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Research Paper

SUPERVISORY CONTROL IN SMART HOME WITH RENEWABLE ENERGY BASED ON DCS AND ZIGBEE

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Home automation is the solution for future household. The smart home technique enables household devices effectively centralize the management and service in a home. DCS (Distributed Control System) technique used here to make a switchover between renewable energy source and power grid. Along with DCS wonderware software is interface to monitor the energy consumptions and energy generation. "Wonderware is a flexible technology which enables reliable monitoring of any energy production" A renewable energy gateway is used to monitor the energy generation of renewable energies. Those measure the power and energy usage of home appliances and also transfer the measured power and energy information to the server through zig bee network. Supervisory control Energy management system provide them with all round function for internal information exchange and help to keep instant contact with outside world using zig bee. By considering both energy consumption and generation simultaneously, the proposed (EMSH) can optimize home energy use and result in energy cost saving.

Keywords: DCS control energy switch over between the energies, Wonderware InTouch monitor and to interface considering different area of smart home, Low-rate wireless network technologies

INTRODUCTION

As suggested, a smart home is understood as an integration system, which takes advantage of a range of techniques such as computers, network communication as well as synthesized wiring to connect all indoor subsystems that attach to home appliances and household electrical devices as a whole. In this way, smart home techniques enable households to effectively centralize the management and services in a house, provide them with all-round functions for internal information and help to keep in instant contact with the outside world. In terms of convenience, they help people in optimizing their living style, rearranging the day-to-day schedule, securing a high quality of living condition and in turn enable people to reduce bills from a variety of energy consumptions in a house.

Home automation, which initially originated in the US, is one of the most fundamental

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technologies in smart home system design. It employs DCS controllers to monitor ovens, washing machines, lighting, refrigerators, and HVAC facilities (Heating/Ventilation/Air-Conditioning) with respect to temperature or humidity and to adjust accordingly to meet the home owner's requirements. Therefore, it is obvious that home automation to some extent takes responsible for the indoor energy management and supervision with the instructions of household owners.

EXISTING SYSTEM

In previous research it consist of that how to manage the power consumption by using power line communication. Here only thing is that to compare and monitoring the current usage by the appliances energy generated by the renewable sources and utility power generator (EB). In that they used power line communication technique to monitor the power generation which is very complicated to monitor all the devices. By using power line communication techniques we want observe all parameter appliances and machines energy consumption.

A. Power Line Communication

Powerline systems use the standard electrical power lines to transmit power. They can be DC or AC powerline systems. The first ones transmit over low DC voltages, typically 12-24 V. They are exploited for smart-home scenarios in a few demotic-buses and in smart systemswith a lot of sensors, such as wearable network for health monitoring where is necessary to send or to read the status without incrementing the number of cables.

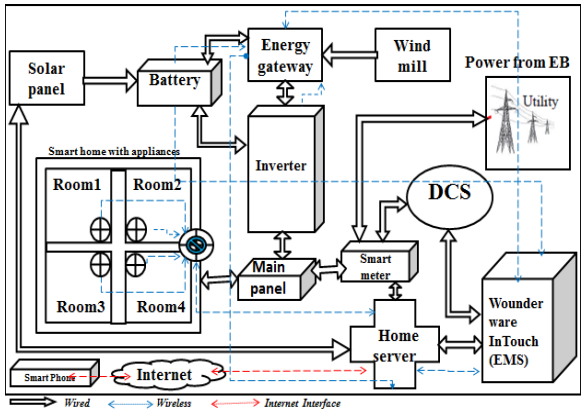
AC powerline systems, instead, are applied over AC voltages both in closed environments (houses but also hospitals, airports and so on and in the big distribution power networks, over very long distances and with big amount of power in play.

In this last case AC powerline systems are able to offer several services such as reading the electricity meter, transmitting power over the standard lines, paying the electricity bill, storing information about the network. Solving the "local-loop" problem is the disadvantage (i.e., how to go from the optic fiber link that serves a city to every single home in the so called "last mile").

