SYSTEMS AND METHODS FOR OPTIMIZATION OF A BUILDING MANAGEMENT SYSTEM

FIELD OF THE DISCLOSURE

This disclosure relates to systems and method for optimizing a building management system.

BACKGROUND

Building management systems (BMS) (also known as Building Automation Systems – BAS) for buildings are onsite controller systems that operate and control components, systems and/or equipment of the building such as heating, cooling and ventilation systems (e.g. HVAC components and systems) and other building components and/or functionality.

BMS systems are often configured in a customised and/or bespoke way according to the specific building they are controlling. Typically, default software or control code of the BMS is updated or changed overtime by building engineers to customise or re-configure or optimize aspects of the BMS depending on the usage and/or needs of the residents or tenants of the building. Bespoke BMS software upgrades can be time-consuming and costly to deploy on a regular basis.

SUMMARY

It is an object of at least some embodiments of the present disclosure to provide an improved method and system of optimizing a building management system, and/or to at least provide the industry with a useful choice.

In a first aspect, this disclosure broadly comprises a building management system (BMS) optimization system for optimizing a pre-existing BMS of a building to reduce energy consumption by equipment instances in the building, the pre-existing BMS executive

native control logic to control the behaviour of the equipment instances in the building via BMS-generated set point commands, the system comprising: a cloud platform that is configured to generate, receive and/or retrieve a digital building model of the building that at least identifies the equipment instances in the building and analyse existing building behaviour of the equipment instances in the building and recommend one or

more optimized control strategies from a strategy library to improve one or more aspects of the operation of specific equipment instances in the building; an onsite controller that is in data communication with the pre-existing BMS of a building, and which is configured to implement the recommended optimized control strategies from the cloud platform by overriding set points of the native control logic of the pre-existing BMS in real-time by generating higher-priority set point commands than the BMS-generated set point commands to thereby optimize the operation of the specific equipment instances in the building; and a data network or data communication link between cloud platform and onsite controller.

In a configuration, the cloud platform comprises a model builder that is configured or operable to generate, receive and/or retrieve a digital building model of the building, the digital building model generated based on extracting meta data and set points from the BMS relating to equipment instances of the building.

In a configuration, the cloud platform comprises a fault detection and diagnostic (FDD) engine that is configured to process the digital building model, incoming BMS time-series data streams representing operation of the equipment instances of the building, and control strategies from a strategy library to generate recommendation data identifying recommended optimized control strategies for each equipment instance and/or category of equipment instance.

In a configuration, the FDD engine comprises a comparator that is configured or operable to compare nominal control strategy curves or functions to the incoming BMS time-series data streams to generate one or more deviation parameters representing or indicative of the current operation of the equipment instances in the building relative to the nominal control strategy curves or functions, and which generates diagnosis time-series data streams comprising at least the deviation parameters generated by the comparison.

In a configuration, the comparator of the FDD engine receives or retrieves incoming BMS time-series data provided by the BMS that represents, for each equipment instance being analysed, the actual controlled output value for the equipment instance, the process variable set point value associated with the equipment instance, and the actual process variable value associated with the equipment instance.

In a third aspect, this disclosure broadly comprises a system for optimizing building behavior of a building to reduce energy consumption by equipment instances in the building comprising: an optimization engine; an analysis system that is configured to generate, receive and/or retrieve a digital building model of the building that at least identifies the equipment instances in the building; analyse existing building behaviour of the equipment instances in the building and generate or select one or more optimized control strategies from a strategy library for execution by an optimization engine to improve one or more aspects of specific equipment instances in the building; and a pre-existing building management system (BMS) executing native control logic to control the behaviour of the equipment instances in the building via BMS-generated set point commands; and wherein the optimization engine that receives and executes the optimized control strategies to override set points of the native control logic of the pre-existing BMS by generating higher-priority set point commands than the BMS-generated set point commands to improve the one or more aspects of the operation of the specific equipment instances in the building.

In a configuration, the commands comprise set points for controlling equipment instances of the building.

In a configuration, the commands are generated and executed in accordance with a BMS communication protocol to control equipment instances of the building.

In a configuration, the BMS communication protocol is BACnet and the equipment instances are BACnet devices.

In a configuration, the commands are executed in accordance with a command prioritization mechanism or system of the BMS communication protocol.

In a configuration, the command prioritization mechanism or system is a command priority array in BACnet.

In a configuration, each generated command comprises a configurable command priority level that determines its priority of execution relative to other competing commands.

In a configuration, the analysis system is a remote or cloud-based system or platform.

BMS-generated commands to thereby improve one or more aspects of building behaviour.

The third and fourth aspects of the disclosure may have any one or more of the aspects or features mentioned in respect of the first or second aspects of the disclosure above.

In a fifth aspect, this disclosure broadly comprises an optimization engine for optimizing a pre-existing building management system (BMS) of a building, the pre-existing BMS executing native control logic to control building behaviour via BMS-generated set point commands, the optimization engine comprising: an interface for data communication with a pre-existing BMS of a building and/or equipment instances of the building; memory for storing one or more optimized control strategies selected from a strategy library that are configured to improve one or more aspects of the operation of specific equipment instances in the building; and a processor or application configured to execute the one or more optimized control strategies to override set points of the native control logic of the pre-existing BMS by generating higher-priority set points commands than the BMS-generated set point commands to thereby improve the one or more aspects of the operation of specific equipment instances in the building.

In a configuration, the optimization engine comprises or is in the form of an edge computer that is in data communication with the pre-existing BMS.

In a configuration, the optimization engine is a virtual machine or software application.

The fifth aspect of the disclosure may have any one or more aspects or features mentioned in respect of any of the first-fourth aspects of the disclosure above.

In a sixth aspect, this disclosure broadly comprises a fault detection and diagnosis (FDD) system for a building management system (BMS) optimization system of a building comprising: a comparator that is configured or operable to compare nominal control strategy curves or functions to incoming BMS time-series data streams for one or more

equipment instances of the building to generate one or more deviation parameters representing or indicative of the current operation of the equipment instances in the building relative to the nominal control strategy curves or functions, and which generates diagnosis time-series data streams comprising at least the deviation parameters generated

5