PART 1 - GENERAL

1.1 SUMMARY

A. The following specification details the minimum compliance and related criteria for a complete and fully operational distributed intelligence sensor and lighting control system for all interior lights.

1.2 REFERENCES

A. American National Standards Institute/ (ANSI) (wwwansi.org)

B. Institute of Electrical and Electronic Engineers (IEEE) (www.ieee.org)
   1. 802.3af-2003 – Power over Ethernet standard

C. International Electrotechnical Commission (www.iec.ch)
   1. (IEC) 801-2 Electrostatic Discharge Testing Standard.

D. International Organization for Standardization (ISO) (www.iso.ch)

E. National Electrical Manufacturers Association (NEMA) (www.nema.org)
   1. WD1 (R2005) - General Color Requirements for Wiring Devices.

F. Underwriters Laboratories, Inc. (UL) (www.ul.com)
   1. 916 – Energy Management Equipment

G. Federal Communications Commission (FCC) (www.fcc.gov)
   1. Title 47 CFR Part 15 Class A

1.3 SYSTEM DESCRIPTION

A. The lighting control system shall be capable of providing all of the following functions for all lighting:
   1. Continuous dimming and automatic on/off controls
   2. Occupancy control
   3. Vacancy control
   4. Daylight harvesting
   5. Temperature sensing
   6. Load management
   7. Outage reports
8. Metered energy savings reports

B. The lighting control system shall be capable of continuous dimming and switching allowing each fixture to monitor its local environment and provide distributed control in response to environmental changes.

C. The LIGHTING CONTROL SYSTEM shall provide network backhaul of all environmental readings for all light fixtures including power consumption, occupancy information, and temperature information.

D. The LIGHTING CONTROL SYSTEM shall be provisioned and commissioned by means of shining a light at the sensor and mapping the sensor to a floor plan of the building.

E. The LIGHTING CONTROL SYSTEM includes the following components:
   1. Sensors each containing a digital passive infrared sensor and a digital photocell and a digital thermistor and a microprocessor and a wireless radio.
   2. Controllers each containing a utility grade power meter chip and a latching relay which powers the sensors and sends the control signal to the lights ballasts or drivers.
   3. Battery powered, wireless room controllers with dimming, on/off and scene selection features for manual override.
   4. Gateways which wirelessly communicate with the sensors and are powered by standard Power-Over-Ethernet standards.
   5. Network appliance which can store data collected by the sensors and host the software for a web-based light management graphical user interfaces for light management and energy savings display software.
   6. Fluorescent Dimming Ballasts and/or LED Dimming Power Electronics. The SJCC Learning Resource Center shall use standard Electronic Fluorescent Ballasts.

1.4 SUBMITTALS

A. Specification Conformance Document - Indicate whether the submitted equipment:
   1. Meets specification exactly as stated.
   2. Meets specification via an alternate means and indicate the specific methodology used.

B. Shop Drawings; include:
   1. Schematic (one-line diagram) of system.
   2. Wiring diagrams for alternative installation configurations

C. Product Data: Catalog data sheets with performance specifications demonstrating compliance with specified requirements.

D. Sequence of Operation to describe how each component operates and how any
building wide functionality is achieved.

1.5 CLOSOUT SUBMITTALS

A. Sustainable Design Closeout Documentation
   1. LIGHTING CONTROL SYSTEM Manufacturer to provide an Operation and Maintenance Manual that details the start-up procedure being performed including a process to follow, details on tests performed and an area that documents any test results.

1.6 QUALITY ASSURANCE

A. Manufacturer: manufacturer must have 5 years of experience in the manufacture of electronic field devices.

B. System components:
   1. Listed by UL specifically for the required loads. Provide evidence of compliance upon request.
   2. Listed by FCC specifically for the required wireless communication protocols. Provide evidence of compliance upon request.

1.7 APPROVALS

A. Prior approval is required for alternate proposals.

B. Complete catalog data, specifications and technical information on alternate equipment must be furnished to the Architect and Owner at least 30 business days in advance of the submission of approved Construction Documents.

C. For wired alternatives, manufacturer shall provide wiring diagrams and architectural details of interconnecting wiring for power signal and control. Contractor shall provide a labor cost (adder or deduction) to install the wired alternative to the LIGHTING CONTROL SYSTEM.

1.8 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: 0 degrees to 40 degrees C (32 degrees to 104 degrees F).
   2. Relative humidity: Maximum 90 percent, non-condensing.
   3. LIGHTING CONTROL SYSTEM must be protected from dust during installation.
   4. Ambient temperature for Lighting Management Appliance: 10 degrees C to 35 degrees C (50 degrees F – 90 degrees F)

1.9 WARRANTY

A. Provide manufacturer’s Enhanced 3 Year Limited Warranty:

SJCC/EVC Prop 39 Year 2
LED Lighting Upgrade 26 00 00 – 3 Digital Network Lighting Controls

© 2014 IBI Group
1. 3-year limited warranty for the replacement of defective system components from the date of system startup completion.

