TOUCHLESS FLUSHING SYSTEM FOR A TOILET

Field of Invention

[0001] The present disclosure relates to a toilet flushing system. More particularly, the disclosure relates to a touchless flushing system employing use of a motion sensing unit to control a flushing mechanism.

Background

[0002] The following discussion of the background is intended to facilitate an understanding of the present disclosure only. It should be appreciated that the discussion is not an acknowledgement or admission that any of the material referred to was published, known or is part of the common general knowledge of the person skilled in the art in any jurisdiction as of the priority date of the invention.

[0003] Cleanliness and efficiency of public restrooms have been improved by the use of sensors that control lighting, sink water flow, and flushing. Existing automated toilet systems are mechanism-specific and have limiting adaptability. What is needed is a system suitable for upgrading existing restroom designs as well as integrating into new designs. This invention provides a universal wireless control interface for diverse flush mechanisms (pistons, solenoids, air pumps), enabling water-efficient, hygienic operation across sanitary fixtures.

Summary of Invention

[0004] Most generally, the first embodiment of the invention is a touchless flushing system for a toilet comprising: (a) a motion sensing unit configured for mounting in proximity to the toilet; and (b) a toilet control subsystem for the toilet. The motion sensing unit generates motion sensor commands based on predefined hand gestures executed within a predetermined distance from the motion sensor by a user of the toilet. These commands are sent wirelessly to a flushing mechanism to control the flushing of the toilet.

[0005] A first embodiment of the invention is a touchless flushing system for a toilet comprising: (a) a motion sensing unit configured for mounting in proximity to the toilet; and (b) a toilet control subsystem for the toilet. The motion sensing unit includes: (i) a motion sensor configured to generate sensor output signals in response to a plurality of predefined hand gestures executed within a predetermined distance from the motion sensor by a user of the toilet; (ii) a first controller in data communication with the motion sensor, wherein the first controller is configured to receive the sensor output signals of the motion sensor and interpret the sensor output signals to generate motion sensor commands for operation of the toilet; (iii) a first transducer configured to receive the motion sensor commands from the first controller and wirelessly transmit the motion sensor commands; and (iv) a first power source. The toilet control subsystem comprises: (i) a second power source; (ii) a second transducer configured to receive the motion sensor commands from the first transducer of the motion sensing unit; (iii) a second controller in data communication with the second transducer, wherein the second controller is configured to decode the motion sensor commands and generate flush signals; and (iv) a flushing mechanism in data communication with the second controller, wherein the flushing mechanism is configured to receive each of the flush signals from the second controller and flush the toilet in accordance with the flush signal.

[0006] Most generally, a second embodiment of the invention is a touchless toilet cover lifting and lowering system for a toilet with a toilet cover and a toilet seat. The system comprising: (a) a lifting unit configured to raise and lower the toilet cover; (b) a motion sensing unit configured for mounting in proximity to the toilet; and (c) a toilet control subsystem for the toilet. The raising and lowering of toilet cover is determined from information received by a user alert, a flush sensor, and/or a pressure sensor. The user alert is created by the motion sensing unit. The toilet cover is thereby raised when the user approaches the toilet and lowers once the toilet has been flushed and the user is no longer seated on the toilet seat.

[0007] A second embodiment of the invention is a touchless toilet cover lifting and lowering system for a toilet with a toilet cover and a toilet seat, the system comprising: (a) a lifting unit configured to raise and lower the toilet cover; (b) a motion sensing unit

