

Nanning CAEXPO Smart Street Light System

1.0 Overview

gridComm's smart street light management system is currently deployed at the China-ASEAN EXPO Center (CAEXPO in Figure 1) in Nanning, capital of Guangxi province, where it controls more than 100 of metal halide street lights, LED and sodium vapor landscape lights. Meijixing Integrated Technology Co. Ltd, as a system integrator based in Shenzhen, China, implemented gridComm smart street light control.



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Figure 1- CAEXPO Center Compound

The idea to implement the smart street light Management at the CAEXPO Center was to save energy after midnight and to enhance efficiency against manual checking for faulty lights. While it is an iconic center in Nanning, CAEXPO Center is basically in sleep mode majority of the time unless there are major events held. As such, running the CAEXPO Center compound at 100% lighting level throughout the night does not make sense as there are basically no visitors in the late evening. On the other hand, due to limited resources and a vast area to cover at the compound, manual checks for faulty lights were few and far between resulting in undesired unlit spots at times.



The CAEXPO Center street light project was deployed with gridComm Street Light Management software (SLMS) installed in a local server in a control room connected to gridComm Master Light Controller (MLC) via a dedicated fiber optic cable. The MLC in turn controls the street lights powered by gridComm Digital Power Supply in three-phase power lines (Figure 2).





Figure 2- gridComm Smart Street Lights System in Action at CAEXPO Center



2.0 Core Technology Superiority

gridComm solution makes use of the existing power lines to perform communications with the street lights. This has the advantage of avoiding to lay dedicated communication cables which could be costly and inconvenient. Besides, the fact that communications take place in power lines, there are no interferences from wireless signals which could cause the street light control to be unreliable.

gridComm's patented Digital Power Supply is able to support a wide AC input range from 90V to 300V. Implemented with a programmable MCU, it is adaptive to different types of load with lesser components and simpler circuit design delivering huge cost-saving advantage and longer life span.

2.1 gridComm PLC versus competitions

gridComm's smart street light solution is the preferred choice for CAEXPO Center because the underlying PLC technology utilizes gridComm's flagship OFDMA (Orthogonal Frequency Division Multiple Access modulation technique) PLC transceiver chip, GC2200, that scans and selects the best frequencies in noisy environments providing both flexibility and opportunity for full redundancy. The GC2200 is ideal for use in noisy environments where it is effective in tackling signal variations that are commonly present in power line applications due to signal attenuation, impulsive noise, and changes in line impedance. GC2200 automatically configures and self-adapts to the varying conditions on power lines, resulting in extremely reliable and robust communications in a Low-Voltage power network. The GC2200 has 18 independent channels capable of operating with up to 54 carrier frequencies over a wide frequency range of 5 KHz to 500 KHz. This is in stark contrast to other PLC technologies such as FSK and other OFDM modulation schemes.

While FSK largely operates on a single fixed frequency which can be easily interfered with impulse noise, hence providing less reliability, OFDM, such as the G3 and PRIME standard, which is better than FSK due to its capability to switch between frequencies, requires a minimum number (overhead) of carrier frequencies to work within the operable band of frequencies. Therefore, robustness becomes an issue for these OFDM standards in very noisy environments where minimum number of carrier frequencies cannot be easily obtained. This is where the GC2200's OFDMA technology truly shines, scaling from 1 to 54 carrier frequencies with additional flexibility available through redundancy settings.

Wireless RF technology (specifically the low-cost Zigbee) can also be found in some small scale street light control deployment. However, RF has inherent limitations in outdoor applications. It is not as robust as PLC because it is susceptible to many types of interference including wireless signals from a dense city or a nearby traffic signal with the same frequency. Weather and obstructions such as metal, trees or walls can easily disrupt RF communications, causing them to become unreliable.

