DATA CENTRE ENERGY EFFICIENCY

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Background

Escalating energy costs and increased environmental awareness in the socio-political domain have helped focus the attention of data centre managers on the energy efficiency debate.

Consuming 3% of all global energy, both existing and higher capacity† data centres (being rolled out to meet the rising demands of cloud-based computing) will be required to include energy efficiency as a key performance metric in their monitoring systems.

† The data centre hosting Microsoft's cloud-based OS 'Azure' has a power capacity of 45MW

The aim of this research then is to specify, design & develop an integrated hardware / software system which will monitor and report data centre energy efficiency using the ISS (Information Solutions & Services) data centre in NUI Galway as a test bed.

Employing a wireless sensor network for cabinet temperatures and SNMP (Simple Network Management Protocol) polling for all other values, the resultant application will provide real-time information to assist ISS personnel manage the energy efficiency of their data centre.

Furthermore, an artificial intelligence component may be implemented to aid data centre staff making both short-term optimisation decisions and formulating energy-saving strategies for the medium to long-term.

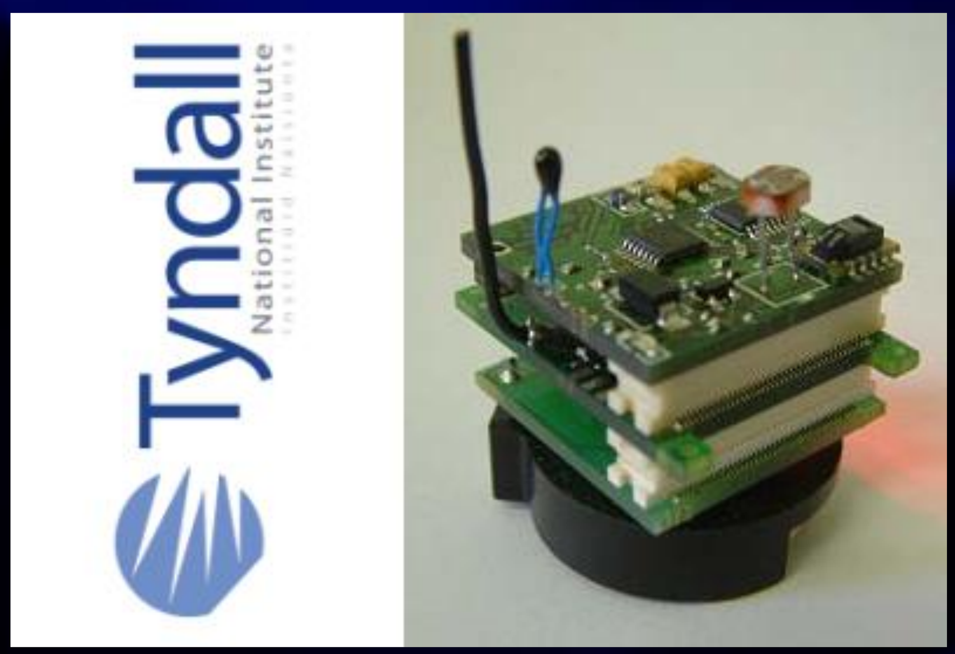

Figure 1: Tyndall Institute Modular Sensor

Monitoring & Compilation

Figure 2 depicts the architecture of the proposed system.