configured for mounting in proximity to the toilet; and (c) a toilet control subsystem for the toilet. The motion sensing unit includes: (i) a motion sensor configured to detect motion and generate sensor output signals; (ii) a first controller in data communication with the motion sensor, wherein the first controller is configured to receive the sensor output signals of the motion sensor and interpret the sensor output signals to detect an approach of a user to the toilet and generate a user alert; (iii) a first transducer in data communication with the first controller, wherein the first transducer is configured to wirelessly transmit the user alert according to a wireless protocol; and (iv) a first power source. The toilet control subsystem includes: (i) a second power source; (ii) a flushing mechanism with a flush sensor for detecting a flush event of the toilet; (iii) a pressure sensor for detecting a presence of the user sitting on the toilet seat; (iv) a second transducer configured to receive the user alert from the first transducer of the motion sensing unit; and (v) a second controller in data communication with the flush sensor, the pressure sensor, and the second transducer. Upon receipt of the user alert, the second controller is configured to send a first signal to the lifting unit to raise the toilet cover. Upon detection of the flush event, the second controller is configured to send a second signal to the lifting unit to lower the toilet cover, provided the pressure sensor does not also detect the presence of the user sitting on the toilet seat.

[0008] Other aspects and features of the present invention will become apparent to those of ordinary skill in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying figures.

Brief Description of the Drawings

[0009] Embodiments of the present disclosure are described herein with reference to the drawings in which:

[0010] **FIG. 1** is an illustration of a system including a motion sensing unit and a toilet control subsystem in an embodiment of the invention.

[0011] **FIG. 2** is an illustration of the exterior of a motion sensing unit in an embodiment of the invention.

[0012] **FIG. 3** is an illustration of a flushing mechanism in an embodiment of the invention.

[0013] **FIG. 4** is an illustration of a lifting unit in an embodiment of the invention.

[0014] **FIG. 5** is a flowchart of a method embodiment of the invention.

Description of Embodiments

[0015] In the following detailed description, reference is made to the accompanying drawings, which form a part hereof. The illustrative embodiments described in the detailed description, drawings and claims are not meant to be limiting. Other embodiments can be utilized, and other changes can be made, without departing from the spirit or scope of the subject matter presented herein. Unless specified otherwise, the terms "comprising," "comprise," "including" and "include" used herein, and grammatical variants thereof, are intended to represent "open" or "inclusive" language such that they include recited elements but also permit inclusion of additional, un-recited elements.

[0016] **FIG. 1** is an illustration of a system **1-00** including a motion sensing unit **10** and a toilet control subsystem **20** in an embodiment of the invention. The motion sensing unit **10** includes a motion sensor **12**, a first controller **13**, a first power source **14**, and a first transducer **15**. Predefined hand gestures **11X** are performed within a predetermined distance of the motion sensor **12**. The toilet control subsystem **20** includes a flushing mechanism **21**, a second controller **22**, a second transducer **23**, a lifting unit **24**, a toilet cover **25**, a pressure sensor **26**, and a second power source **27**. The system **1-00** can also include a remote control unit **30**.

[0017] As discussed below, in a first embodiment of the invention, the primary elements are a motion sensing unit **10** with a motion sensor **12** and a first controller **13** configured to first interpret predefined hand gestures **11X** made by the user within a predefined distance of the motion sensor **12** to generate motion sensor commands sent by the second controller **22** to the flushing mechanism **21**.

[0018] In a second embodiment of the invention, the primary elements are a motion sensing unit **10**, the raising and lowering of toilet cover **25** is determined from information received by a user alert, a flush sensor, and/or a pressure sensor **26**. The user alert is created by the motion sensing unit.

[0019] **FIG. 2** is an illustration of the exterior of a motion sensing unit **10** in an embodiment of the invention, with a front view and side view. From the front view a motion sensor **12** is visible in the center. The front face of the motion sensing unit **10** includes upward gesture symbol **11A**, a rightward gesture symbol **11B**, a leftward gesture symbol **11C**, and a downward gesture symbol **11D**. These symbols are imprinted on the front face to assist the user in controlling the functions of the toilet by using predefined hand gestures **11X**. The motion sensing unit **10** is mountable in proximity to the toilet.

[0020] **FIG. 3** is an illustration of a flushing mechanism **21** in an embodiment of the invention. In this embodiment, the flushing mechanism **21** has two plunger rod holder arms **21A** of differing lengths (e.g., one for half flush and the other for full flush). This flushing mechanism **21** can, in addition to an electrically driven flush, be manually activated. This flushing mechanism **21** includes a removable rechargeable battery pack **21B** as the second power source **27**. This flushing mechanism **21** can also integrate the second transducer **23** to receive a flush signal.