B. Contractor shall provide limited workmanship warranty for one year from customer acceptance.

C. A standard 0-10V dimmable ballast module warranty is 3 years; however when purchased with a LIGHTING CONTROL SYSTEM this warranty is extended to 5 years.

1.10 MAINTENANCE MATERIAL SUBMITTALS

A. The manufacturer shall make available to the End-User a method of ordering new equipment for expansions, replacements and spare parts.

B. The manufacturer shall make new replacement parts available for minimum of 5 years from date of manufacture.

C. The manufacturer shall make remanufactured parts available for a minimum of 10 years from the system’s date of purchase.

D. The manufacturer shall provide extended support that is billable at an hourly rate OR support that can be purchased on an annual maintenance contract basis.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Enlighted Inc. – System: Enlighted’s Distributed Intelligence Sensor and Lighting Controls System

OR

B. Basis of design product: Enlighted LIGHTING CONTROL SYSTEM or subject to compliance and prior approval with specified requirements of this section, one of the following:
   1. Enlighted Inc.

2.2 GENERAL

A. Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0 degrees C (32 degrees F) to 40 degrees C (104 degrees F) and 90 percent non-condensing relative humidity.

B. Designed and tested to withstand discharges without impairment of performance when subjected to discharges of 15,000 volts per IEC 801-2.

2.3 SENSORS AND CONTROL UNITS

A. Ceiling Mounted or Fixture Mounted Built Environment Sensors
   1. Product: Built Environment Sensor
2. Components
   a. Sensing Mechanisms:
      1) Digital Passive Infrared Occupancy Sensor
      2) Digital Ambient Light Sensor
      3) Digital Temperature Sensor
   b. Processing Mechanisms:
      1) 8 bit Microcontroller in each sensor
   c. Communication Mechanism
      1) Low power 2.4 GHz Transceiver for IEEE 802.15.4
   d. Other:
      1) Unique internal reference number visibly displayed on module cover.
3. Operations:
   a. Sensors shall monitor changes in occupancy, changes in ambient light levels and changes in temperature and communicate digital control commands to light fixtures according to a control strategy stored locally in the sensor.
   b. Sensor shall wireless transmit occupancy, light level, power and temperature information to a gateway device which allows the data to be stored in a central location.
   c. Sensors shall be fully adaptive and able to remotely adjust their sensitivity and timing to ensure optimal lighting control for any use of the space.
   d. Sensors have remotely adjustable settings for dimming levels, active motion windows for occupancy/vacancy sensing, and sensitivity to changes in motion and changes in ambient light levels.
   e. Sensors have the ability to remotely adjust light output to reduced levels and linger at that reduced level for an adjustable time period before turning off when a space is vacant.
   f. Sensors have the ability to remotely adjust their sensitivity to the magnitude, stability of changes in ambient light levels and sensors have the ability to remotely adjust the timeframe between daylight harvesting events.
   g. Sensors can respond to Lighting Power Density levels that can be specified either to a defined LPD OR a percent reduction over an existing ASHRAE or Title 24 standard.
   h. If power is interrupted and subsequently returned, lights automatically return to their setting prior to power interruption.
   i. Power failure memory:
      1) Sensors incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and learned parameters saved in protected memory shall not be lost.
   j. Responds to digital load shed command
      1) Sets high end trim via priority assigned in profile.
      2) Automatically scales light output proportional to load shed command.
         a) Example: If light output is at 30 percent and a load shed command of
10 percent is received, the ballast automatically sets the maximum light output at 90 percent and lowers current light output by 3 percent to 27 percent.

4. Electrical/Connections:
   a. Sensor shall connect to a 0-10V dimmable ballast via a controller or power pack.
   b. Sensor shall connect to a controller via a RJ-12 Power-over-Ethernet connector cable.
   c. Manufacturer to provide all necessary mounting hardware and instructions.
   d. Sensor shall be FCC certified.
   e. Sensor shall be a Class 2 device.
   f. Sensor shall communicate no more than 300 bytes per minute.