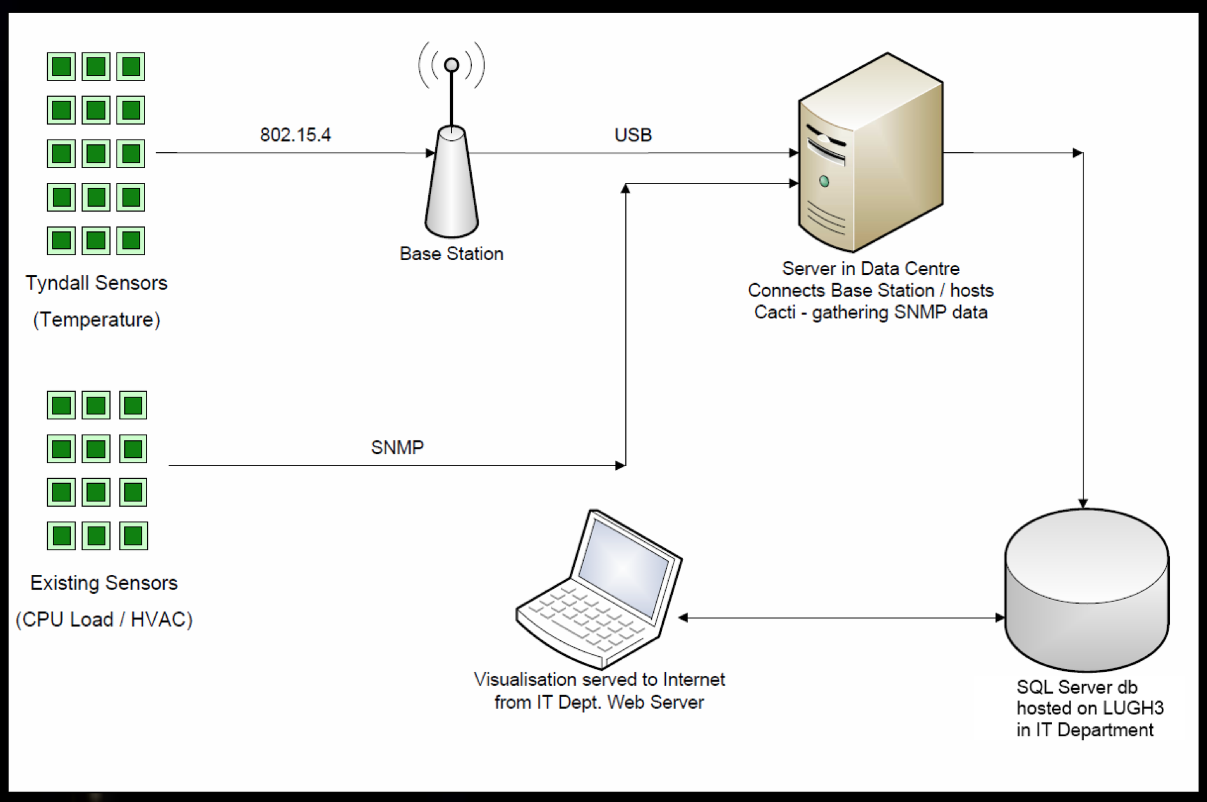

Figure 2: System Architecture

3 temperature sensors will be attached to the doors of each of 6 cabinets in the data centre. They will be positioned high, middle and low to give a range of values per cabinet. The data from these sensors will be transmitted over the wireless (802.15.4) network, via the base station, to the data centre server.

All other readings in the system will be gathered using an open-source software application known as Cacti, which includes an SNMP polling manager and a round robin database which facilitates data archiving.

The primary function of the Cacti software will be to poll SNMP-enabled equipment on the ISS data centre network. With a minimum polling interval of 5 seconds, values being returned to Cacti from the network will include:

- CPU load (Process Queue Average)
- CPU draw (Watts)
- CPU fan speed (RPM)
- Power Distribution Unit draw (Watts)
- HVAC draw (Watts)

The entire dataset (from both wireless and SNMP sources) will be intermittently transmitted from the data centre server to the SQL Server database hosted on the LUGH3 server in the IT Department, where it will then be available to the front-end website for visualisation and reporting.

Visualisation & Reporting

External access to the raw dataset is provided by the website hosted on the LUGH2 server in the IT Department.

Authorised users each have an account. On login, a clickable floor plan of the data centre becomes available.

If readings are available for a sensor in Cabinet 1, Row 1 for example, then this cabinet will be clickable and the user is redirected to the reporting page.

The user selects one or more sensors from the cabinet's available list, chooses the time range for the report and clicks 'Report'. A chart is generated where visual comparisons can be made between sensors (Figure 3).

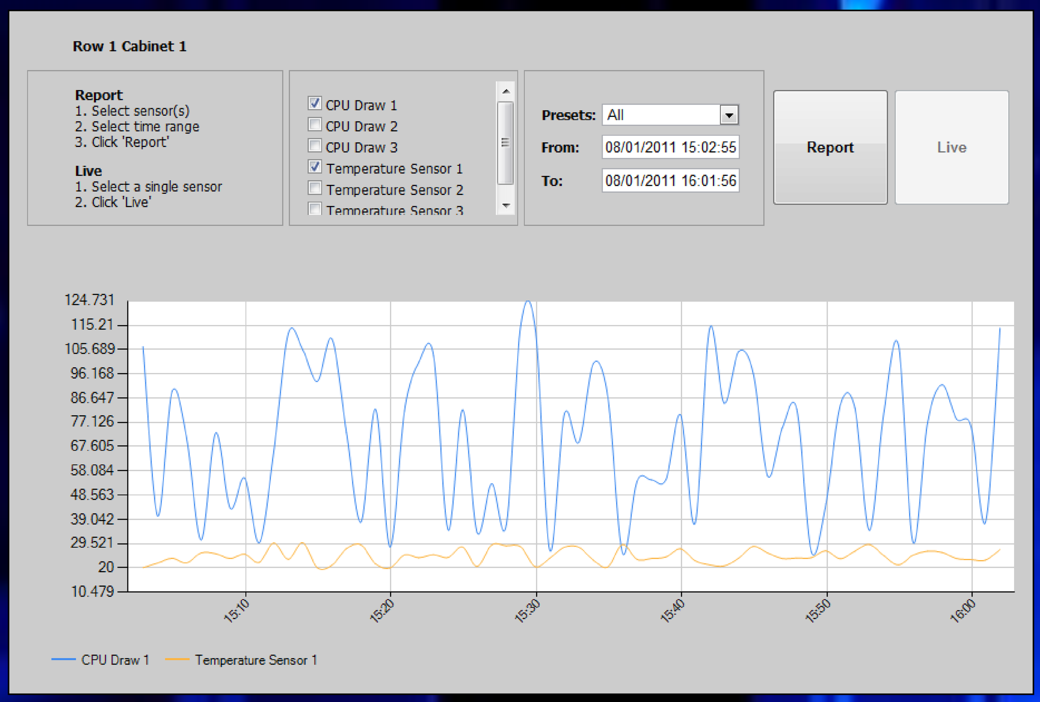

Figure 3: Reporting Chart

A 'live' function is also provided where the user may select a single sensor to view the most recent readings available. A 60 second delay allows time for transmission across both the wireless and local area networks and some processing of the server-side dataset before rendering to a gauge control on the website.

Further Research

The basis upon which good decisions are made is good information. Once reliable data is being received and analysed, we propose to incorporate an artificial intelligence agent into the analysis engine which should, at least in part, eliminate the need for time-consuming mining of large datasets by data centre staff.

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