POWERNET

Application Guide

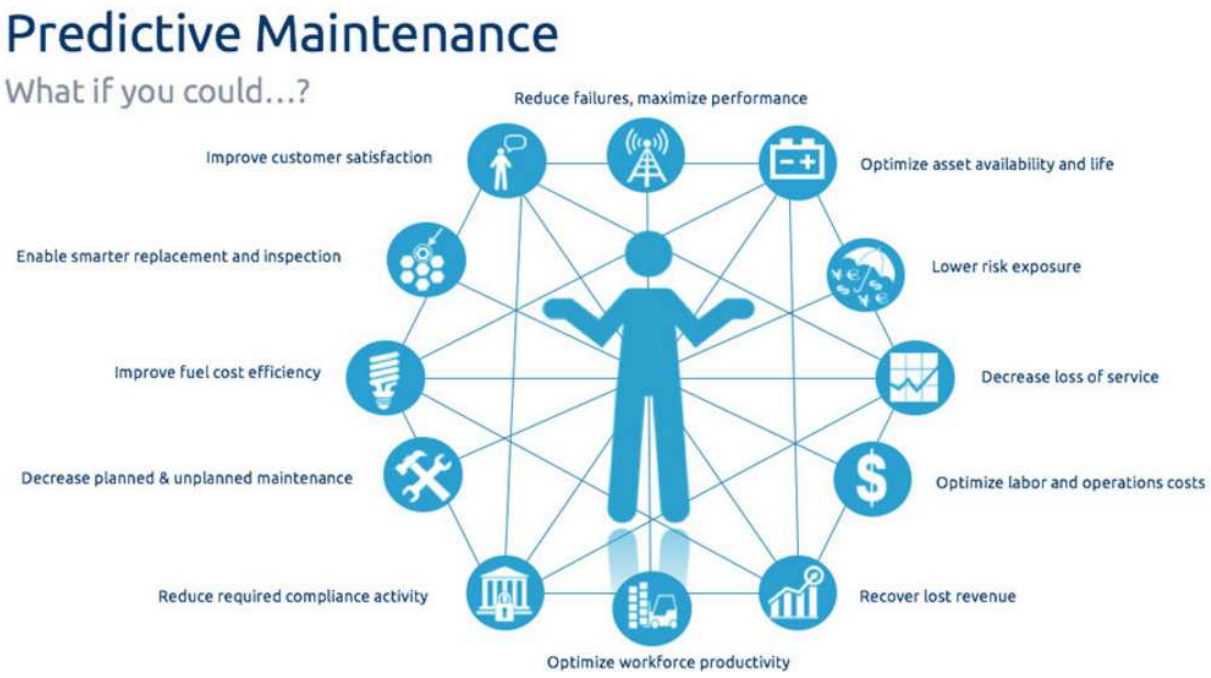
IIoT enabled Intelligent Battery Management

Small stationary batteries provide critical local backup power reserve in numerous applications. Lead acid batteries are well established technology and provide reliable and low cost energy storage for large scale of applications. Large installed base of battery backup systems need continuous maintenance and create service cost. If batteries are not inspected periodically, critical backup power may not be available when needed.

The cost of battery replacement far exceeds the cost of actual battery in many cases. In distributed infrastructure systems (power grid, telecom, road traffic and weather observation) small capacity backups batteries are spread on wide geographical area. Service activities are labor intensive and nodes requiring periodic maintenance can be far from each other. Intelligent battery management can provide valuable information for service planning and operative optimization.

In critical applications battery replacement intervals are unnecessary short as true battery condition is not available. Conditions where ambient temperatures can be high, batteries can fail prematurely. To keep up operative capability, batteries can be replaced even in few month intervals. A monitoring solution that can give early warning of abnormal ageing can help extend battery replacement intervals.