B. Controller
   1. Product: Control unit
   2. Components:
      a. Power Meter capable of 1% power measurement accuracy.
      b. Controller to include latching relay, to decrease power requirements of the power pack.
         1) Operate Bounce Time: 3 ms. Max
         2) Max Switching Voltage 277VAC and 125VDC
         3) Insulation Rating: Class B and Class F
   3. Operations
      a. Controller shall measure the actual wattage of the fixture(s) that it controls
      b. Controller shall meter real-time energy use at each fixture.
      c. Controller shall communicate real-time energy use to sensor unit.
   4. Electrical/Connections:
      a. Circuit protection:
         1) Listed to UL 916.
         2) FCC Part 15 Class A certified.
      b. Mounting instructions shall be included on unit.
      c. Controller shall be plenum rated.
      d. Control wiring between sensors and control units shall be Class 2, 18-24 AWG, stranded U.L Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.

2.4 BALLASTS

A. Product: 0-10V dimmable programmable ballast OR 0-10V dimmable LED power electronics.

B. Electrical/Connections:
   1. Continuous 3-Wire signal dimming to electronic dimming ballast.
   2. Each ballast shall connect via a Power pack to:
a. Occupant sensor (motion detector).
b. Daylight sensor.

2.5 MANUAL OVERRIDE CONTROLS

A. Wireless Room Controllers
   1. Product: Room Controller
   2. Components:
      a. 4 button control key pad
      b. Digital Temperature Sensor
      c. Communication Mechanism
         1) Low power 2.4 GHz Transceiver for IEEE 802.15.4
      d. Security
         1) AES 128 encryptions
      e. Other:
         1) CR2025 battery
   3. Operations:
      a. Room controller shall be battery powered and wirelessly communicate with
         the sensors.
      b. Room controller shall have the ability to programmed to allow for a space
         to be controlled with an Auto-on / Auto-off control strategy or a Manual-on /
         Auto-off control strategy.
      c. Room controller shall have the ability to brighten, dim, turn on and off
         fixtures.
      d. Room controller shall have the ability to handle 6 scenes and each scene
         can by remotely adjusted.
      e. Room controller shall make a temperature reading any time on of its
         buttons is depressed and shall wirelessly transmit the temperature data to
         the sensors it controls.

2.6 GATEWAYS

A. Product: Gateway
   B. Components:
      1. Low power 2.4 GHz Transceiver for IEEE 802.15.4
   C. Electrical/Connections:
      1. Gateways shall wirelessly collect data from sensor units and relay it to the
         Lighting Energy Manager.
      2. Gateways shall communicate over IP to Lighting Energy Manager.
      3. Gateway connection cables shall be plenum rated.
      4. Gateways shall be Powered-over-Ethernet at 48V.
      5. Gateway Units shall be FCC Part 15 Class A, RoHS certified.
      6. Gateways shall be Class 2 devices.
D. Operations:
   1. Gateways are used for information gathering and commissioning communications only; lighting control remains with the individual sensors and power packs.
   2. Data Collection Mechanism:
      a. Gateways shall communicate with sensors wirelessly via 802.15.4 protocol.
      b. Gateways communications frequency shall be RF 2405-2480MHz.
   3. Gateways shall support AES 128 bit encryption.

2.7 ENERGY MANAGEMENT HARDWARE

A. Product: Lighting Energy Management Server

B. Operations
   1. Used 24 hours per day, 7 days per week to program, monitor, control, and provide data logging of digital network lighting controls.
   2. Server can either be local (at the client site) or cloud-based.
   3. Server software preinstalled and tested prior to shipping.
      OR
   4. Cloud-based server configured and tested by the manufacturer before being operated at client site.
   5. Server data can be accessed through a secure web portal at location provided by owner.

2.8 ENERGY MANAGEMENT SOFTWARE

A. Provide system software license that is designed, tested, manufactured, and warranted by a single manufacturer.

B. Graphical User Interface
   1. Software shall be capable of loading floor plans of the installation and showing sensors appropriately located on each floor plan.
   2. The GUI shall show real time occupancy, energy use and on/off control for each sensor on the floor plan.
   3. The GUI shall clearly show distinct savings from task tuning, daylight harvesting, and occupancy sensing.
   4. Lighting Profiles:
      a. GUI system shall facilitate mass-updating of sensor profiles by drag-and-dropping sensor units into desired profile setting.
      b. User shall have the ability to update profile descriptions, including but not limited to:
         1) Time-of-day cutoffs
         2) Light levels when occupied
         3) Ramp up and ramp down speed
         4) Time delays
         5) Sensor sensitivity
C. Data Access
   1. Energy Management System shall have the ability to integrate with building
      management systems and building automation systems via BacNET, ModBus.

2.9 SOURCE QUALITY CONTROL

   A. Perform full-function testing on all completed assemblies at end of line. Statistical
      sampling is not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

   A. Install equipment in accordance with manufacturer’s installation instructions.

   B. Provide complete installation of system in accordance with Contract Documents.

   C. Provide dedicated network between Gateways and Sensors.

   D. Provide equipment at locations and in quantities indicated on Drawings. Provide any
      additional equipment required to provide control intent.