DESCRIPTION OF PROPOSED SYSTEM

In terms of energy management, the operation mode is intended for two categories: home appliances, and renewable energy sources covering PV systems (solar panels), wind turbines and PEB/PHEV batteries. A Distributed Control System (DCS) refers to a control system usually of a manufacturing system, process or any kind of dynamic system, in which the controller elements are not central in location (like the brain) but are distributed throughout the system with each component sub-system controlled by one or more controllers. The entire system of

Figure 1: Block Diagram of Proposed System

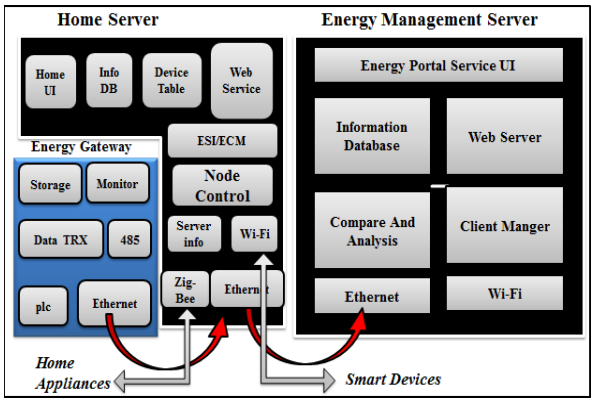


controllers is connected by networks for communication and monitoring.

TECHNOLOGY INDEPENDENT REQUIREMENTS OF UTILITIES IN A SMART HOME

In order to provide a guideline of serviceability, security and interoperability intended for HSN (Home Server Network) device manufacturing and home network management in terms of electricity control, a couple of technical frameworks and functional considerations have been established and discussed from the perspective of utilities.

Figure 2: A Mature Home Server Network in Secure Communication With Utilities



Typically, Figure 4 illustrates a complete HSN framework partially under remote control by utilities. In this framework, the key devices are ESI (Energy Services Interface) and Premise EMS (Premise Energy Management System). ESI is an independent device mostly provided by utilities and serves as a gateway between the AMI infrastructure and the HSN.

To establish a secure communication connection between utilities and HSN, all HSN customer devices associated with energy management must register themselves via ESI on the utility network. In this way, confidential control data or information sensitive to customer could be delivered through the secure from utilities to target devices in the home network. Also, device status information or operation result could be transferred conversely in the same to utilities for data recording.

As a software program, EMS actually works as an application gateway to other functional components. It controls energy generation, consumption and storage in the HSN, shares the functions with ESI to delivery control commands or events from utilities to smart appliances, and gathers all types of information from HSN devices. It could also connect to other networks in homes for non-energy control, providing a secure from the external interface (i.e., the Internet) to the internal network for the purpose of remote access. Normally, ESI resides in a smart meter whereas EMS resides in a computer as an independent gateway with centralized control. Based on similarities in their functionality, the two entities could be integrated into one physical device.

DISTRIBUTIVE CONTROL SYSTEMS (DCS)

A DCS refers to a control system usually of a manufacturing system, process or any kind of dynamic system, in which the controller elements are not central in location (like the brain) but are distributed throughout the system with each component sub-system controlled by one or more controllers. The entire system of controllers is connected by networks for communication and monitoring. DCS is a very broad term used in a variety of industries, to monitor and control distributed equipment.

A DCS typically uses custom designed processors as controllers and uses both proprietary interconnections and communications protocol for communication. Input and output modules form component parts of the DCS. The processor receives information from input modules and sends information to output modules. The input modules receive information from input instruments in the process (or field) and transmit instructions to the output instruments in the field. Computer buses or electrical buses connect the processor and modules through multiplexer or DE multiplexers. Buses also connect the distributed controllers with the central controller and finally to the Human Machine Interface (HMI) or control consoles.

