Document WO 2009/061857 A2 proposes a method for automatically generating work orders for a toilet, whereby not only states of a large number of device sensors, but also states of a non-device sensor are captured and these states are used to determine the state of a device, which has no sensor. In particular, the need for replenishing consumables is calculated.

In the document US 2011/0114202 A1, a valve in a water supply line is closed by means of a control when an unusual water flow rate is detected by a sensor located in the water supply line, and is opened again after a waiting period.

The immediate detection of a malfunction of a urinal and/or the correct assignment of a malfunction of a urinal to a specific cause is often problematic. For example, when the urinal is flushed, the water flowing from the fluid inlet via the urinal ceramic to the urinal outlet passes the urinal outlet after a certain delay. In some urinal systems, such a delay can be caused, for example, by a hydraulic delay in the inlet valve, the path to be covered by hoses/pipes between the inlet valve and the fluid inlet, or by reservoir devices. However, a malfunctioning inlet valve or an at least partially obstructed urinal outlet can also lead to delays. With known urinal systems, the specific cause of the problem can usually only be determined by a sanitary technician or service employee, despite the sensors used.

Summary

Embodiments of the present disclosure seek to increase the functionality of the urinal system mentioned at the outset, the water consumer system mentioned at the outset, and the methods mentioned above.

An aspect of the present disclosure provides a urinal system having a urinal bowl, a fluid inlet with an inlet valve, a urinal outlet, at least one HF motion sensor for detecting fluid motion provided on the urinal bowl and/or at the urinal outlet, and a urinal controller coupled with the at least one HF motion sensor and the inlet valve, wherein the urinal controller has a data processing system and/or is connected to a data processing system which is designed to retrieve and/or receive data captured by at least one HF motion sensor, to evaluate the data arithmetically and, based on the evaluated data, to detect at least one of the following malfunctions, and/or initiate at least one action in order to avoid at least one of the following malfunctions:

- that the urinal outlet is obstructed, and/or
- that there is a pressure fluctuation in a wastewater system connected to the urinal system, and/or
- that the fluid inlet and/or the inlet valve is/are malfunctioning, and/or
- that there is a malfunction of at least one of the at least one HF motion sensor,

and/or to recognize a predefined urinal usage situation and/or frequency of use based on the evaluated data, and to adjust an opening time and/or an opening position and/or an opening frequency of the inlet valve based on the evaluated data during at least one subsequent urinal flushing process.

The urinal system according to the present disclosure can have a urinal bowl or a plurality of urinal bowls.

The at least one HF motion sensor is preferably arranged on the urinal bowl and/or the urinal outlet in such a way that it can detect flowing fluids in the region of a drain of the urinal bowl. The at least one HF motion sensor is preferably arranged on the rear side of the urinal bowl in the immediate spatial vicinity of the urinal outlet. In particular, the at least one HF motion sensor itself or at least one holding device comprising the at least one HF motion sensor is glued, bolted, or otherwise fastened to the rear of the urinal bowl.

The at least one HF motion sensor preferably does not point in the direction of a sealing water in an odor trap of the urinal outlet. The arrangement and alignment of the motion sensor advantageously ensures that it is able to detect the flush water flowing from the fluid inlet to the urinal outlet during a urinal flushing process and/or the urine hitting and/or flowing out of the urinal bowl when the urinal system is used.

The data acquired by the at least one HF motion sensor are retrieved and/or received by the data processing system contained in the urinal controller or connected to it. The data is preferably transmitted via a wireless or mesh data transmission network, such as via Bluetooth, for example, and particularly preferably via Bluetooth mesh. This advantageously enables communication with a mobile device, which has the advantage of a simplified operating function and simple setting and diagnosis options. It is also advantageous that communication with a building control via a cloud or a building management system is made possible, which in particular simplifies the retrieving of operating data or

The urinal system preferably also has at least one pressure sensor and/or at least one flow sensor in the fluid inlet, and/or is coupled to at least one pressure sensor and/or at least one flow sensor in the fluid inlet via a mesh and/or wireless local data transmission network.

Advantageously, by combining the signals of at least one of the at least one HF motion sensors with the signals of the at least one pressure sensor and/or of the at least one flow sensor, a distinction can be made between different situations that lead to the same or similar reactions of at least one of the at least one HF motion sensors. The absence of a reaction of at least one of the at least one HF motion sensors to a previously triggered flushing can be attributed, for example, to the fact that a complete obstruction is present, and due to this, at least one of the at least one HF motion sensors is blind, to the fact that the inlet valve is not opening due to a valve malfunction or an electronics defect, or to the fact that there is a malfunction in the water supply.

