/or current status etc.
- c) Alarms will be raised if a fault is detected by the system during the polling process and the fault will be displayed on the grid in red, and if desired with an audible warning, to focus the attention of the operator.
- d) Diagnostic alarms can also be reported by e-mail to designated users on the system.

## **6. Database and Logging Requirements**

The IPGS shall support the polling of devices, to monitor their status, value and health. This logging shall include:

- a) The ability to configure the logging period for each device, from 30 seconds to 12 hours.
- b) The ability to configure, for each Device Type, which NTCIP objects are logged into the database at each poll.
- c) The ability to configure, for each Device Type, the length of the logs that are to be kept in the database, before the oldest logs are overwritten.

## **7. Audit Trail**

All user activity shall be logged for audit trail purposes, as follows

- a) Any changes to configuration, or operation, shall be logged
- b) All logs shall include a User Name, Device ID and a Date Timestamp of user activity.

It shall be possible to view and print reports of User Activity, filtered by Date and/or User and/or Device

## **8. Reports**

IPGS shall support user configurable reports, as follows:

- a) This report writer shall be Microsoft Access, or equivalent, and shall support connection to the main IPGS SQL Server database
- b) The report writer shall support the display of tables, graphs and any other data that is located in the IPGS database.
- c) The IPGS shall provide as standard filters for date ranges, device types, devices and users so that any or all reports can be filtered with these parameters

### **Parking System Reports:**

These reports shall reflect the status and health of the system over time, and shall include the following reports as standard:

- a) Communication Statistics Summary by Date By Device (this key performance indicator indicated the overall health of the communication system)
- b) Communications Statistics By Date By Device
- c) Operator Activity by Date (an operator audit trail report)
- d) Current Operators
- e) Offline History by Device By Date
- f) Sensor Errors by Device By Date

### **Parking Data Reports**

These reports shall reflect the current and historical parking activity. Current reports can be viewed and printed for violation enforcement. Historical reports can be used for trend analysis.

- a) Current Parking Utilization By Zone
- b) Parking Utilization Summary by Zone By Date
- c) Parking Utilization Detail By Zone By day, week, month, year
- d) Current Overstay Violations By Zone
- e) Overstay Violation By Zone By date
- f) Current Reservations By Zone
- g) Current Reservation Overstay Violation By Zone
- h) Estimated Parking Revenue
- i) Average time bays are occupied by day, week, month, year
- j) Bay stay reporting
- k) Sensor Failures

## **9. Variable Message Sign Control**

The IPGS shall include the ability to select any one of the available signs and control it through the use of a user interface that includes the following:

- a) Current data for the sign selected will be displayed on the interface.
- b) All the available pre-programmed or changeable messages will be displayed, depending on which message type is selected.
- c) Ability to check the content of these messages, change them and/or download them to the sign for future or current display.

The DMS Signs user interface should include the ability to:

- a) Preview the message that is being edited in a WYSIWYG (what you see is what you get) format.
- b) Change a message on multiple signs at the same time.
- c) Send messages out to the sign; be displayed on the sign or both.
- d) Blank a sign.
- e) Set the priority and duration for the sign message.
- f) Limit the words used on a sign to those available on a pre-determined approved word list.
- g) Sequence more than one message on a sign and set the display rate for each page

When a message is edited, the following options shall be available:

- a) Font selection with up to 4 choices
- b) Line Justification
- c) Page Centering (Top, Bottom, Middle)
- d) Page Breaks
- e) Flashing
- f) Timers
- g) Background / Foreground Colour
- h) Moving Text
- i) Insert date, time, speed or temperature information

Word checking capabilities shall include the ability to offer an approved list of words and/or a disapproved list of words.

- j) The IPGS shall enable the user to modify the list of signs and the selected message(s) prior to display. A mechanism shall also be included to terminate a message and restore the next highest priority message that was previously displayed until the duration time of said message expires. The opportunity to select a different message will also be provided.
- k) The IPGS shall display the highest priority message when multiple messages are being requested for display on the same sign at the same time. The message shall continue to be displayed until a higher priority message is requested, the message is terminated or the message duration time expires.
- l) Prior to expiration of the message duration time, the IPGS system shall notify the user of the imminent expiration of the message duration time and allow the user to extend the message display or extinguish the message.
- m) The IPGS will retain the current message up to 10 minutes beyond the expiration duration time while waiting for the operator's response before extinguishing a message with an expired duration time or sooner if the operator indicates that the message can be extinguished.
- n) Once the operator terminates the message or when it is overridden by a higher priority message, the IPGS shall display the highest priority message competing for display on the sign.

