[0007] Water operations for the water control devices may operate on a fixed time operation using a water valve. However, the volume of water that is passed by the valve during the water operation may vary depending on a number of factors.

[0008] For example, the volume of water used during a flush can vary due to water pressure variations in the water supply.

[0009] Further, faults, such as blockages or leakages, in the water supply can result in a reduction in pressure and/or flow rate and so a reduction occurs in the volume of water used during a water operation.

[0010] Further, this problem may be exacerbated when water control devices are arranged to operate in different modes of operation.

[0011] Further, different types and designs within types of water control devices may require different volumes of water, flow rates and different water pressures in order to operate effectively (i.e. safely and/or efficiently and/or within set Standards).

Summary

[0012] It is an object of the present invention to substantially overcome, or at least ameliorate, one or more disadvantages of existing arrangements.

[0013] Disclosed are arrangements which seek to address the problems associated with the provision of water to water control devices to enable effective operation of those water control devices.

[0014] According to a first aspect of the present disclosure, there is provided a building facility water management method for controlling at least one operational parameter associated with a volume of water used by a water control device of a plurality of water control devices during a device operation of the water control device in a building facility, wherein the plurality of water control devices are arranged in a mesh network and organised in a hierarchical structure, the method comprising the steps of: obtaining a water operation value associated with a volume of water for the water control device during the device operation; determining whether the water operation value is outside of a defined threshold associated with the device operation; upon a determination that the water operation value is outside of the defined threshold, adjusting an operational parameter associated with the water

control device during the device operation to enable the water control device to be effectively operated, wherein the water operation value is based on one or more previous device operations; and adjusting the operational parameter associated with the volume of water to be used by the water control device in one or more subsequent device operations in dependence on the hierarchical structure to enable the water control device to be effectively operated.

[0014a] According to a second aspect of the present disclosure, there is provided a controller for controlling at least one operational parameter associated with a volume of water used by a water control device during a device operation of the water control device in a building facility, wherein the controller is a water control device controller of a plurality of water control devices, the plurality of water control devices being arranged in a mesh network and organised in a hierarchical structure, and wherein the controller is arranged to execute the method as described.

[0015] According to a third aspect of the present disclosure, there is provided a building facility water management system for controlling at least one operational parameter associated with a volume of water used by a water control device during a device operation of the water control device in a building facility, the system comprising at least one water control device and a plurality of controllers, wherein at least one of the plurality of controllers is the controller as described.

[0016] Other aspects are also disclosed.

Brief Description of the Drawings

[0017] At least one embodiment of the present invention will now be described with reference to the drawings and appendices, in which:

[0018] Figs. 1A and 1B form a schematic block diagram of a general-purpose computer system upon which arrangements described can be practiced;

[0019] Figs. 2A and 2B collectively form a schematic block diagram representation of an embedded electronic device upon which described arrangements can be practised;

[0020] Figs. 3A to 3F show example network configurations upon which describe arrangements can be practised;

[0021] Fig. 4 shows an example water control device schematic diagram in accordance with a described embodiment;

[0022] Fig. 5 shows a controller of a water control device in accordance with a described embodiment;

CLAIMS:

1. A building facility water management method for controlling at least one operational parameter associated with a volume of water used by a water control device of a plurality of water control devices during a device operation of the water control device in a building facility, wherein the plurality of water control devices are arranged in a mesh network and organised in a hierarchical structure, the method comprising the steps of:

obtaining a water operation value associated with a volume of water for the water control device during the device operation;

determining whether the water operation value is outside of a defined threshold associated with the device operation;

upon a determination that the water operation value is outside of the defined threshold, adjusting an operational parameter associated with the water control device during the device operation to enable the water control device to be effectively operated,

wherein the water operation value is based on one or more previous device operations; and

adjusting the operational parameter associated with the volume of water to be used by the water control device in one or more subsequent device operations in dependence on the hierarchical structure to enable the water control device to be effectively operated.

2. The method of claim 1, wherein the water operation value is a measured real-time water operation value or the water operation value is a stored water operation value.

3. The method of claim 1, wherein the water operation value is one or more of: an inlet water pressure at the water control device; a water supply pressure value associated with a water supply for the water control device; a water level of the volume of water associated with the device operation; an inlet flow rate associated with the device operation; an outlet flow rate associated with the device operation; and a water volume associated with the device operation;

4. The method of claim 1, wherein the at least one operational parameter comprises at least one water regulating value of an inlet water valve associated with the device operation.

5. The method of claim 4, wherein the water regulating value is a time value associated with the device operation comprising one or more of: an inlet water valve on-time; an inlet water valve off-time; and a sequence of an inlet water valve on-time and off-time.