[0021] **FIG. 4** includes a top, front, and perspective view of a lifting unit **24** in an embodiment of the invention. The lifting unit includes lifting arms **24A** and a lifting base **24B**. **FIG. 4** also demonstrates potential placement of the second power source **27** adjacent the lifting unit **24**.

[0022] **FIG. 5** is a flowchart of a method embodiment of the first embodiment of the invention. Steps **5-01** to **5-07** are listed below.

mounting a motion sensing unit **10** with a motion sensor **12** in proximity to the toilet;	**5-01**

generating sensor output signals in response to a plurality of predefined hand gestures **11X** executed within a predetermined distance from the motion sensor **12** by a user of the toilet;	**5-02**
receiving the sensor output signals of the motion sensor **12** at a first controller **13**;	**5-03**
interpreting, at the first controller **13**, the sensor output signals to generate motion sensor commands for operation of the toilet;	**5-04**
transmitting the motion sensor commands to a toilet control subsystem **20**;	**5-05**
decoding, at the toilet control subsystem **20** with a second controller **22**, the motion sensor commands to generate flush signals for a flushing mechanism **21**; and	**5-06**
flushing the toilet with the flushing mechanism **21** in accordance with the flush signal.	**5-07**

[0023] Most generally, the first embodiment of the invention is a touchless flushing system **1-00** for a toilet comprising: (a) a motion sensing unit **10** configured for mounting in proximity to the toilet; and (b) a toilet control subsystem **20** for the toilet. The motion sensing unit **10** generates motion sensor commands based on predefined hand gestures **11X** executed within a predetermined distance from the motion sensor **12** by a user of the toilet. These commands are sent wirelessly to a flushing mechanism **21** to control the flushing of the toilet.

[0024] A first embodiment of the invention is a touchless flushing system **1-00** for a toilet comprising: (a) a motion sensing unit **10** configured for mounting in proximity to the toilet; and (b) a toilet control subsystem **20** for the toilet. The motion sensing unit **10** includes: (i) a motion sensor **12** configured to generate sensor output signals in response to a plurality of predefined hand gestures **11X** executed within a predetermined distance from the motion sensor **12** by a user of the toilet; (ii) a first controller **13** in data communication with the motion sensor **12**, wherein the first controller **13** is configured to receive the sensor output signals of the motion sensor

12 and interpret the sensor output signals to generate motion sensor commands for operation of the toilet; (iii) a first transducer **15** configured to receive the motion sensor commands from the first controller **13** and wirelessly transmit the motion sensor commands; and (iv) a first power source **14**. The toilet control subsystem **20** comprises: (i) a second power source **27**; (ii) a second transducer **23** configured to receive the motion sensor commands from the first transducer **15** of the motion sensing unit **10**; (iii) a second controller **22** in data communication with the second transducer **23**, wherein the second controller **22** is configured to decode the motion sensor commands and generate flush signals; and (iv) a flushing mechanism **21** in data communication with the second controller **22**, wherein the flushing mechanism **21** is configured to receive each of the flush signals from the second controller **22** and flush the toilet in accordance with the flush signal.

[0025] In an alternative embodiment of the first embodiment of the invention, at least one of the motion sensor commands generated by the first controller **13** for transmission by the first transducer **15** includes a broadcast advertisement packet. The broadcast advertisement packet can contain a service Universally Unique Identifier (UUID), a device identifier, and a flush command characteristic. The flush command characteristic in the broadcast advertisement packet can be dynamically mapped to at least one of: (a) a motor rotation angle for piston arm displacement; (b) a solenoid activation duration; and (c) an air pump pressurization time.

[0026] In an alternative embodiment of the first embodiment of the invention: (a) the first transducer **15** and the second transducer **23** are configured for wireless communication using a Bluetooth protocol; and (b) the Bluetooth protocol is one of Bluetooth Classic or Bluetooth Low Energy (BLE).