More data and information is being captured from systems, machines, and devices and made available to IT systems. This data capturing and collection for IT systems is often referred as IoT, internet of Things. When same principles are applied to industrial and commercial environment we may call it IIoT, Industrial Internet of Things. Data capture and collection can be expanded to lowest level of equipment, like battery chargers and power supplies. These devices provide prime information about energy flow within systems and machines. An intelligent battery charger with fieldbus communication can provide system integrator information that is not available anywhere in system: system power consumption, battery state of charge, battery state of health, currents and voltages. This basic information can be collected and analyzed from large network of installed systems. Data can be utilized for increasing robustness, reliability, and preemptive maintenance.



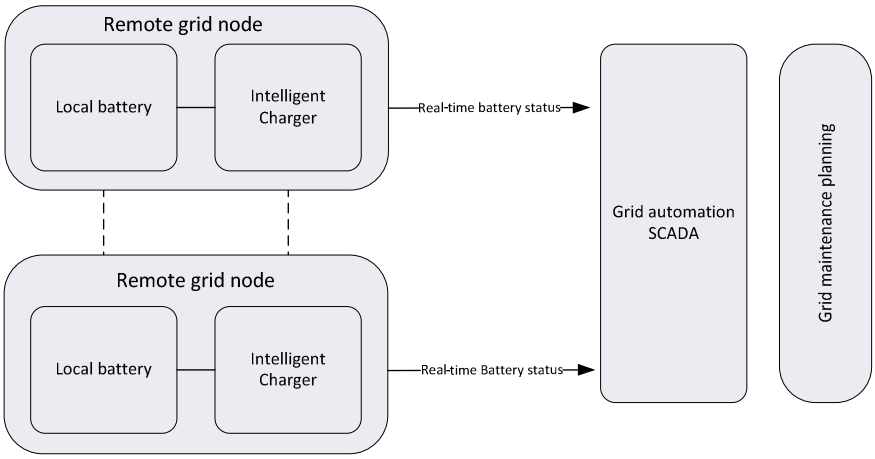
Examples of IIoT-enabled predictive maintenance. (Courtesy: ADLINK Technology.)

 Created: JRo 23.01.2017

POWERNET

Grid Automation

Power distribution networks have remotely controlled nodes that need local power reserves for network power failures. Power network must be controlled to known state in all conditions. Local small lead acid batteries are needed for this purpose. Remotely controlled nodes are spread over large geographical areas and periodic maintenance is major contributor for life-cycle cost. Locations for grid nodes are usually not temperature controlled and it is difficult to predict battery wear. A reliable monitoring of battery state and remaining service life gives direct benefit for maintenance planning as replacement schedules can be extended and replacements can be planned as a part of other maintenance activities. A battery charger with battery condition monitoring is convenient way to combine battery charging, monitoring and power distribution functions into one managed entity. Network automation system, SCADA, transmits battery related information to system operator for maintenance planning.

