



SMART CAMPUS SIMULATION

A simulation based tool to understand energy consumption patterns and behaviour cost reduction in large campuses.

OBJECTIVE

We conceptualised and campus as a socio-technical system and use design theory to look at adaptive approaches to improve energy utilisation. This work also explored approaches to convey the need to change energy usage patterns to address the issue of the campus's carbon footprint. Just as energy usage behaviour assumes energy to be ubiquitous, we planned to understand the use of technology to achieve responsible energy consumption ubiquitously as well.

Intended Audience

*Campus administration,
Energy researchers, Architects*

Keywords

*Energy-consumption, Adaptive,
agent-based simulations,
Socio-technical system, Sensor
Deployment*

2-D Temperature Gradient in Room 204

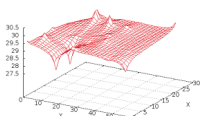


Figure 7: Variation of Temperature in a room. Temperature was measured in Celsius using 130776 sensor

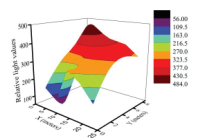


Figure 8: Pair of Relative Humidity values vary from 40-60% in a room. Humidity was measured using the DHT22 sensor

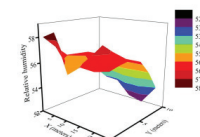


Figure 9: Photograph showing temperature sensor interfaced with Intel Galileo board.

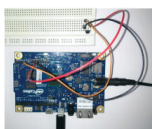


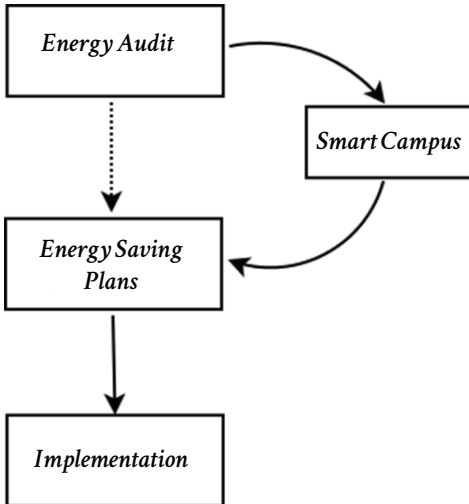
Figure 10: Photograph showing temperature sensor interfaced with Intel Galileo board.

APPROACH

In order to model the socio-technical aspects of the campus, we collected data about the physical dimensions, the energy meter readings from its buildings, a catalogue of all the devices with their locations, campus operational policy, user behaviour and their preferences. We used IIIT - Bangalore as a case study.

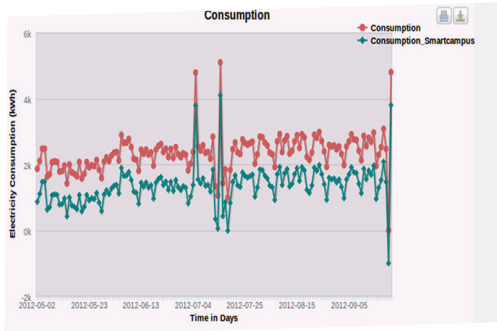
We used FoV's Phoenix simulation platform to implement an agent based model for the campus along with additional information such as population, the current billing and tariffs, etc,. Using this model we create different scenarios of operations for the campus such as:

- How does the energy usage behaviour change with staggered work hours and changing course structures?
- What is the cost-benefit of deploying a new technology, for example, an adaptive sensor based device control, on the campus?
- How can we raise awareness about issues of climate change and energy responsible consumption with a dynamic campus population?



OUTPUT

- A multi-agent simulation tool for a smart energy campus.
- A specification for the sensors for long term deployment.
- A range of possible energy saving options based on different policies and scenarios.
- Research articles.



Dashboard
 Define campus
 Add Simulation
 View Existing
 Live

#	Simulation Name	Date	Created by	Status	Actions
0	test simulation	2013-11-22	editor	Complete	<input type="radio"/> View <input type="button" value="Save"/>
1	test simulation2	2013-11-22	editor	Complete	<input type="radio"/> Runagain <input type="button" value="Save"/>
2	test simulation5	2013-11-22	editor	Complete	<input type="radio"/> View <input type="button" value="Save"/>
				Complete	<input type="radio"/> Runagain

Simulation results

Areas simulated: "MH1GF", "MH1FF"

Acknowledgements

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Publications

Harsha Krishna, Onkar Hoysala, Murali Krishna G., Bharath M. Palavalli and Eswaran Subrahmanian. (2014). Modelling technology, policy and behaviour to manage electricity consumption. Proceedings of the IEEE Region 10 Humanitarian Technology Conference, Chennai.