[0027] In an alternative embodiment of the first embodiment of the invention, the motion sensing unit **10** and the toilet control subsystem **20** are paired via Near Field Communication (NFC) or a physical button during installation.

[0028] In an alternative embodiment of the first embodiment of the invention: (a) the flushing mechanism **21** includes at least one of a piston arm, a solenoid valve, and an air pressure-driven system for actuating a flush; and (b) the second controller **22**

includes at least one of a motor driver circuit for actuating a piston arm, a solenoid driver circuit with a MOSFET or relay for driving a solenoid valve, and an air pump control circuit with pressure sensing for driving and controlling an air pressure-driven system.

[0029] In an alternative embodiment of the first embodiment of the invention: (a) the first controller **13** or the second controller **22** includes non-volatile memory to store parameter values; and (b) the parameter values are configurable by a computing device via data communication from the computing device to the first controller **13** or the second controller **22**. At least one of the parameter values can include: (a) a mechanical parameter of the flushing mechanism **21**; (b) an electrical parameter of the flushing mechanism **21**; and (c) a flush command mapping. The computing device can be one of a laptop computer, a desktop computer, a tablet computer, or a smartphone.

[0030] In an alternative embodiment of the first embodiment of the invention: (a) the first controller **13** or the second controller **22** includes non-volatile memory to receive firmware upgrades; and (b) the first controller **13** or the second controller **22** is configured to receive the firmware upgrades to the non-volatile memory by a computing device via data communication from the computing device to the first controller **13** or the second controller **22**. Also: (a) the first controller **13** can includes first firmware and the second controller **22** includes second firmware; and (b) the first firmware can be remotely upgradable via the first transducer **15** and the second firmware is remotely upgradable via the second transducer **23**. The computing device can be one of a laptop computer, a desktop computer, a tablet computer, or a smartphone.

[0031] In an alternative embodiment of the first embodiment of the invention: (a) the motion sensor **12** includes an optical time-of-flight (ToF) sensor; and (b) the predetermined distance is less than 10 centimeters.

[0032] In an alternative embodiment of the first embodiment of the invention, the motion sensing unit **10** includes a visible legend summarizing the predefined hand gestures **11X**.

[0033] In an alternative embodiment of the first embodiment of the invention: (a) the first power source **14** is a lithium battery; and (b) the second power source **27** is a removable rechargeable battery pack.

[0034] A method implementation of the first embodiment of the invention is a method for touchless flushing of a toilet, comprising: (a) mounting a motion sensing unit **10** with a motion sensor **12** in proximity to the toilet; (b) generating sensor output signals in response to a plurality of predefined hand gestures **11X** executed within a predetermined distance from the motion sensor **12** by a user of the toilet; (c) receiving the sensor output signals of the motion sensor **12** at a first controller **13**; (d) interpreting, at the first controller **13**, the sensor output signals to generate motion sensor commands for operation of the toilet; (e) transmitting the motion sensor commands to a toilet control subsystem **20**; (f) decoding, at the toilet control subsystem **20** with a second controller **22**, the motion sensor commands to generate flush signals for a flushing mechanism **21**; and (g) flushing the toilet with the flushing mechanism **21** in accordance with the flush signal. Also: (a) the motion sensing unit **10** can include non-volatile memory for storing parameter values; and (b) the parameter values are configurable by a computing device via data communication between the motion sensing unit **10** and the computing device. At least one of the parameter values can include: (a) a mechanical parameter of the flushing mechanism **21**; (b) an electrical parameter of the flushing mechanism **21**; and (c) a flush command mapping.

[0035] Most generally, a second embodiment of the invention is a touchless toilet cover **25** lifting system 1-**00** for a toilet with a toilet cover **25** and a toilet seat. The system 1-**00** comprising: (a) a lifting unit **24** configured to raise and lower the toilet cover **25**; (b) a motion sensing unit **10** configured for mounting in proximity to the toilet; and (c) a toilet control subsystem **20** for the toilet. The raising and lowering of toilet cover **25** is determined from information received by a user alert, a flush sensor, and/or a pressure sensor **26**. The user alert is created by the motion sensing unit **10**. The toilet cover **25** is thereby raised when the user approaches the toilet and lowers once the toilet has been flushed and the user is no longer seated on the toilet seat.