2.2 Digital Power Supply



gridComm's patented Digital Power Supply (DPS) integrates PLC and metering functions all within one unit. It is ideal for Smart Street Light control, transforming traditional street lighting into energy-aware, remotely managed monitored networks. The DPS employs a 32-bit MCU to replace the control feedback compensation loop in the traditional power supply. This has the advantage of doing without the failure-prone electrolytic capacitor in the circuit design, hence saving large amount of discrete components and boosting longer life-span. Besides, due to its programmable nature, the DPS is adaptive to different types of loads with simpler circuit design and lower cost. The end result is higher accuracy and performance with capabilities for multiple phase control, non-linear control and load current and failure predictions. Therefore, gridComm DPS can be used to drive LED, Sodium Vapor and Metal Halide lamps.

In summary, gridComm Street Light Solution delivers the following key benefits for CAEXPO Center:

- Less energy usage by using automatic lighting schedules, hence reducing the carbon footprint
- Savings in operating and maintenance costs
- Efficient remote monitoring system, thus doing away with using surveillance vehicles to check for faulty lights
- Flexibility in mixing different lamp types and technologies
- Scalability and extendibility to support other applications such as traffic, weather, and motion monitoring
- Display of street light locations on a map for real-time control and monitoring.

3.0 GUI Controls and Monitors

The authority at CAEXPO Center makes use of the following features in the Street Light Management Software to control and manage the street lights:

3.1 Dashboard

A dashboard showing the street lights on a map with various icons representing the different status of the lights. This gives the user a bird's eye view of what is happening on the streets. For example, an icon in dark green represents the light is fully lit, an icon in light green represents it is dimmed, an icon in black represents it is off and an icon in red represents an error condition has happened etc.





3.2 Manual control of individual DPS

While the dimming strategy generally brings on electrical saving to CAEXPO during wee hours, there are occasions where full lighting level is desired for specific sites and reasons. For example, a New Year Count Down party at a particular site would require full lighting level late at night. The manual control of individual DPS gives the authority full flexibility and control over the selected lights. Clicking on the street light icon will bring up a control manual whereby different dimming levels can be set manually. The control manual also shows other information such as the lamp ID, its GIS information, lamp type, brand and model as well as the various electrical data such as input/output voltage, current, power, power factor and temperature.





3.3 DPS Listing

For a quick tabular view of DPS, the user is able to click the DPS tab for a list of status and information for each DPS.

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3.4 Dimming Profile



The user is able to create a dimming profile comprising of different dimming points and priority including sunrise/sunset timing. He/she can create as many dimming points as necessary. For example, a dimming profile named "Weekdays" is created with the schedule in the table below.

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3.5 Dimming Schedule

A dimming schedule can be created by week, month or year. In CAEXPO's use case, weekly dimming schedule is deployed with "Weekdays" dimming profile created as in (3.4).



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The dimming schedules can also be viewed on the calendar – weekday, weekend, holidays.

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CS9300001-01 gridComm Street Light Solution Case Study

3.6 Reports

In order to understand the amount energy savings generated as a result of implementing gridComm smart street light management system, the user could go to "Report" tab to read the data in table or chart view form. Besides energy report, the system is able to capture and tabulate alerts or failures due to the various conditions such as over temperature, over/under input voltage or current, over/under output voltage, over/under input power, open circuit and short circuit. Historical data of Burn Hours are also automatically recorded for each DPS so that preventive maintenance could be scheduled and carried out before the lights burnt out.



4.0 Conclusion

gridComm smart street light system has been in operation for several months without any issue. CAEXPO authority benefits immensely from the advantages brought upon by the system. Firstly, the street lights are automatically turned on and off without manual intervention based on sunset and sunrise timing. Secondly, the staff are now able to monitor the streetlights at the convenience of a browser. As a result, more time is saved for other tasks which would otherwise be used to roam around the streets to check for faulty lights. In addition, much energy is saved by implementing dimming strategy while maintaining optimal lighting level late in the night. The success at CAEXPO has attracted the attention of the Nanning Street Light Bureau, which is now planning to roll out gridComm smart street light system in the entire Nanning city.