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Energy conservation with RFID based sensor networks

Ambient Sensor Network

Challenge

The coming decade will see a widespread demand and deployment of sensors throughout environments. Specifically, smart-metering applications in heating, ventilation, air conditioning, and lighting present tremendous opportunities for improved energy consumption and therein necessitate the development of new sensor networks and sensor deployments; Improved sensor systems present a more optimized way of achieving extensive savings on energy consumption and personnel costs.

Solution

Whereas traditional building automation systems typically employ only a centralized control scheme to manage energy consumption, our solution helps to build a distributed control system. This topology forms the reflex arc through which the facilities control can be more efficient. The largest challenge in implementing this solution comes from developing a sustainable power supply for the sensor network; typical power supplies are delivered through battery or power lines and both presented inefficient options. We saw ambient energy harvesting as a possible solution to this problem, therein collecting energy from renewable sources near the node.
Moreover, we wanted to reduce the total power consumption by the individual sensor nodes and we investigated RFID solutions and Zigbee solutions. Whereas RFID solutions are suitable for data gathering in living spaces, the advantage to using zigbee is that it offers highly efficient routing for large area deployment. We looked to develop an RFID chip that was capable of harvesting energy from the environment to charge the sensor; the developed chip core is a miniature transformer with a nona ferrofluids magnetic core. The embedded transformer can convert harvested energy to variable voltage output for driving multiple loads.
The RFID tag powered by solar cell was constructed and integrated with multiple sensors including temperature, humidity, light and air flow. By distributing the tags, RFID based sensor networks were completed.

Results

The energy harvesting wireless sensor network (WSN) was deployed in a 24-hour convenience store to detect thermal comfort degree from the air conditioning control. All sensor nodes were only powered by the artificial lighting in the store. The network resulted in constant comfort level control and 45% savings in A/C energy consumption.

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