A Wireless Sensor based solution that enables the Enterprise to enable intelligent Energy Monitoring & Management using Artificial intelligence

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ABSTRACT

Abstract— Wireless Sensor networks running on artificial intelligence coupled with GSM enabled cell phones allow for the eterprise across diverse sectors in emerging economies to monitor and manage energy and trade credits and help Utilities and communities gain multi- level incentives.

Keywords: energy monitoring, wireless sensors, carbon credits

1 INTRODUCTION

Innovative wireless sensor network solutions based on artificial intelligence can enable the enterprise in emerging economies to monitor, save and manage their carbon footprint- specifically water and electricity. All this is done using a disruptive and innovative solution: simple legacy cell phones are integrated with complex wireless sensor networks across a distributed network within the enterprise. The solution automatically enables savings in water, electricity, light and other forms of energy. As the solution scales up, the artificial intelligence in the network not only enables resource management for the community but also enables trading of carbon credits using a simple cell phone which can act as an income generator by trading carbon credits

2 TECHNOLOGY

Low cost wireless Sensors networks in Hebbian mode and mesh topology connect over ubiquitous GSM cellular network. The automated and entrenched network acts as the carrier of information. The network and combined processing power acts as the intelligent processor.

2.1 Architecture

The architecture is an M to M model: Machine to Machine model wherein, the wireless sensor network mesh communicates with cellular phones over the GSM network. The wireless sensor network mesh acts as an Artificial Neural Network (ANN). Over a period of time, the ANN is trained using a database of inputs using a Multiple Signal Classification Algorithm. The ANN is trained by simulating the network with the environment data. The final installation will test the ANN Mesh using actual data over a period of time.

Small physical size: At any point in technological evolution, size and power consumption restricts the processing, storage, and interconnect capability of the processing devices. Highly compact and integrated sensor based solutions coupled with lean embedded software enable easier integration and retrofit at installations

Information- eccentric design: the mesh of sensors allow for data to flow in a hub and spoke model or in a star model. The redundancy built into the system allows data flow to happen seamlessly. The sensor actuator provides the interface to the processing hardware over the standardized GSM network, making data ubiquitously available for processing.

Robust architecture: These networked sensory devices will be numerous, fragmented, largely unattended, and integrated into the centralized application that has a CRM front end. Enhancing the reliability of individual devices is essential to maintain redundancy over the network. Additionally, we can increase the reliability of the application by tolerating individual device failures and isolating them. To that end, the operating system running on a single node is not only robust, but also capable of facilitating the development of reliable distributed applications.

Cell phone integration: Cell phones are ubiquitous, even in low incomes factories, making it the perfect choice of human machine interface to the wireless sensor grid. Every enterprise and consumer equipped with a cell phone can access the grid pertaining to his domain and monitor, save and manage their individual carbon footprint, and thus holistically reducing the carbon footprint of the community as a whole

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2.2 Demand response

Demand response refers to the modification of customer electricity consumption during times of peak usage in order to help address system reliability, reflect market conditions and pricing, and support infrastructure optimization or deferral. Demand shedding is a dynamic temporary reduction, or curtailment of peak load when dispatched and

refers to strategies that can be possibly implemented within a shorter period of response time.
Types of Demand Response
i. Manual Demand Response: Involves a labor intensive approach such as turning off unwanted lights or equipment
ii. Semi-Automated Response: Involves the use of controls for DR, with a person initiating a preprogrammed DR strategy
iii. Fully-Automated Demand Response: Does not involve human intervention, but is initiated at a facility, in our case a PC, through receipt of an external communications signal

2.3 Results

The results of the ANN based network have yielded savings across the enterprise specifically with energy efficiency within the shop- floor. As the shop- floor utilisation increases, the network works to achieve lowered operational expenses. This helps justify the upfront capex. In a manged service model, the payback period is roughly 12-15 months.

TABLE 1: ENERGY SAVINGS ILLUSATRATION ACROSS THE ENTERPRISE

Industry Vertical	Utility Footprint	Energy Savings
Small scale manufacturers	$500/Mo.	25%
Medium Scale Enterprise	$1000/Mo.	28%
Large Scale Manufacturers	$5,000/ Mo.	20%

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3 ILLUSTRATION

FIGURE 1: ENERGY MONITORING APPLICANCE WITH SENSOR ARRAY NETWORK

- The platform provides a solution that is a one stop shop for energy efficiency and building operations optimization that automatically predicts, detects, diagnoses and prioritizes faults and anomalies
- It provides a "Just-in-time" Maintenance approach via predictive energy analytics platform, leveraging artificial intelligence
- The platform compares predicted energy and system efficiencies against real-time consumption and demand
- A breakthrough predictive analytics platform delivered via Solution as a Service (SaaS) that requires no upfront capital, providing customers value pricing based on documented maintenance, energy, and asset savings
- Produces demonstrable results relatively short time and a ROI within months of deployment
- A certified baseline of energy consumption and spending, broken down at the asset level, by each facility over time
- Tracks system service and compares to actual performance to determine if improvements are realized
- Provides continuous reporting required to meet specific elements of LEED and other global organizations' certification compliance

4 INFERENCE

The solution provides updated energy and budgeting information to utilities that help optimize domestic consumer energy use. With this solution consumers can gain visibility into household energy usage and control how energy is utilized to begin with. Consumer energy management gives utilities and electric companies potential new revenue streams from offering new services and strengthening relationships with customers. In addition, these solutions can increase customer interest in energy efficiency audits and rebate programs, as well as purchasing power from green energy sources. Consumers can use an extension of the solution- a web enabled CRM product that leverages their mobile phones to trade energy credits after it gets certified by the bureau of energy efficiciency

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