6. The method of claim 4, wherein the water regulating value is a flow rate value of the inlet water valve associated with the device operation.

7. The method of claim 1, wherein the adjusting of the operational parameter adjusts the volume of water available to the water control device to complete the device operation and/or subsequent device operations.

8. The method of claim 1, wherein the adjusting of the operational parameter comprises the step of controlling at least one inlet water valve associated with the water control device, wherein the controlling of the inlet water valve is based on the obtained water operation value.

9. The method of claim 8, wherein the operational parameter comprises one or more of a time period that the inlet water valve is open, a time period that the inlet water valve is closed, a sequence of time periods in which the inlet water valve is open and closed, a flow rate of the inlet water valve, or any combination thereof.

10. The method of claim 8, wherein the adjusting of the operational parameter comprises the step of controlling the at least one inlet water valve to perform a maintenance device operation.

11. The method of claim 10, wherein the maintenance device operation is determined using artificial intelligence and/or machine learning based on a plurality of water operation values obtained from a plurality of water control devices.

12. The method of claim 8, wherein a water outlet of the inlet water valve is in direct fluid connection with the water control device.

13. The method of claim 12, wherein a water inlet of the inlet water valve is connected to a header.

14. The method of claim 8, wherein the water outlet of the inlet water valve is in indirect fluid connection with the water control device.

15. The method of claim 14, wherein the water outlet of the inlet water valve is connected to an inlet of a cistern, where the cistern provides the volume of water for the water control device during the device operation.

16. The method of claim 1, wherein the step of obtaining the water operation value comprises obtaining a water pressure value of water associated with the device operation, or obtaining a water flow rate value of water associated with the device operation, or obtaining a water level value of water associated with the device operation.

17. The method of claim 1, wherein the method further comprises the steps of:

obtaining a previous water pressure value;

comparing the obtained water pressure value with the obtained previous water pressure value; and

determining whether the water pressure value is outside of the defined threshold based on a calculated pressure difference value based on a difference in water pressure between the water pressure value and the previous water pressure value.

18. The method of claim 16, wherein the water flow rate value is based on one or more water flow rate values and obtained during one or more previous device operations.

19. The method of claim 1, wherein enabling the water control device to be effectively operated comprises the step of operating in accordance with one or more manufacture specifications associated with the water control device so that the volume of water during the one or more subsequent device operations is in accordance with the one or more manufacture specifications, or

wherein enabling the water control device to be effectively operated comprises the step of operating in accordance with one or more technical standards associated with the water control device so that the volume of water during the one or more subsequent device operations is in accordance with the one or more technical standards, or

wherein enabling the water control device to be effectively operated comprises the step of operating in accordance with one or more legal standards associated with the water control device so that the volume of water during the one or more subsequent device operations is in accordance with the one or more legal standards.

20. The method of claim 1, wherein the adjusting of the operational parameter comprises selecting, obtaining, adjusting or applying a profile associated with the device operation based on the obtained water operation value.

21. The method of claim 20, wherein the profile defines at least one relationship between the operational parameter and the water operation value.

22. The method of claim 21, further comprising the step of adjusting the profile using artificial intelligence and/or machine learning based on the at least one relationship over time.

23. The method of claim 20, wherein the profile is associated with one or more of: a water control device mode of operation; a water control device code; a water control device type; a water control device group; a unique water control device ID; and a location of a water control device.

24. The method of claim 1, wherein the device operation comprises a plurality of modes of operation, and the adjusting of the operational parameter for the device operation is dependent on a selected mode of operation selected from the modes of operation.

26. The method of claim 1, wherein each of the plurality of water control devices may be configured to connect and disconnect to the mesh network as it is plugged in and unplugged from the mesh network.

27. The method of claim 1, wherein a first controller in a first water control device of the plurality of water control devices may be enabled to control the first water control device.

28. The method of claim 1, wherein the first controller in the first water control device may be enabled to control one or more of the others of the plurality of water control devices.

29. A controller for controlling at least one operational parameter associated with a volume of water used by a water control device during a device operation of the water control device in a building facility, wherein the controller is a water control device controller of a plurality of water control devices, the plurality of water control devices being arranged in a mesh network and

organised in a hierarchical structure, and wherein the controller is arranged to execute the method according to any of the preceding claims.

30. A building facility water management system, for controlling at least one operational parameter associated with a volume of water used by a water control device during a device operation of the water control device in a building facility, the system comprising at least one water control device and a plurality of controllers, wherein at least one of the plurality of controllers is the controller of claim 29.