The IPGS shall also include the ability to create scenarios or Amber Alerts that can be activated immediately on one or more signs or that can be scheduled at pre-determined dates / times. Scenarios or alerts shall include:

- a) Pre-prepared procedures that can be implemented, providing extensive and accurate incident management.
- b) Permissions for the administrator to set up the pre-prepared procedures so that operators will be able to activate the correct messages on the correct signs for any given scenario.
- c) Selecting messages from those prepared using the Sign interface.
- d) Capacity to verify a scenario before sending it out to the signs
- e) Ability to cancel a scenario
- f) Capability to add any number of Standard Operating Procedures as part of the scenario
- g) Creation of a log of the scenario actions.

The IPGS shall include the ability to manage a Message Queue for each sign device on the system.

- a) The intention is to provide Travel Time messages as the default message on the system.
- b) In the event of an incident, it shall be possible to display incident messages, which as a higher priority message will displace the lower priority Travel Time message on the sign, for the duration selected.
- c) When the duration of the message, is set to expire, the IPGS shall, 10 minutes before the expiry time, alert the operator that the message is due to expire. The operator may elect to extend the message duration.
- d) If the message is allowed to expire, then the message queue shall remove the message from the sign, and replace it with the next highest priority, non-expired message that is on the Message Queue.
- e) It shall be possible to manage the message queue, by deleting messages, changing duration, or changing the sequence of messages of the same priority.

- f) The operator shall be alerted when a message that the operator tries to display will not be displayed as there is a higher priority message already on the sign.
- g) The operator shall be prompted to resolve the conflict that occurs when a message is placed on the queue, where there are already messages of the same priority. The operator shall be allowed to place the message at the front of the queue, the back of the queue, or allow the IPGS to auto-resolve based on user defined auto-resolution rules previously configured.

## Hardware

### 1. Sensors

- a) Sensors will detect vehicles using Ultrasonic technology
- b) Each sensor will be mounted centrally above the parking bay and have an integrated LED status indicator. Where the centre of the bay is not easily visible the sensor will have a separate LED indicator Pod, for mounting in the alleyway for ease of visibility to motorists looking for parking.
- c) Sensors can either be hardwired back to a central controller using RS485 BUS or they can use RF wireless technology for communication
- d) Sensors must be hot swappable
- e) Each sensor must be given a unique address or identifying number in a specific zone, so that both the Data concentrator as well as the central control software can identify it and its position in the Car park.
- f) Sensor LED Status indicators will be visible through 360 degrees.
- g) Individual sensors will be able to run test patterns and diagnostics using the LED status indicators. This is for ease of installation and calibrating the system.
- h) The LED indicators that are to be located above each Bay shall operate in accordance with a truth table driven by the status of the bay, as follows:
  - **GREEN:** Vacant (not Occupied), not Disabled, not Reserved, not Sensor Failure
  - **RED:** Occupied (not Vacant), not Sensor Failure
  - **AMBER:** Vacant (not Occupied), Reserved, not Sensor Failure
  - **BLUE:** Vacant (not Occupied), Disabled, not Reserved
  - **RED Flashing:** Occupied (not Vacant), Overstay Violation
  - **AMBER Flashing:** Reserved Overstay Violation.
  - **Red Amber (No LED on):** Sensor or Communication failure.
- i) The brightness of the sensor LED indicators will be able to be set Through 255 different levels, using either the central control software Or a laptop and diagnostics package locally at the Zone Controller. This is to ensure the sensor runs at the optimum brightness for the ambient light
- j) Each sensor will be capable of running in stand-alone mode, whereby if it hasn't had communication from the Zone Controller for a predefined interval, it will operate in Red / Green mode independently until such communication is restored

### 2. Zone Controller

- a) The Parking area will be divided into Zone's. Each zone will have a zone controller that is linked via RS 485 to all the sensors in that zone.
- b) The Zone Controller will communicate real-time with all the sensors in that zone. The zone controller will poll each sensor individually for its current state

and be able to report this state, including sensor failure to the Central Control system when it in turn is polled.

