TELEMANAGEMENT OF PUBLIC STREETLIGHTING INFRASTRUCTURES

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Introduction:

Streetlighting fulfils many roles within our environment, although mostly facilitating a safety and security function. This is compromised through vandalism, cable theft, failures in lamps, ballasts, circuit breakers, and electrical supply infrastructures.

PUBLIC LIGHTING IN DEMANDING ENVIRONMENTS

Today's Public Lighting designers and managers are required to provide far more reliable infrastructures, adopt ever increasing energy saving principles and to provide effective on-demand and proactive maintenance of these systems. Further to this situation, South African legislation enforces the requirement for well maintained systems, through strict operational requirements to avoid wasteful energy use, and to incorporate dimming during out-of-peak times.

LEGISLATION

The South African Electricity Regulation Act (4/2006): Electricity Regulations for Compulsory Norms and Standards for Reticulation Services enforces very specific requirements for the adoption of Energy Efficiency practices in public lighting, as per below excerpt:

> (a) In respect of lighting -
> (ii) street and highway lighting must be energy efficient and licensee must ensure that it is switched off during the day;
> (iii) streetlights must be fitted with systems that allow for remote reduction of power especially during capacity constraints.

Furthermore stating that "the Energy Act (2008) will be used to implement regulations on the management, measurement and reporting of energy efficiency."

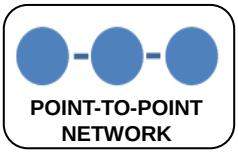
With the prevalent copper theft and luminaire vandalism adding to the already challenging task, one is no longer able to rely upon purely reactive processes to keep these critical systems running.

OWLET *nightshift,* a telemanagement system designed specifically for the effective and efficient management of Public Lighting networks, addresses these issues at various levels.

TELEMANAGEMENT

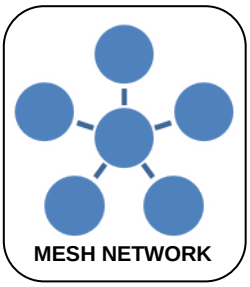
Telemanagement, as a technological enabler for system or infrastructure management, is not a new concept and has been successful in assisting organisations manage various systems across many industries. The challenges preventing legacy proprietary systems from providing a meaningful solution and contribution for the Public Lighting realm has been due to numerous factors, mostly surrounding communication – the primary backbone for an effective system.

Traditional communication methods, typically based upon PLC (Power Line Communication) or proprietary wireless systems, have found many stumbling blocks in achieving meaningful and effective large scale implementations. Both these communication systems rely on point-to-point communication which is rendered ineffective once a pole or luminaire is removed from the communication chain, through accident or malicious activity, effectively breaking the communication path.



OPEN STANDARDS ENABLED SOLUTION

New wireless mesh network technologies, based upon the open standard IEEE 802.15.4, incorporate both self-learning and self-healing which provides for a stable and reliable communication backbone. Adopting open standards, within such a system, is critical in order to prevent vendor lock-in. The principle technological requirement in facilitating this challenging management task is to adopt an open, scalable and modular system.



Developed from the ground up, OWLET *nightshift* has been built upon a reliable platform, incorporating open and industrial standards, to prevent proprietary system lock-in, which occurs with older legacy systems.

SYSTEM STRUCTURE

OWLET *nightshift* is composed of a three tier architecture, incorporating the individual end-point device controller, area controller, and centralised server. The end-point device control is facilitated through either a Luminaire Controller, for single output control, or Column Controller, for double output control. The Luminaire Controller, typically installed within the luminaire, facilitates the controlling and monitoring of the individual luminaire. A Column Controller, installed within the streetlight pole, can control two luminaires or alternatively a luminaire and Power Change-over Unit (PCU) for dimming control of High Pressure Sodium light sources. Each Column Controller also supplies a dimmable output, for either an LED-based luminaire or advertising sign.

These devices communicate via the self-discovering, self-healing wireless mesh network in order to transmit the data between themselves and a central Segment Controller. Each Segment Controller co-ordinates the interaction of manual commands and pre-programmed switching schedules with up to 150 Column and/or Luminaire Controllers and also interacts directly with the centralised OWLET server for data logging and error reporting.

The centralised OWLET *nightshift* server incorporates a Web Management Interface (WMI) and communication (Email and/or SMS) module. Daily error reports are emailed for maintenance teams to address the previous days failures, whilst the WMI allows Public Lighting Managers to interrogate the current operating status and also effect manual control.

OWLET Web Management Interface

OWLET *nightshift* groups the entire system into a logical hierarchy, namely city, suburb, street and control-device levels. This ensures that you have holistic view over each and every level within the system. Emergency or public events can be responded to in order to override any pre-programmed dimming or switching state during the particular event. Every device manually overridden is indicated within the system through a change in the displayed icon on the Google Map component, making identification of each device's state extremely simple. This status icon also indicates any failure states.

BENEFITS

Each individual light point or end-point device can be monitored for actual energy consumption, lamp status as well as failures, and can be switched on and off or dimmed at any time. Scheduled control of the system, based upon a split weekday and weekend calendar, at fifteen minute intervals, is configured for each group or individual end-point. This allows for granular control and ensures that the maximum energy saving can be achieved during low-use times, whilst maintaining the required level of lighting during peak use times. Operating state, energy consumption and failures are reported and stored in a central database with exact timestamp and geographic location. This information will assist Public Lighting managers to ensure that service levels are maintained.

Maintenance time and cost is reduced, as staff are able to check the status of the installation, identify faults and respond to these. Time spent checking installations, section by section, is now negated. Maintenance cost reduction schemes, such as group lamp replacement, now also become feasible in public lighting. With OWLET *nightshift*, management reports show luminaires with lamp burning times exceeding certain timescales, any luminaire which has had a recent lamp replacement is therefore automatically excluded. The strength of this is that maintenance time is not expended on replacing good lamps, the primary drawback of traditional group lamp

replacement schemes.

LOCAL CHALLENGES

Controlling and switching the end-point device results in a required change to the installation paradigm, as the sections are now permanently live. This ensures that cables installed in the Public Lighting Network will be less prone to theft due to the added risk. Furthermore, with the constant threat of cable theft, having an insight into the failures occurring in the field, at the time of occurrence, would help to alert staff to respond accordingly to this.

FUTURE PROOF

Any system implemented today needs to allow for the future technologies as they emerge. LED will soon supersede traditional HID light sources, bringing with it the ability to dim the output on demand. OWLET *nightshift* allows for the scheduling of dimming levels in 0.5% increments, ensuring that the streetlight of tomorrow can be controlled through today's systems.

OWLET gives public lighting managers the right tools to assure the correct lighting level on the street while improving the overall reliability of outdoor lighting, effecting energy efficiency and reducing operating costs.