[0036] A second embodiment of the invention is a touchless toilet cover **25** lifting system 1-**00** for a toilet with a toilet cover **25** and a toilet seat, the system comprising: (a) a lifting unit **24** configured to raise and lower the toilet cover **25**; (b) a motion sensing unit **10** configured for mounting in proximity to the toilet; and (c) a toilet control subsystem **20** for the toilet. The motion sensing unit **10** includes: (i) a motion sensor **12** configured to detect motion and generate sensor output signals; (ii) a first controller **13** in data communication with the motion sensor **12**, wherein the first controller **13** is configured to receive the sensor output signals of the motion sensor **12** and interpret the sensor output signals to detect an approach of a user to the toilet and generate a user alert; (iii) a first transducer **15** in data communication with the first controller **13**, wherein the first transducer **15** is configured to wirelessly transmit the user alert according to a wireless protocol; and (iv) a first power source **14**. The toilet control subsystem **20** includes: (i) a second power source **27**; (ii) a flushing mechanism **21** with a flush sensor for detecting a flush event of the toilet; (iii) a pressure sensor **26** for detecting a presence of the user sitting on the toilet seat; (iv) a second transducer **23** configured to receive the user alert from the first transducer **15** of the motion sensing unit **10**; and (v) a second controller **22** in data communication with the flush sensor, the pressure sensor **26**, and the second transducer **23**. Upon receipt of the user alert, the second controller **22** is configured to send a first signal to the lifting unit **24** to raise the toilet cover **25**. Upon detection of the flush event, the second controller **22** is configured to send a second signal to the lifting unit **24** to lower the toilet cover **25**, provided the pressure sensor **26** does not also detect the presence of the user sitting on the toilet seat. The wireless protocol can be one of Bluetooth Classic or Bluetooth Low Energy (BLE).

[0037] In an alternative embodiment of the second embodiment of the invention, the system 1-**00** further comprises a remote control unit **30** including a third controller and a third transducer. Also: (a) the remote control unit **30** is configured to receive remote control commands from the user; and (b) to relay the information from each remote control command to the second controller **22** of the toilet control subsystem **20**, the remote control unit **30** is configured to transmit the information on each remote control command via the third transducer of the remote control unit **30** to the second transducer **23** of the toilet control subsystem **20** according to the wireless protocol. The wireless protocol can be one of Bluetooth Classic or Bluetooth Low Energy (BLE).

The remote control unit **30** can be one of a smartphone, a tablet, or a dedicated controller. The system 1-**00** can further comprises at least one of: (i) a seat warmer; (ii) a bidet; (iii) a sterilization unit including at least one of an ozone-water generator and an electrolyzed-water generator; (iv) a disinfecting unit with an ultraviolet-C light emitting diode (UVC LED); (v) an odour removal unit comprising an exhaust suction fan and an activated carbon filter; (vi) a drying unit with a heated air blower, the drying unit configured to dry a private part of the user; and (vii) an ambient light sensor and a nightlight. The remote control commands can include instructions for at least one of: (i) raising a toilet cover **25**; (ii) lowering a toilet cover **25**; (iii) raising a toilet seat; (iv) lowering a toilet seat; (v) flushing the toilet; (vi) controlling the toilet seat warmer, wherein the toilet seat warmer has a maximum temperature setting of 48 degrees Celsius or less; (vii) controlling the bidet, wherein the instructions for controlling the bidet include at least one of a gender setting and a water pressure setting; (viii) sterilizing the toilet bowl with the sterilization unit; (ix) disinfecting the toilet cover **25** or the toilet seat with the disinfecting unit; (x) removing an odour with the odour removal unit; (xi) drying with the drying unit; and (xii) controlling the nightlight in response to information from the ambient light sensor. The disinfection unit can be configured to activate a disinfection cycle when the user leaves the toilet seat. The bidet can include multiple spray modes and adjustable nozzle positions for enhanced user comfort. The heated air blower can include an adjustable temperature setting.

