

ADJUSTABLE FLUSHING SYSTEM FOR RESOURCE CONSERVATION

Technical Field

Embodiments described herein generally relate to automatic flushing system
5 that can be used in conjunction with flush urinals and no-flush (water-free) urinals.

Background

Flush urinals are commonly designed to activate a flush action after every
usage to maintain restroom hygiene. Consequences of this flush usage pattern
10 include immense consumption of water resources and construction of infrastructure
to treat and transport potable and sewage water.

No-flush urinals do not require water flushing after every usage as they
employ barrier fluids, one-way valve, microbiological action, or other processes to
prevent odor from emitting into the restroom. This no-flush usage pattern offers
15 many advantages, including greatly reducing water consumption, decreased fixtures
maintenance and improved sanitation. However, due to a common perception that
no-flush urinals are unhygienic and emit odour and also possibly for other reasons,
no-flush urinals have encountered rejection from certain building owners and
regulatory bodies.

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Summary

Embodiments of the invention provide a flushing system which has an
adjustable flush mode to suit various preferences of building owners. The system
allows building owners to pre-set, and also adjust, a desired flush interval which
25 determines a usage count to be reached before a flush action is automatically
activated.

According to one embodiment, an adjustable flushing system comprises a
proximity sensor for detecting a usage of a urinal; a first switch for setting a flush
interval; and a microprocessor electrically coupled to the proximity sensor and the
30 first switch, the microprocessor adapted to compute a usage count from the detected

usage, compare the usage count with the pre-set flush interval and activate a flush action when the usage count reaches the pre-set flush interval.

In one embodiment, the adjustable flushing system may comprise a manual switch for activating a flush action and being coupled to the microprocessor, wherein
5 upon activating the manual switch, the usage counter is reset.

In one embodiment, the adjustable flushing system may comprise a second switch for adjusting a sensing distance range of the proximity sensor, the second switch coupled to the proximity sensor and the microprocessor.

In one embodiment, the adjustable flushing system may comprise a third
10 switch for adjusting a volume of water to be released during a flush action.

In one embodiment, the microprocessor is adapted to reset the usage counter after the flush action is activated.

According to one embodiment, a method of operating a urinal comprises pre-setting a flush interval; detecting a usage of the urinal by a proximity sensor and
15 updating a usage counter; ascertaining whether the usage counter has reached the pre-set flush interval; and activating a flush action if the usage counter has reached the preset usage interval or if a user has manually activated a flush action; and upon activating the flush action, resetting the usage counter.

In one embodiment, the method may comprise manually activating a flush
20 action before the usage counter has reached the preset usage interval.

Brief Description of the Drawings

Figure 1 is a simplified block diagram illustrating components of a detection and control system and signal flow among the system components according to one
25 embodiment of the invention.

Figure 2 is an operation sequence of an adjustable flushing system according to one embodiment of the invention

Description of Embodiments

In the following description, numerous specific details are set forth in order to provide a thorough understanding of various illustrative embodiments. It will be understood, however, to one skilled in the art, that the various embodiments may be practiced without some or all of these specific details. In other instances, well known process operations have not been described in detail in order not to unnecessarily obscure pertinent aspects of embodiments being described. In the drawings, like reference numerals refer to same or similar functionalities or features throughout the several views.

Embodiments described in the present disclosure provide an adjustable flush system which can be used in conjunction with a flush urinal or a waterless urinal by new installation or by retrofitting an existing urinal with a detection and control system.

According to one embodiment, the detection and control system comprises detection circuits and control circuits which may be provided on separate or same circuit boards. The detection circuits may comprise proximity sensors which employs active infrared emitter and infrared receiver to perform object detection, and which have adjustable sensing distance. The control circuit is to control peripheral components and logic functions such as, but not limited to, infrared sensing, detection logic, and timing setup. To this purpose, the control circuit may include a microprocessor, a flash program memory with self-read/write capability, an internal 32MHz oscillator, an integrated capacitive mTouch sensing module, a data signal modulator module, timers, and other suitable components.

Figure 1 is a simplified block diagram illustrating components of the detection and control system and signal flow among the system components. A microprocessor 102 is electrically connected to a first switch, e.g. rotary switch, and adapted to receive a flush interval input 104 from a user via the first switch. The flush interval input 104 defines the number of usage to be reached before a flush action is activated. The flush interval input 104 may be transferred to a memory storage (not shown) which is electrically connected to the microprocessor 102. The microprocessor 102 is further electrically connected to a second switch and adapted

to receive a sensing range input 106 from a user via the second switch. A voltage regulator module 108 is electrically connected to the microprocessor 102 to provide an appropriate supply voltage, e.g. 5 V, which is stepped down from a power supply unit 110, e.g. supplying a direct current of 12 V.

