DATA COMMUNICATION APPARATUS, SYSTEM, AND METHOD

Background

Machine to machine communication is becoming increasingly important to the energy, communications, and security markets, among others. Supervisory Control and Data Acquisition (SCADA) systems used in those industries rely on inputs from remotely located sensors to function properly. SCADA systems can also output signals to actuate remote equipment in the field. A sizeable portion of that equipment (~18% for U.S. electric utilities) is located underground, and providing wireless communications between above ground and underground equipment is a serious challenge.

Current methods used to locate underground cable faults are still slow and labor intensive. Even relatively short outages can be used against utilities and lead to rate adjustments for customers, so a faster means of locating and fixing underground faults is needed.

Thus, there is a need for communicating wireless signals into and out of underground equipment vaults and other structures where underground equipment is located.

Summary of the Invention

In one aspect of the invention, a data communication system comprises a transceiver disposed on an entrance port to an enclosure the transceiver including a housing, the housing mountable to the entrance port, wherein the transceiver is configured to communicate with a network outside of the enclosure. The data communication system also includes a monitoring device disposed in the enclosure that provides data related to a real-time condition within the enclosure. The data communication system also includes a sensor analytics unit to process the data from the monitoring device/sensor and generate a processed data signal and to communicate the processed data signal to the transceiver.

In another aspect, the sensor detects at least one of: power, voltage, current, temperature, combustible materials or byproducts of combustion, mechanical strain,

includes a signal processing chip to process the measured data and a communication chip to communicate processed data to the transceiver.

In another aspect, the sensored cable accessory further comprises a power harvesting device coupled to the power line to provide power to the signal processing chip and communication chip.

In another aspect of the invention, a data communication system comprises a transceiver disposed on a portion of an enclosure containing utility equipment, the transceiver including a housing, the housing mountable to the enclosure, wherein the transceiver is configured to communicate with a network outside of the enclosure. The system also includes a monitoring device, such as a sensor, disposed in the enclosure that provides data related to a real-time condition within the enclosure. The system also includes a sensor analytics unit to process the data from the monitoring device and generate a processed data signal and to communicate processed data signal to the transceiver.

In another aspect, the enclosure comprises an underground vault. In a further aspect, the enclosure comprises a grade level or above-ground enclosure.

The above summary of the present invention is not intended to describe each illustrated embodiment or every implementation of the present invention. The figures and the detailed description that follows more particularly exemplify these embodiments.

Brief Description of the Drawings

The invention will be described hereinafter in part by reference to non-limiting examples thereof and with reference to the drawings, in which:

Fig. 1 is a schematic view of a data communication system according to a first aspect of the invention.

Figs. 2A- 2E are side views of alternative transceiver mountings and constructions according to other aspects of the invention.

Fig. 3 is a schematic view of a data communication system according to another aspect of the invention.

8. The data communication system of claim 1, wherein the transceiver unit includes a hardened above ground antenna and radio.

9. The data communication system of claim 1, wherein the transceiver is configured to send aggregated information upstream to another aggregation node or cloud server above ground.

10. The data communication system of claim 9, wherein the aggregated data comprises one or more of periodic status notification and asynchronous alarm notification.

11. The data communication system of claim 1, wherein the transceiver is configured to respond to messages sent to it by an upstream aggregation node or cloud.

12. The data communication system of claim 1, wherein the enclosure comprises an underground enclosure and wherein the entrance port comprises a manhole cover and a ring portion to receive the manhole cover.

13. The data communication system of claim 12, wherein the transceiver is secured to the manhole cover and a portion of the transceiver housing extends through a hole formed in the entrance cover.

14. The data communication system of claim 13, wherein the transceiver housing portion extending through the hole formed in the entrance cover is substantially flush with a top surface of the entrance cover.

15. The data communication system of claim 12, wherein the transceiver is secured to a ring portion of the entrance port.

16. The data communication system of claim 1, further comprising a power harvesting device coupled to at least one power line located in the enclosure.