[0038] In an alternative embodiment of the second embodiment of the invention: (a) the lifting unit **24** is powered by an energy-efficient motor; and (b) the lifting unit **24** is configured to allow a user-adjustable speed.

[0039] In an alternative embodiment of the second embodiment of the invention, the motion sensor **12** is a time-of-flight (ToF) sensor.

[0040] In an alternative embodiment of the second embodiment of the invention: (a) the first power source **14** is a lithium battery; and (b) the second power source **27** is a removable rechargeable battery pack.

[0041] In an alternative embodiment of the second embodiment of the invention: (a) the first controller **13** or the second controller **22** includes non-volatile memory to store

parameter values; and (b) the parameter values are configurable by a computing device via data communication from the computing device to the first controller **13** or the second controller **22**. The at least one of the parameter values can include: (a) a mechanical parameter of the flushing mechanism **21**; (b) an electrical parameter of the flushing mechanism **21**; and (c) a flush command mapping. The computing device can be one of a laptop computer, a desktop computer, a tablet computer, or a smartphone.

[0042] In an alternative embodiment of the second embodiment of the invention: (a) the first controller **13** or the second controller **22** includes non-volatile memory to receive firmware upgrades; and (b) the first controller **13** or the second controller **22** is configured to receive the firmware upgrades to the non-volatile memory by a computing device via data communication from the computing device to the first controller **13** or the second controller **22**. Also: (a) the first controller **13** includes first firmware and the second controller **22** includes second firmware; and (b) the first firmware is remotely upgradable via the first transducer **15** and the second firmware is remotely upgradable via the second transducer **23**. The computing device can be one of a laptop computer, a desktop computer, a tablet computer, or a smartphone.

[0043] Reference numbering for the items in this disclosure include:

1-00	system
10	motion sensing unit 10
11A	upward gesture symbol
11B	rightward gesture symbol
11C	leftward gesture symbol
11D	downward gesture symbol
11X	predefined hand gestures
12	motion sensor
13	first controller 13
14	first power source 14
15	first transducer
20	toilet control subsystem
21	flushing mechanism
21A	plunger rods
21B, 27	second power source

22	second controller
23	second transducer
24	lifting unit
24A	lifting arms
24B	lifting base
25	toilet cover
26	pressure sensor
30	remote control unit

[0044]While various aspects and embodiments have been disclosed herein, it will be apparent that various other modifications and adaptations of the invention will be apparent to the person skilled in the art after reading the foregoing disclosure without departing from the spirit and scope of the invention and it is intended that all such modifications and adaptations come within the scope of the appended claims. The various aspects and embodiments disclosed herein are for purposes of illustration and are not intended to be limiting, with the true scope and spirit of the invention being indicated by the appended claims.

CLAIMS

1. A touchless flushing system for a toilet comprising:

(a) a motion sensing unit configured for mounting in proximity to the toilet, the motion sensing unit comprising:

(i) a motion sensor configured to generate sensor output signals in response to a plurality of predefined hand gestures executed within a predetermined distance from the motion sensor by a user of the toilet;

(ii) a first controller in data communication with the motion sensor, wherein the first controller is configured to receive the sensor output signals of the motion sensor and interpret the sensor output signals to generate motion sensor commands for operation of the toilet;

(iii) a first transducer configured to receive the motion sensor commands from the first controller and wirelessly transmit the motion sensor commands; and

(iv) a first power source; and

(b) a toilet control subsystem for the toilet comprising:

(i) a second power source;

(ii) a second transducer configured to receive the motion sensor commands from the first transducer of the motion sensing unit;

(iii) a second controller in data communication with the second transducer, wherein the second controller is configured to decode the motion sensor commands and generate flush signals; and

(iv) a flushing mechanism in data communication with the second controller, wherein the flushing mechanism is configured to receive each of the flush signals from the second controller and flush the toilet in accordance with the flush signal.