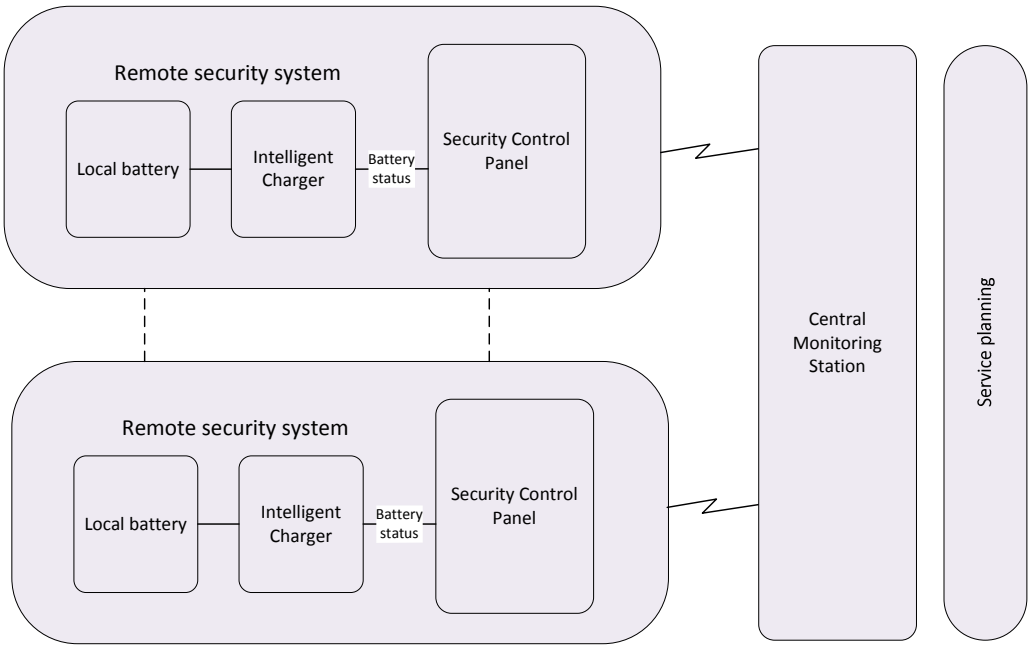


 Created: JRo 23.01.2017

POWERNET

Security systems

A local backup power is a must for any security system, large or small. These systems need to be online without any loss of power 24/7. Security system back-up is located in a temperature controlled environment where battery service life can be predicted more accurately. Battery service life is affected by temperature, use profile and manufacturing tolerances. Balance between unnecessary battery replacement and backup power capability are defined based on empirical knowledge and large safe margins. This yields to frequent battery replacements and high maintenance costs.
A remotely managed battery backup with real time battery service life estimate can benefit security system operator to increase battery replacement intervals and plan periodic maintenance based on true battery wear, not empirical knowledge. Intelligent battery management gives early warning of battery end-of-life. System operator can plan battery replacement for next periodic service/inspection.



 Created: JRo 23.01.2017

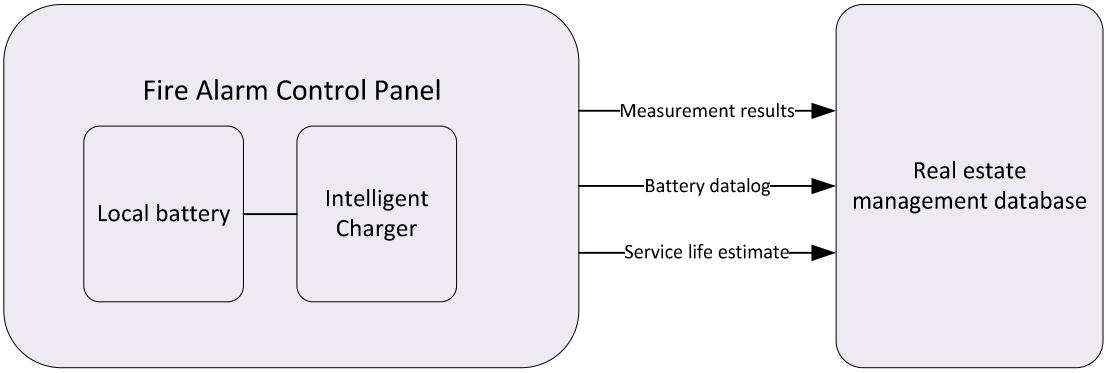
POWERNET

Fire alarm and signalling systems

Building automation systems related to fire and safety are locally supplied with battery backup. Fire alarm and signalling systems and their power supply requirements are controlled by standards such as NFPA 72-2013 *National Fire Alarm and Signalling Code*. As a norm, two power supplies are required: mains and battery. Power supplies are normally built into the Fire Alarm Control Panel. Periodic inspection and replacement of batteries is mandatory. Technician performs battery condition testing on site, and test may take 24h to complete.

An intelligent battery charger can be set to perform automated test procedures defined by standards. Test sequences may contain long discharge cycles, with capacity calculation and datalogging. Technician can engage test procedures and intelligent battery charger performs predefined test sequence. When test sequence is completed, technician can download logged data from charger and verify test results.