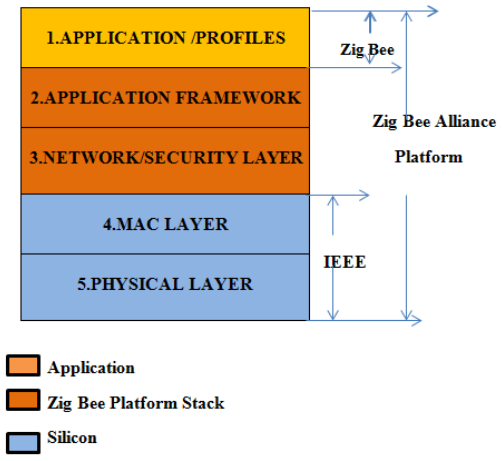
LOW-RATE WIRELESS NETWORK TECHNOLOGIES

Due to the complexity and cost of re-wiring and potential retrofit in a house, a variety of short distance wireless technologies are emerging to provide flexible networking patterns convenient to residents without the considerations of physical wiring and deployment. These technologies, including WLAN, Bluetooth, Zig Bee, Z-Wave, etc., mostly work in the Industrial Scientific Medical Bands(ISM Bands), especially the 2.4 GHz frequency range. In terms of the control network in a smart home, the commonalities of those wireless technologies are associated with low speed, low power consumption, high cost effectiveness, flexibility in networking and deployment as well as the coverage of a house.

A. Zig bee

Zig Bee is a bidirectional wireless technology featured with short-range, low cost, low power consumption, low data rate as well as small size, which makes it more suitable for any domains associated with monitoring and remote control that is integrated with functional sensors and actuators. Normally, Zig Bee works in the registration-free 2.4 GHz ISM band with a data rate of up to 250 Kbps and the transmission distance range from 10 to 75 m, depending on the power output and environmental dynamics.

Figure 3: Block Diagram of IEEE 802.15.4 / zig bee



At the PHY layer, IEEE 802.15.4/Zig Bee uses Direct-Sequence Spread Spectrum (DSSS) with two different Phase-Shift Keying (PSK) modulations to minimize interference. At the MAC layer, Zig Bee adopts the CSMA/CA access to improve network throughput and minimize transmission delay.

WONDERWARE INTOUCH TECHNOLOGY SIMULATION.

Human Machine Interface (HMI) and SCADA solutions vary widely from simple and straight forward to complex and demanding. Wonderware InTouch HMI and Visualization software coupled with the award-winning Wonderware System

Platform are uniquely positioned to be extremely easy to use as well as powerful and sophisticated to meet the most demanding and challenging of solution requirements.

Wonderware is a flexible technology which enables reliable monitoring of any energy production. The Wonderware technology has measured up to and exceeded our expectations Renewable energy. It's the mantra for today's society—to identify and implement clean renewable energy sources to wean us off our dependence on fossil fuels. This is one of the fields where taking the initiative to a global level.

The Wonderware Historian is a high-performance real-time database for historical information and is designed to collect a wide variety of plant data, at full resolution and very high data rates. Delivery of this vital information ensures that decision-makers at all levels will have the information needed to make informed decisions that ensure maximum operational efficiency.

The Wonderware installation was done while running the existing control system simultaneously without making any modifications to the hardware systems. The Wonderware technology was deployed as a layered, modular system which guaranteed maximum security levels for data management.

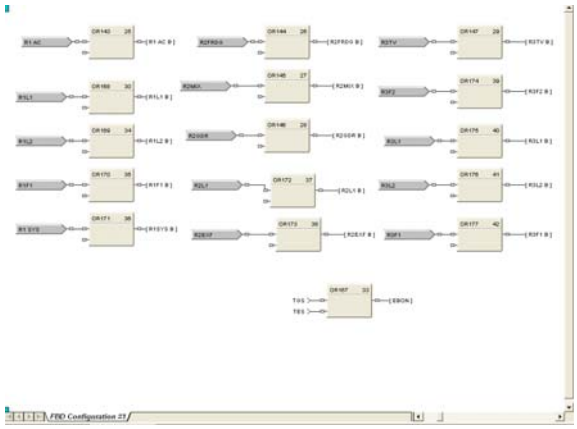
A. Benefits

- Easy-to-use, easy to implement
- Easy configuration, simplified maintenance
- High security and availability
- Virtually unlimited scalability