The at least one pressure sensor in the fluid inlet is expediently able to detect whether there is a water supply, while the at least one flow sensor in the fluid inlet is able to detect whether water is flowing out of the fluid inlet or not. The corresponding situations can be recognized and distinguished from each other based on typical signal profiles of at least one of the at least one HF motion sensors in conjunction with data from the at least one pressure sensor and/or the at least one flow sensor in the fluid inlet, by means of a classifier or another suitable AI algorithm—that is, an algorithm using artificial intelligence.

Another aspect of the present disclosure provides a urinal system having a urinal bowl, a fluid inlet with an inlet valve, a urinal outlet, at least one HF motion sensor for detecting fluid motion provided on the urinal bowl and/or at the urinal outlet, and a urinal controller coupled with the at least one HF motion sensor and the inlet valve, wherein the urinal system also has at least one pressure sensor and/or at least one flow sensor in the fluid inlet, and/or is coupled to at least one pressure sensor and/or at least one flow sensor in the fluid inlet via a mesh data transmission network, and the urinal controller has a data processing system, and/or is connected to a data processing system, which is arranged to retrieve and/or receive data captured by the at least one HF motion sensor and/or the at least one pressure sensor and/or the at least one flow sensor, to evaluate the data arithmetically and, based on the evaluated data, to identify at least one of the following malfunctions

and/or trigger at least one action in order to prevent at least one of the following malfunctions:

- that the urinal outlet is obstructed, and/or
- that there is a pressure fluctuation in a wastewater system connected to the urinal system, and/or
- that the pressure in the fluid inlet has dropped below a minimum pressure value, or has exceeded a maximum pressure value, and/or
- that the inlet valve is malfunctioning, and/or
- that there is a malfunction of the at least one HF motion sensor,

and/or to identify a predefined urinal usage situation and/or frequency of use based on the evaluated data and adjust an opening time and/or an opening position and/or an opening frequency of the inlet valve based thereon during at least one subsequent urinal flushing process.

The urinal system according to the present disclosure can have a urinal bowl or a plurality of urinal bowls.

The at least one HF motion sensor is preferably arranged on a rear side of the urinal bowl in the immediate spatial vicinity of the urinal outlet. The at least one HF movement sensor preferably does not point in the direction of a sealing water in the odor trap of the urinal drain.

Fluids flowing in and out in the region of the urinal outlet can be detected with the at least one HF motion sensor. The at least one HF motion sensor itself can be glued, screwed or otherwise fastened to the rear of the urinal bowl, or by means of at least one holding device having or holding the at least one HF motion sensor.

The arrangement and alignment of the motion sensor advantageously ensures that it is able to detect the motion of the flush water flowing from the fluid inlet to the urinal outlet during a urinal flushing process, and/or of the urine hitting and/or flowing out of the urinal bowl when the urinal system is used.

The urinal system according to the present disclosure also has at least one pressure sensor and/or at least one flow sensor in the fluid inlet and/or is coupled to at least one pressure

error or malfunction detected by the data processing system, the error message and/or service message output unit is instructed to issue an error message and/or a service message, which advantageously significantly shortens the period of time until the error or malfunction is recognized by a user and/or a service employee.

In an advantageous embodiment, the data processing system has at least one data processing block with machine learning, or comprising an artificial neural network, and/or containing an expert system.

By using the at least one data processing block with machine learning, or comprising an artificial neural network, and/or containing an expert system, the data processing system of the urinal system according to the present disclosure is advantageously able to make intelligent decisions based on its own operating data and additional data from other sensors or from a building control. In this way, for example, water consumption and/or convenience can be optimized for the user or users, and the amount of actions which must be carried out by people, for example to maintain the urinal system, can be reduced.

The implementation of AI algorithms, that is to say algorithms using artificial intelligence, is preferably carried out directly in at least one of the at least one HF motion sensors as so-called “embedded AI.” At least one microcontroller connected to the HF motion sensor preferably has the resources required for this, such as a suitably large memory, a corresponding computing power, and/or availability of further suitable tools.