- c) Each Zone Controller will be of an industrial nature and tested by a third party test house to withstand the following environmental conditions which occur in the traffic environment
  - Random Vibration
  - Corrosion testing via salt spray
  - -15 to +60 degree Celsius operating temperature, condensing and none condensing.
  - EMI testing, the zone controller shall neither be affected by EMI nor emit EMI
- d) Each zone controller will have as a minimum, 1 Ethernet port and 2 RS232 ports to enable communication with the central control system as well as allow a technician onsite to plug in laptop and run diagnostic software for maintenance, Calibration or fault finding.
- e) Each Zone Controller will be capable of being programmed with a unique IP address and its associated gateways and subnet masks.
- f) Each Zone controller will have an associated Zone board which consists of Amber LED numbers and alternately a Green Arrow indicating Bays in a certain direction, or a Red Cross indicating no bays available.
- g) The Zone Controller will update each Zone Board real time as the parking status in a particular zone changes. This will happen independently of the central control system and run as a self contained system.
- h) Each zone Controller will be polled real time for the central control system and will report current sensor status as well as any sensor failures which have occurred.
- i) Each Zone controller will have 4 heartbeat status LED's. These LED's will show the communication status with both the central as well as the sensors.
- j) Multiple Zone Controllers will connect back to the central control system via an Ethernet network. The communication modes are listed under the section dealing with communications above
- k) The zone controller will be capable of running test patterns on every sensor connected to it, to assist with the installation, calibration and maintenance of the system.

### **3. Variable Message Signs**

- a) All Zone Boards, Intersection Boards and external Variable Message Signs will conform to Br Eng 12966
- b) All numeric digits will be displayed using Amber AlInGaP II LED's, 590nm Wavelength of light +/- 3nm.
- c) Each LED shall have a typical brightness of 4.8 Candela
- d) Red crosses will use Red AlInGaP II LED's, 650 nm wavelength of light +/- 3nm
- e) Green Arrows will use InGaN LED's, 525 nm of Light +/- 3nm
- f) All LED's will have a minimum cone of vision of 30 degrees.

- g) All LED's shall be mounted on a PCB in a 7 pixel high x 5 pixel wide character format
- h) Each PCB shall be capable of pixel monitoring and be capable of reporting this via the sign controller to the Central control System for maintenance purposes. i.e. pixel failures shall be reported to the central system.
- i) Each PCB shall be hot swappable and have be addressable using binary addresses set on a dipswitch.
- j) Each PCB shall have a heartbeat LED on the rear of the PCB. The heartbeat LED will assist with fault finding and show the PCB status
- k) The VMS housing will be constructed from seamlessly welded high grade 2mm, aluminium.
- l) The face of the aluminium housing shall be punched to form a contrast mask. This serves to make the VMS more legible as well as protect the face of the VMS from damage and vandalism.
- m) The whole VMS housing will be powder coated wear resistant matt black
- n) A sheet of Lexan or equivalent will be fixed to the rear of the contrast mask so as to form a seal preventing the ingress of water and dust from outside.
- o) The VMS Housing will conform to IP66 ingress standards.
- q) The VMS controller and power supply will be mounted separately in an Easily accessible control box rated IP65 or better.
- r) The VMS controller will be of an industrial nature and as a minimum have passed third party testing as per BR Eng 12966 for Environmental conditions such as temperature, corrosion, random vibration as well as EMI testing. The controller shall not emit EMI nor be affected by it.
- s) The controller will have a minimum of 8 digital and analog ports, to monitor the status of the power in the case of backup power supplies, the door status as well other parameters which may need monitoring.
- t) The controller will have a photocell which will help the controller Dim/ Bright the VMS to suite the ambient light conditions.
- u) The VMS controller will continually monitor communications from the central control system. If the controller does not receive communication from the central control system for a predefined period, it will replace the message on the VMS with a communications loss message so as not to display incorrect information.