Intelligent battery charger can automate periodic inspections and provide digital maintenance record. Technician can engage test sequence remotely in advance. When test is completed results can be downloaded from intelligent battery charger to real estate management databases. Remote control saves time spent on location and logged data can be stored to service database.



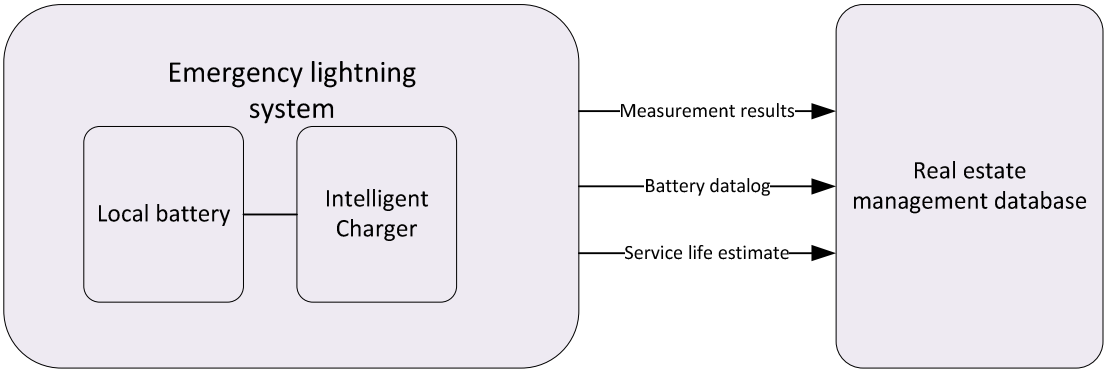
 Created: JRo 23.01.2017

POWERNET

Emergency lightning

Requirement for emergency lightning applications are similar to fire alarm and signaling systems. Several standards and local requirements define power supplies and batteries in emergency lightning applications. Common factor in all requirements is need for periodic inspections and test procedures. During inspections, technician performs predefined test sequence and records results.

Intelligent battery charger can automate periodic inspections and provide digital maintenance record. Technician can engage test sequence remotely in advance. When test is completed results can be downloaded from intelligent battery charger to real estate management databases. Remote control saves time spent on location and logged data can be stored to service database.