There is also disclosed a water consumer system having a urinal system as described, wherein the water consumer system has, in addition to the urinal system, at least one further water consumer on which at least one further sensor is provided, wherein the data processing system is coupled with the at least one further sensor and is arranged to arithmetically evaluate the data captured by the at least one further sensor and received by the data processing system, and to include this data in the detection and/or prevention of at least one of the malfunctions.

The water consumer system according to the present disclosure can have a urinal system or a plurality of urinal systems, wherein the urinal system or the urinal systems can each have one urinal bowl or a plurality of urinal bowls.

transmission network, such as Bluetooth or Bluetooth mesh. Advantageously, this form of connection enables the water consumer system to communicate with a mobile device, which has the advantage of a simplified operating function and simple adjustment and diagnosis options. It is also advantageous if the water consumer system can communicate with a building control via a cloud or a building management system, which in particular simplifies the retrieving of operating data or the display of service requirements. Another advantage of data transmission using a wireless or mesh data transmission network, such as Bluetooth or Bluetooth mesh, is the ability to communicate with other sensor products either directly in the network or indirectly via at least one gateway.

Another aspect of the present disclosure provides a method for operating a urinal system having a urinal bowl, a fluid inlet with an inlet valve, a urinal outlet, at least one HF motion sensor for detecting fluid motion provided on the urinal bowl and/or at the urinal outlet, and a urinal controller which is coupled with the at least one HF motion sensor and the inlet valve and by means of which the inlet valve is opened for a predetermined time when draining fluid is detected by the at least one HF motion sensor, wherein the urinal controller has a data processing system and/or is connected to a data processing system that at least retrieves and/or receives data captured by the at least one HF motion sensor, evaluates the data arithmetically and, based on the evaluated data, recognizes when there is at least one of the following malfunctions, and/or triggers at least one action to prevent one of the following malfunctions:

- that the urinal outlet is blocked, and/or
- that there is a pressure fluctuation in a wastewater system connected to the urinal system, and/or
- that the fluid inlet and/or the inlet valve is faulty, and/or
- that there is a malfunction of the at least one HF motion sensor,

and/or to identify a predefined urinal usage situation and/or frequency of use based on the evaluated data and adjust an opening time and/or opening position and/or an opening frequency of the inlet valve based thereon during at least one subsequent urinal flushing process.

The urinal system operated with the method according to the present disclosure can have a urinal bowl or a plurality of urinal bowls.

The detection of a predefined urinal usage situation and/or urinal frequency and reaction to this can also take place as described above.

Another aspect of the present disclosure provides a method for operating a urinal system having a urinal bowl, a fluid inlet with an inlet valve, a urinal outlet, at least one HF motion sensor for detecting fluid motion provided on the urinal bowl and/or the urinal outlet, and a urinal controller which is coupled with the at least one HF motion sensor and the inlet valve and by means of which the inlet valve is opened for a predetermined time if draining fluid is detected by the at least one HF motion sensor, wherein, in the fluid inlet a fluid pressure is captured with at least one pressure sensor and/or a fluid flow is captured with at least one flow sensor, and the urinal controller has a data processing system and/or is connected with a data processing system that at least retrieves and/or receives data captured by the at least one HF motion sensor and/or the at least one pressure sensor and/or the at least one flow sensor, evaluates the data arithmetically, and recognizes on the basis of the evaluated data when there is at least one of the following malfunctions, and/or triggers at least one action in order to prevent at least one of the following malfunctions:

- that the urinal outlet is blocked, and/or
- that there is a pressure fluctuation in a wastewater system connected to the urinal and/or
- that the pressure in the fluid inlet has dropped below a minimum pressure value, or has exceeded a maximum pressure value, and/or
- that the fluid inlet and/or the inlet valve is faulty, and/or
- that there is a malfunction of at least one of the at least one HF motion sensor.

Advantageously, by the computational evaluation of the data from the at least one pressure sensor and/or the at least one flow sensor with respect to the data from at least one of the at least one HF motion sensors, different malfunctions can be distinguished that lead to identical or similar reactions from at least one of the at least one HF motion sensors. In this regard, reference is made to the entirety of the foregoing explanations.

The data processing system preferably detects that the urinal outlet is obstructed and/or the fluid inlet is malfunctioning if, despite the open inlet valve, the at least one HF motion sensor detects no running fluid and/or the at least one HF motion sensor detects that at least a lower region within the urinal bowl is filled with standing fluid.