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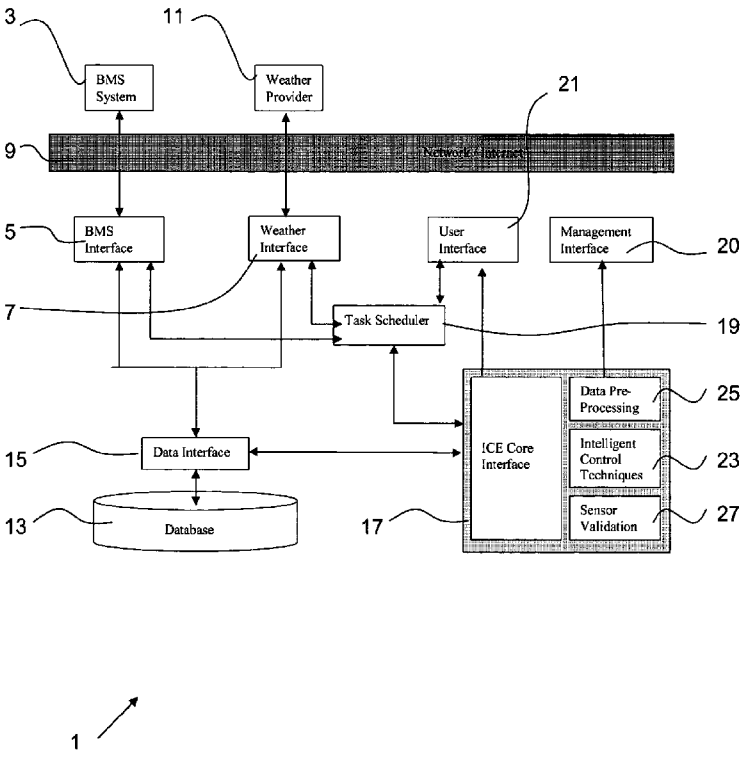
(54) Title: A METHOD OF OPTIMISING ENERGY CONSUMPTION



(57) Abstract: This invention relates to a method and controller (1) for optimising energy consumption in a building. More specifically, the present invention describes a method and controller (1) for use in a building having a building management system (BMS) (3). Typically, the BMS (3) has sensors distributed throughout the building to determine the environmental conditions in the building and the BMS controls a heating/cooling system of the building.

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The method comprises the steps of gathering weather data relevant to the building, applying a number of intelligent control techniques to the environmental conditions and weather data before determining the accuracy of the intelligent control techniques and thereafter determining an appropriate control input for the BMS (3) for subsequent implementation by the BMS. In this way, the energy consumption in a building may be minimised by analysing the data in the BMS (3) and suggesting and implementing appro-

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"A Method of optimising energy consumption"

Introduction

This invention relates to a method of optimising energy consumption in a building having a building management system (BMS), the BMS being used to monitor the environmental conditions of the building and control the heating and/or cooling system of the building. This invention further relates to a controller for carrying out such a method.

Throughout this specification, reference is made to a heating system. However, it will be understood that the heating system may be used to increase the temperature in a building and also may be used to decrease the temperature in a building, operating effectively as a cooling system. However, for simplicity, reference is made predominantly to a heating system and it will be understood that this invention applies equally to a cooling system and where reference is made to a heating system this is deemed to include a cooling system also. Furthermore, throughout the specification the invention is described with respect to a building, however, it will be understood that the invention equally applies to other structures such as ocean liners, cruising vessels, aircraft and other controlled environments and any reference to a building is intended to incorporate these other structures.

Building management systems have been in use for some time now and are typically found in a wide variety of buildings ranging in size from skyscrapers down to much smaller individual office blocks and personal dwellings. These building management systems are used to control various aspects of the building ranging from security access to certain areas of the building at certain times, the lighting of the building and more recently the heating and cooling system of the building. By having such a building management system, an operator will not have to manually turn the lighting and the heating on and off every day and set the temperature of the heating and cooling system each and every day. In the case of heating systems in office blocks in particular, the heating system will normally have to be turned on some time in advance of the normal working hours in order to ensure that the building is at a suitable temperature when the employees begin work. By using a building

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management system, an operator will not have to be on site many hours in advance of the other workers in order to determine when to start the heating system.

There are however, problems with the known building management systems. First of all, these building management systems are not intelligent systems and require direct input from an operator in order to operate. Although effective in starting and stopping the heating system at any given time in response to an operator's input, these systems by and large do not take account of other factors such as ambient temperature either inside the building or outside the building, the weather conditions of the day and the most economical way of achieving a particular desired temperature in the building. However, these can be very important factors and in many countries where the climate may be changeable from day to day with large changes in temperature from one day to the next, the known systems become relatively inefficient. For example, during winter months, in order to heat an office building up to a desired temperature, the building management system may be programmed to start the heating at 7.00am in the morning. However, this does not in any way take account of the fact that there may have been heavy snow fall the night before which will slow down the heating process and therefore the building will not be at the desired temperature by the time the employees begin their working day. Similarly, if there was a particularly mild winter's day and the ambient temperature outside the building is higher than normal, the heating may not have had to have been engaged until a later time after 7.00am thereby wasting valuable energy and resources. This problem is exacerbated by global warming whereby weather is becoming highly unpredictable and weather conditions that would be considered to be abnormal for a particular time of year are becoming more common.

Another problem with the known building management systems is that they do not allow the operator of the building management system to evaluate the actual cost of heating versus the comfort level of the employees. Furthermore, the known systems do not appear to appreciate that different heating requirements may apply in different floors in a building. For instance, in a tall skyscraper in a very warm climate, the air conditioning may have to be started earlier on the higher floors of the building than the lower floors of the building as the sun will affect the higher floors first as it rises over the horizon. Similarly, certain parts of the building may be exposed to direct

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sunlight at different times of the day requiring a different cooling strategy for those parts of the building. Currently, it is not possible to take that into account.

It is an object therefore of the present invention to provide a method of optimising energy consumption in a building that overcomes at least some of these difficulties that is both simple to implement and cost effective to provide.

Statements of Invention

According to the invention there is provided a method of optimising energy consumption in a building having a building management system (BMS), the BMS being used to monitor the environmental conditions of the building and control the heating system of the building, the method comprising the steps of:

gathering the building environmental conditions data from the BMS;

gathering weather data relevant to the building;

applying a plurality of intelligent control techniques to the building environmental conditions data and the weather data to determine a proposed BMS control input for each intelligent control technique;

determining the accuracy of the proposed BMS control input for each of the intelligent control techniques and thereafter determining an appropriate control input for the BMS; and

providing the appropriate control input to the BMS for subsequent implementation by the BMS.

By having such a method, it is possible to use information relating to the environmental conditions of the building such as the internal temperature along with weather data such as the outside temperature to determine the thermodynamic characteristics of the building (how the building behaves under varying external weather conditions) and in turn build up a thermodynamic profile of the building. It is

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