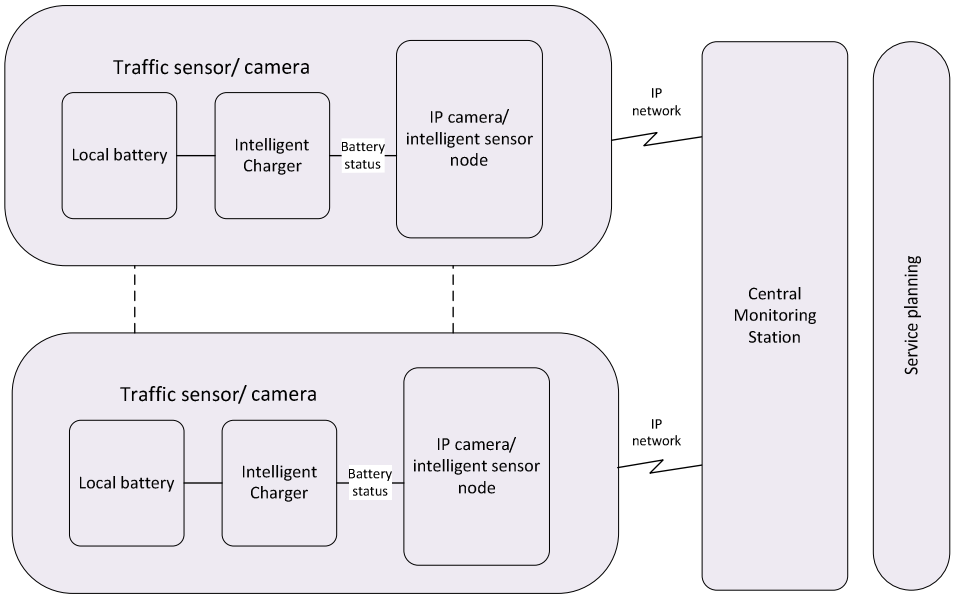


 Created: JRo 23.01.2017

POWERNET

Traffic Control and Surveillance

All traffic control and surveillance systems are distributed by nature. Large quantities of surveillance cameras, traffic sensors, emergency lightning, control lights road condition sensors are located in critical nodes in road networks. A reliable and continuous data stream is vital for ensuring smooth day to day traffic. Harsh conditions on a roadside application predict short life expectancy for batteries: hot sun on summer time and salt fog on winter seasons. A continuous battery condition monitoring can give early warning on battery ageing. Even corrosion on battery terminals can be measured and signaled. Battery replacements can be scheduled as part of routine maintenance. This ensures high data availability and lower maintenance costs.



 Created: JRo 23.01.2017

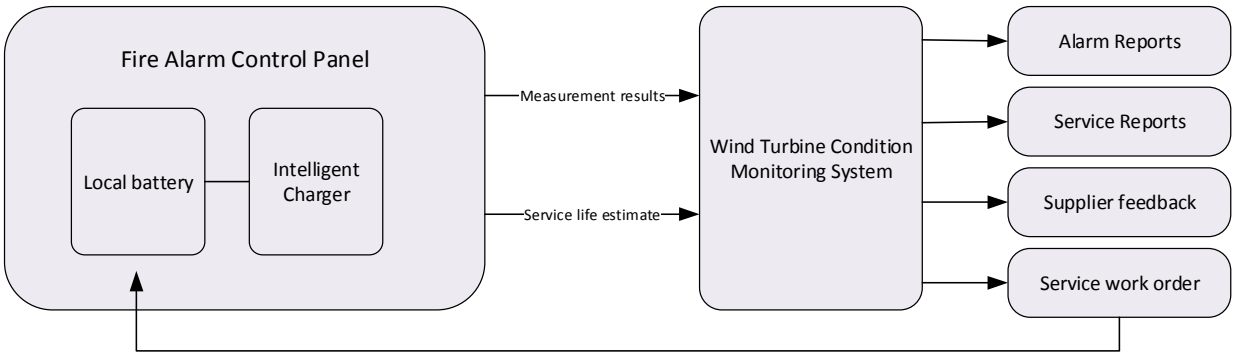
POWERNET

Renewable energy

Renewable energy production relies on large quantity of self-sustained production units. These units can be wind turbines on offshore wind park or solar panel installations on commercial buildings. Common factor for the all of them is remote control and monitoring in all possible conditions. This requires local backup power to be stored on site. To minimize risk the risk of losing backup power for the whole system, several independent small DC UPS systems are used.

Offshore wind park is prime example of application where cost of battery backup maintenance work far exceeds cost of maintenance material: replacing 50 Euro battery on remote offshore wind park can cost thousands of Euros. Conditions inside a wind turbine nozzle can be extremely harsh: high ambient temperatures, corrosive humidity and mechanical vibration. These conditions predict short life expectancy and batteries are replaced in few month intervals. A continuous battery condition monitoring linked to wind turbine diagnostics application can give early warning on premature battery ageing. Batteries can be replaced during routine scheduled maintenance operations based on true state of health.

Renewable energy as a technology segment is in front row commissioning latest innovations on Big Data into use. Big Data stands for collecting large quantities of prime data for predictive analytics. Prime data can be anything but most useful are variables that are not calculated based on other variables. For example battery voltages, currents, temperatures, battery impedances are great examples of prime data. They are direct measurements that can be used for statistical analysis. Intelligent battery charger is perfect supplement to Big Data infrastructure. It reports values only available from power supplies such as power consumption and battery data.



 Created: JRo 23.01.2017