5 The microprocessor 102 is electrically connected to one or more proximity sensors, e.g. infra-red emitter and receiver, which are pulse-operated by the microprocessor 102. Particularly, the microprocessor 102 is adapted to activate an infra-red emitter 112 to emit an infra-red beam in a predetermined direction. An infra-red receiver 114, which is suitably arranged, is adapted to receive reflected
10 infra-red waves to ascertain a presence of an object 116 or person within a distance specified by the sensing range input. The output from the infra-red receiver 114 may be suitably amplified by an operational amplifier 118 before being transmitted to the microprocessor 102. The microprocessor 102 may be electrically connected to an indicator 120, e.g. LED light, whereupon detecting a presence of an object, the
15 indicator is lighted and the infra-red emitter 112 and receiver 114 will detect the object 116 continuously. After the object 116 moves away, the infra-red receiver 114 detects a change in the presence of the object 116 and transmits an appropriate signal to the microprocessor 102. The microprocessor 102 is adapted to update a usage counter and to check whether the usage counter has reached the preset flush
20 interval 104. If the usage counter has reached the preset flush interval 104, the microprocessor 102 is adapted to activate a relay 122 to control a solenoid valve 124 for releasing flush water. The solenoid valve 124 is also electrically powered by the aforementioned power supply unit 110.

 Figure 2 illustrates an operation sequence 200 of an adjustable flushing
25 system according to one embodiment of the invention. At a urinal provided with an adjustable flushing system, a building maintenance staff or janitor may manually adjust a flush interval by manipulating a first switch (block 202). The flush interval defines the number of usage to be detected before a flush action is activated. The staff may also manually adjust an effective sensing range of the proximity sensor by
30 manipulating a second switch (block 202). The staff may further manually adjust a flush water volume by manipulating a third switch (block 202). When a user enters the effective sensing range, the proximity sensor will detect a presence of a user and

continuously detects the user (block 204). After the user is detected to have stepped away (block 206), the usage counter is increased (block 208). The usage counter is then checked against the preset flush interval, as to whether the preset flush interval has been reached (block 210). If the usage counter has not reached the preset flush interval, the operation sequence awaits a next usage without activating a flush action. If the usage counter has reached the preset flush interval, the operation sequence proceeds to activate a flush action (block 212). The flush volume is determined by the preset flush volume. After the flush action is activated, the usage counter is reset.

At any time during the above-described operation sequence or before the usage counter reaches the preset interval, a user may manually activate a flush action (block 214) by pressing an external force switch. If a flush action is activated manually, the usage counter is reset.

The above embodiments are advantageous in easing a transition from a flush urinal to a no-flush urinal. Conventional flush urinals can easily be retrofitted with the above embodiments. Adjustable interval flushing allows progressively decreasing flush frequency until a building owner is satisfied of the hygiene and odour levels even with decreased flush frequency and until such time the sensor may be disabled and no-flush is fully adopted. This will eliminate the huge financial outlay to convert no-flush urinals to flush urinals if no-flush urinals have been installed but found to be unsuitable subsequently. Adjustable sensing range allows the proximity sensors to customize performance to site conditions, toilet design and size of urinal. Adjustable flush volume allows water discharge and flow rate to be varied according to requirements. Manual flush activation provides flexibility in facilitating cleaning and maintenance process.

Other embodiments will be apparent to those skilled in the art from consideration of the specification and practice of the invention. Furthermore, certain terminology has been used for the purposes of descriptive clarity, and not to limit the disclosed embodiments. The embodiments and features described above should be considered exemplary, with the invention being defined by the appended claims.

Claims:

1. An adjustable flushing system comprising:

a proximity sensor for detecting a usage of a urinal;

a first switch for setting a flush interval; and

5 a microprocessor electrically coupled to the proximity sensor and the first switch, the microprocessor adapted to compute a usage count from the detected usage, compare the usage count with the pre-set flush interval and activate a flush action when the usage count reaches the pre-set flush interval.

10 2. The adjustable flushing system of claim 1, further comprising: a manual switch for activating a flush action and being coupled to the microprocessor, wherein upon activating the manual switch, the usage counter is reset.

15 3. The adjustable flushing system of claim 2, further comprising: a second switch for adjusting a sensing distance range of the proximity sensor, the second switch coupled to the proximity sensor and the microprocessor.

4. The adjustable flushing system of claim 3, further comprising: a third switch for adjusting a volume of water to be released during a flush action.

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5. The adjustable flushing system of any of preceding claims, wherein the microprocessor is adapted to reset the usage counter after the flush action is activated.

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6. A method of operating a urinal, comprising:

pre-setting a flush interval;

detecting a usage of the urinal by a proximity sensor and updating a usage counter;

5 ascertaining whether the usage counter has reached the pre-set flush interval;
and

activating a flush action if the usage counter has reached the preset usage interval or if a user has manually activated a flush action; and

upon activating the flush action, resetting the usage counter.

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7. The method of claim 6, further comprising: manually activating a flush action before the usage counter has reached the preset usage interval.

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