   E. Contractor shall be responsible for installing in the field Enlighted Control Units in all
      fixtures that contain any type of Enlighted sensor. For exterior sensors, contractor
      shall also provide a wet location enclosure that can house the Enlighted Ruggedized
      Sensor and Enlighted Control Unit.

   F. Contractor shall either purchase the Enlighted sensor and Enlighted Control Unit
      preinstalled in all fixtures or he has the option of field installing the components, if a
      manufacturer won’t preinstall the system. The contractor shall determine prior to bid
      whether or not he must include labor in his proposal to field install Enlighted
      components. No change orders will be allowed for field installation of any Enlighted
      components.

   G. All suspended fixtures shall have integral Enlighted sensors and Enlighted Control
      Units (except for SJCC Learning Resource Center). The Enlighted sensors shall be
      integrated into the bottom of the fixture for a seamless appearance. The contractor
      shall be responsible for field modifying the suspended fixtures, if the manufacturer
      doesn’t preinstall the components. The contractor shall contact Ed De Sousa at
      Enlighted at 408-687-7202 for any questions concerning options for field mounting
      sensors integral to the fixture body. Enlighted sensors should not be field installed
      in the fixture lens, but rather in the fixture body. The contractor shall be responsible
      for providing a warranty that supersedes the factory warranty on any lighting fixtures
      that are field modified for a period of 1 year after date of installation.

   H. For the SJCC Learning Resource Center, the contractor shall be responsible for
      installing Enlighted Control Units in the existing suspended fixtures. The contractor
      shall fabricate in the field an Enlighted sensor holder out of a piece of ¾” EMT
      conduit that shall be suspended off of the support truss for the existing library stack
      lighting fixtures. Prior to bid, provide a photo of the existing installation to Enlighted
for recommendations on field mounting of Enlighted sensors. The Enlighted sensor layout shall match the drawings so that if a sensor location falls where there is no truss, the contractor shall have to fabricate an extension of the truss or conduit that will locate the Enlighted sensor where it is shown on the plans. The final elevation of the Enlighted sensor shall be equal to the bottom of the existing lighting fixture. All conduit and truss extensions shall be painted to match the existing truss.

I. Enlighted shall provide a Sequence of Operations for typical control scenarios based on the room or exterior area usage. This document shall be used to program the Enlighted 4 Button Control Keypad and the Energy Manager.

J. Based on a contractor required pre-bid walk-through of the second floor SJCC Learning Resource Center, library stack lighting in the main stack area and periodical stack area will be inspected for emergency battery back-up units. It shall be the responsibility of the electrical contractor to determine how many fixtures contain the emergency battery back-ups and determine if an equal number of Enlighted Control Units and sensors to match the number of battery packs need to be added to the Enlighted Control Unit and sensor layout drawings. These additional Enlighted components shall be included in their bid. Contractor shall coordinate with Enlighted based on their site visit and determination of emergency battery back-up units as to the total number of required Enlighted Control Units and sensors for a complete and operational system.

3.2 SERVICE AND SUPPORT

A. Startup and Programming
   1. Provide factory certified field service engineer to make minimum of two site visits to ensure proper system installation and operation under following parameters
      a. Qualifications for factory certified field service engineer:
         1) Certified by the equipment manufacturer on the system installed.
      b. Make first visit upon completion of installation of LIGHTING CONTROL SYSTEM:
         1) Verify connection of sensor units to controllers and ballasts.
         2) Place sensors onto the user-provided floor plan in the lighting energy management server.
         3) Verify system operation control by control.
         4) Obtain sign-off on system functions.
      c. Make second visit to demonstrate and educate Owner’s representative on system capabilities, operation and maintenance.

B. Training of customer representatives for Energy Management Software.
   1. Configuration Software used to make system programming and configuration changes

C. Tech Support
   1. Provide factory direct technical support hotline 24 hours per day, 5 days per
3.3 CLOSEOUT ACTIVITIES

A. Training Visit
   1. LIGHTING CONTROL SYSTEM manufacturer to provide 1 day additional on-site system training to site personnel.

B. On-site Walkthrough
   1. LIGHTING CONTROL SYSTEM manufacturer to provide a factory certified Field Service Engineer to demonstrate system functionality to the Commissioning Agent.

3.4 MAINTENANCE

A. Capable of providing on-site service support within 48 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.

B. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system startup.

3.5 PROPOSAL

A. In addition to supplying Enlighted material pricing for bidding purposes to electrical contractors, Enlighted shall be able to submit a labor and material proposal to Gilbane Building Company for the SJCC Learning Resource Center to modify existing lighting fixtures in the field and provide the Enlighted Control System.

END OF SECTION