2. The system of claim 1, wherein at least one of the motion sensor commands generated by the first controller for transmission by the first transducer comprises a broadcast advertisement packet.

3. The system of claim 2, wherein the broadcast advertisement packet contains a service Universally Unique Identifier (UUID), a device identifier, and a flush command characteristic.

4. The system of claim 3, wherein the flush command characteristic in the broadcast advertisement packet is dynamically mapped to at least one of:

(a) a motor rotation angle for piston arm displacement;

(b) a solenoid activation duration; and

(c) an air pump pressurization time.

5. The system of claim 1,

(a) wherein the first transducer and the second transducer are configured for wireless communication using a Bluetooth protocol; and

(b) wherein the Bluetooth protocol is one of Bluetooth Classic or Bluetooth Low Energy (BLE).

6. The system of claim 1, wherein the motion sensing unit and the toilet control subsystem are paired via Near Field Communication (NFC) or a physical button during installation.

7. The system of claim 1,

(a) wherein the flushing mechanism comprises at least one of a piston arm, a solenoid valve, and an air pressure-driven system for actuating a flush; and

(b) wherein the second controller comprises at least one of:

(i) a motor driver circuit for actuating a piston arm;

(ii) a solenoid driver circuit with a MOSFET or relay for driving a solenoid valve; and

(iii) an air pump control circuit with pressure sensing for driving and controlling an air pressure-driven system.

8. The system of claim 1,

(a) wherein the first controller or the second controller comprises non-volatile memory to store parameter values; and

(b) wherein the parameter values are configurable by a computing device via data communication from the computing device to the first controller or the second controller.

9. The system of claim 8, wherein at least one of the parameter values comprises:

(a) a mechanical parameter of the flushing mechanism;

(b) an electrical parameter of the flushing mechanism; and

(c) a flush command mapping.

10. The system of claim 1,

(a) wherein the first controller or the second controller comprises non-volatile memory to receive firmware upgrades; and

(b) wherein the first controller or the second controller is configured to receive the firmware upgrades to the non-volatile memory by a computing device via data communication from the computing device to the first controller or the second controller.

11. The system of claim 10,

(a) wherein the first controller includes first firmware and the second controller comprises second firmware; and

(b) wherein the first firmware is remotely upgradable via the first transducer and the second firmware is remotely upgradable via the second transducer.

12. The system of claim 8 or 10, wherein the computing device is one of a laptop computer, a desktop computer, a tablet computer, or a smartphone.

13. The system of claim 1,

(a) wherein the motion sensor includes an optical time-of-flight (ToF) sensor; and

(b) wherein the predetermined distance is less than 10 centimeters.

14. The system of claim 1, wherein the motion sensing unit comprises a visible legend summarizing the predefined hand gestures.

15. The system of claim 1,

(a) wherein the first power source is a lithium battery; and

(b) wherein the second power source is a removable rechargeable battery pack.

16. A method for touchless flushing of a toilet, comprising:

(a) mounting a motion sensing unit with a motion sensor in proximity to the toilet;

(b) generating sensor output signals in response to a plurality of predefined hand gestures executed within a predetermined distance from the motion sensor by a user of the toilet;

(c) receiving the sensor output signals of the motion sensor at a first controller;

(d) interpreting, at the first controller, the sensor output signals to generate motion sensor commands for operation of the toilet;

(e) transmitting the motion sensor commands to a toilet control subsystem;

(f) decoding, at the toilet control subsystem with a second controller, the motion sensor commands to generate flush signals for a flushing mechanism; and

(g) flushing the toilet with the flushing mechanism in accordance with the flush signal.

17. The method of claim 16,

(a) wherein the motion sensing unit comprises non-volatile memory for storing parameter values; and

(b) wherein the parameter values are configurable by a computing device via data communication between the motion sensing unit and the computing device.

18. The method of claim 17, wherein at least one of the parameter values comprises:

(a) a mechanical parameter of the flushing mechanism;

(b) an electrical parameter of the flushing mechanism; and

(c) a flush command mapping.