B. Capabilities

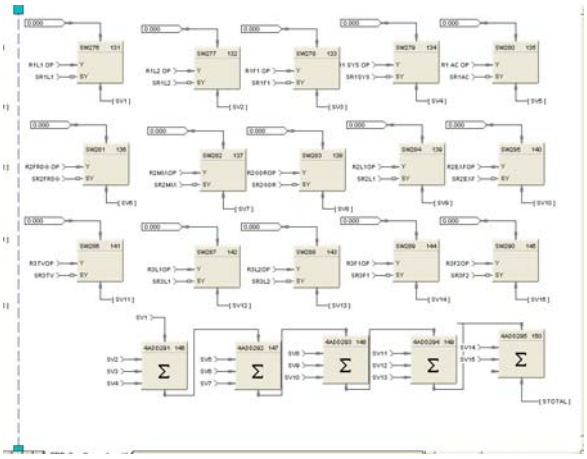
- HMI visualization and geographically distributed SCADA
- Template based development and maintenance
- Remote application deployment and change management
- Data level security built into the system
- Easy and flexible alarm definition
- Data collection and analysis for new and existing systems
- Easy-to-use report generation

Figure 4: Initializing The Device With Their Corresponding Watts



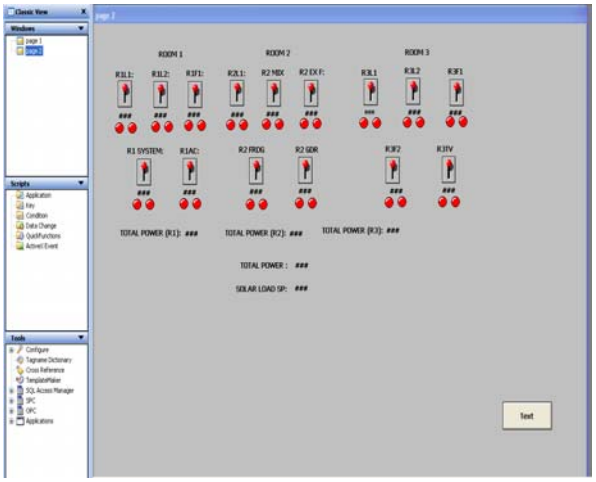
Splitting the current to different appliance in the respective allocated rooms.

Figure 5: Simulated Comparison the Power Between the Appliances



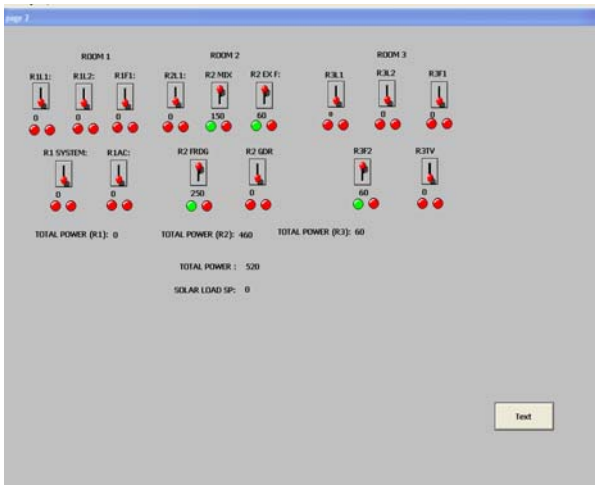
Under requirements of devices parameter are defined in the DCS as tag name which show in above simulation diagram.

Figure 6: DCS simulation zero set point



With the help of overview block diagram shows all the devices were gather together at a single window in wonderware software at initially at zero set point.

Figure 7: DCS simulation desired set point



The above Figure 7 shows the power switch over between the devices and its shows thatthe what are the devices are consuming power in renewable sources and from power grids.

CONCLUSION

This paper has shown a new cost-effective approach for power saving technology. The simulation of power switch over between renewable energy and power from grid compared and manage by the DCS through the desired set point. By using the DCS the additive devices are liked easy by addressing them. A low power Zig Bee communication network to measure and transfer the power and energy of home appliances and lights. Through the ESI and EMS, all energy information of home appliances and lights is aggregated for analysis in the home server. A standard wonderware technology is adopted to monitor the status of each solar panel.

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