

Towards Self-Managing Energy Systems in Buildings

The project was aimed towards Self-Managing Energy Systems in Buildings” (SESB) project that was carried out to investigate energy efficiency and renewable energy integration in the existing electricity systems of common buildings such as houses or office.

The major goal was to develop low cost solutions for energy efficiency and maximal utilization of renewable energy through hardware/software interfaces. In this regard, the team developed software tool called PCAT to monitor and control energy utilization in buildings. With this software there is an intelligent module known as Smarti to automatically control the energy utilization. The Smarti uses an algorithm called ColorPower 2.0 that allows the users to specify devices preferences. Additionally, in SESB we have developed an indigenous implementation of a meshed Home Areas Network (HAN) to control the devices from PCAT.

Key Objectives

- Using a very simple user interface allow the consumers to state goals, priorities, and constraints on energy usage in a typical building to automatically plan the energy usage through controlling devices.
- Make the consumers, aware of their energy usage patterns and show them the energy and cost savings by modifying energy usage patterns.
- Develop a localized low cost Home Area Network implementation for controlling heavy duty electric appliances for energy conservation.
- Be able to seamlessly integrate alternate sources of energy such as solar energy in the overall energy systems of buildings.

Significant Results

A very important component of the project was to develop all the solutions with as little cost as possible. The Project Team has achieved building some cheaper but quality hardware components that could provide nearly the same results as expensive off-the-shelf components.

The demonstration sites developed during the project could be used a blueprints for the development of similar locations and ultimately result in energy efficiency and renewable energy utilization. The details of the significant results achieved during the Project are as under:

- The project lets the user specify a set of usage priorities for any electrical device.
- The software controls the devices to keep the energy bill within a budget and communicate with the devices through a home area network.
- When renewable energy is available the software tries to use it to the maximum and try to run all of the elastic loads from renewable energy.
- One PhD (Fahad Javed) was awarded from the work of the project.
- Two MS theses (Usman Ali and Muhammad Nabeel) were awarded from the work of the project.
- One MS these (Qasim Khalid) is ongoing from the work of the project.
- In total about twenty students did their internships with the project at various stages.
- Students and RAs working on this project got admissions in MS and PhD programs at the following universities: UPenn (Saira Hussain), Virginia Tech (Taha Hassan), Georgia Tech (Asif Rana), and TU Damstad (Ali Harron Babri).

- Four journal publications and about five conference publications have been produced.