Category 3: Architecture; architectural engineering

10. Smart Building Energy Systems Monitoring, Controls and Diagnostics Using a Wireless Sensor Network for Energy Efficiency and Conservation

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http://www.nuengr.unl.edu/ENonline/Fall05/fc10.shtml

The trend of building functionality is to provide a personalized, comfortable and roductive indoor environment with low energy consumption and environmental impacts. However, the status quo of the building industry is non-personalizable with low energy efficiency and high operation and maintenance expenditure (about 15%~50% of the energy can be saved) because 1) the huge rewiring cost is a tremendous barrier for advanced technologies to be applied to old non-direct digital control based buildings; 2) limited useful information makes current buildings rely on costly manual continuous commissioning to recover the designed energy efficiency and functionality, and makes current buildings non-scalable/non-expandable to new control algorithms for improving energy efficiency; 3) the lack of flexibility makes the current building unable to provide personalized environment, 4) the current use of wireless technologies in building automation is mainly focusing on providing equivalent functionalities as their wired counterparts, which are not cost effective, energy efficient, and reliable.

The wireless sensor network (WSN) is an emerging cutting-edge technology which has a potential to enable a revolution in building monitoring, controls and diagnostics to overcome the above barriers and deficiencies due to its unique merits in cost effectiveness, energy-efficiency, fault tolerance, and capability of multi-dimensional information collection. We propose to explore the full potential of the synergy between the WSN technology and building monitoring, controls and diagnostics to enhance building energy efficiency and conservation. 1) to build a test bed of WSN-based building monitoring, controls and diagnostics systems to develop, implement, and deploy innovative methods for building energy systems and 2) through the test bed to demonstrate improved building energy efficiency and conservation, system cost-effectiveness, fault tolerance and reliability, flexibility in terms of building space reconfiguration and personalized environment, and scalability/expandability in terms of adding/adopting new technologies.