WEB-BASED BUILDING ENERGY USAGE VISUALISATION

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Introduction

With the ever increasing focus on energy efficient buildings, simpler and more user friendly ways to visualise and control Building Management Systems (BMS) are essential. Current systems often require special training in order to use them.

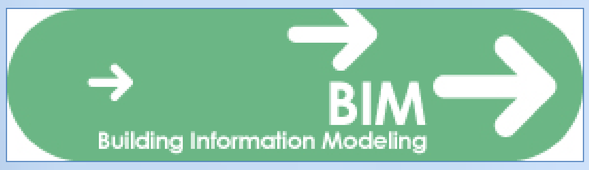
The objective of this research is to integrate existing technologies in order to develop a system which is easily understandable and controllable, making energy efficiency a simpler task. To do this a method to utilise Building Information Models (BIM) in order to create 3D interactive web-based visualisations of buildings will be developed.

(http://www.prlog.org/10434091-3d-building-models.jpg)

These models will be displayed in web-browsers without using plug-ins, with the WebGL context of the HTML5 canvas element. Data from a BMS can then be displayed on the model, to show energy usage for each building zone. This visualisation combined with energy simulation tools will assist in optimising energy usage.

Building Information Modelling

A Building Information Model (BIM) is typically a 3-D model of a building as opposed to 2-D CAD (Computer-Aided Design) drawings. These models aren't just graphical representations of buildings but also incorporate information about the properties and attributes of individual parts of a building. This leads to increased productivity and cooperation in a building's design process and production. These BIMs can then be updated and modified throughout the buildings life cycle. BIMs are a relatively new technology, though usage is growing. Much like the changeover from hand drafting to CAD, it will take time for people to change from CAD to BIM.



(http://bim.arch.gatech.edu/contents/img/402_1.gif)

Building Management Systems

These computer based systems control and monitor buildings mechanical and electrical equipment, such as heating, ventilation and air-condition (HVAC), power, lighting and security etc. They have the potential to significantly increase a building's energy efficiency if correctly used. However, such optimisation is often difficult due to the fact that using these systems often require specialised training, and ways to predict what the downstream effect of changing a setting, for example changing the temperature in a room by a degree, will have on energy usage.

3D Web Visualisation

Until recently displaying 3-D graphics in a web-browser was only possible via browser plug-ins. However , with the incorporation of HTML5 support in browsers, 3D graphics in web-browsers without plugins is becoming a possibility. This is thanks to WebGL.

WebGL is based on OpenGL. It uses the HTML5 canvas element.

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Prototype

A prototype is being developed using the new Nurses Library Building in NUIG.

This already has a BMS up and running and a BIM is currently being developed. The BIM will be split into the separate zones that will need to be interacted with and saved as separate BIM ifc (Industry Foundation Class) files. Each of these then will be converted to COLLADA (**COLLA**borative **D**esign **A**ctivity)dae files.

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The separate parts will then be reassembled to seem as one 3D model on a webpage using WebGL; however as each zone is a different COLLADA file they can be manipulated independently.

BMS data will be fed directly into the website database and displayed on the 3D model in the appropriate places. This can then be used to monitor energy usage.

Energy simulation and subsequent implementation of the simulated change can then be integrated into the system.

Potential of the System

Studies have proven that visualisation of complex data makes it much more understandable. This better understanding of the BMS data will lead to better decisions in managing a building's energy and therefore will increase energy efficiency. Due to the system being web-based it can be accessed remotely from any computer with a modern web-browser. There is no need for any software installation.

Using this system a building manager could potentially lower a building's energy usage significantly. Over time, the benefits should be visible through tracking the key metric of kWh/m^2/year.

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