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Houghtaling et al.

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(54) **SYSTEM AND METHOD FOR INSURING HAND-HYGIENE COMPLIANCE**

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(51) **Int. Cl.**

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G06F 1/16	(2006.01)
G08B 25/10	(2006.01)
G08B 7/06	(2006.01)

(52) **U.S. Cl.**

CPC ***G08B 21/245*** (2013.01); ***G06F 1/163*** (2013.01); ***G08B 7/06*** (2013.01); ***G08B 25/10*** (2013.01)

(58) **Field of Classification Search**

CPC G08B 21/245; G08B 7/06; G08B 25/10; G06F 1/163; G06F 3/016

See application file for complete search history.

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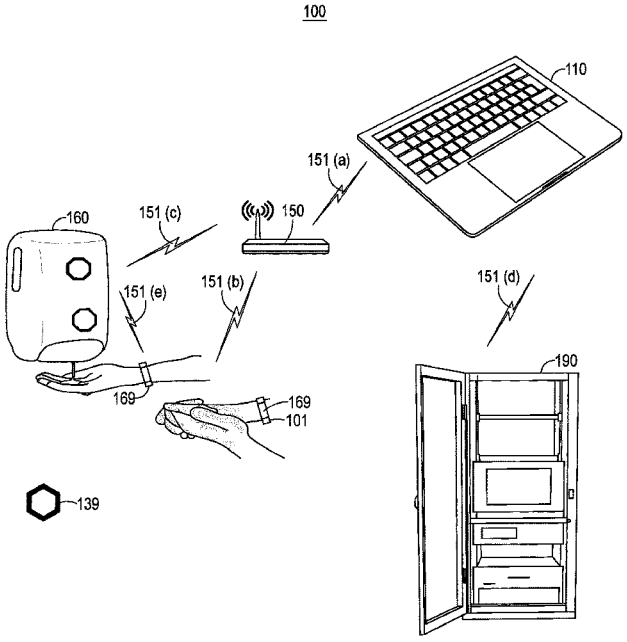
(57) **ABSTRACT**

The present invention relates to hardware, systems and software methods to insure compliance of personnel in jobs where sanitized hands are dependent on washing according to time intervals. The system includes a hand-hygiene station, a sanitizing dispensing device, a computer and a communication channel. A wearable vibration and visual alert device communicates, illuminates and vibrates dependent on timing between hand washing utilizing sensors positioned both adjacent to a hand washing station and installed in un-sanitized areas. Each of the plurality of sensors may be configured to provide a corresponding sensor output signal that is indicative of whether a person has washed their hands at a hand washing station.

19 Claims, 4 Drawing Sheets



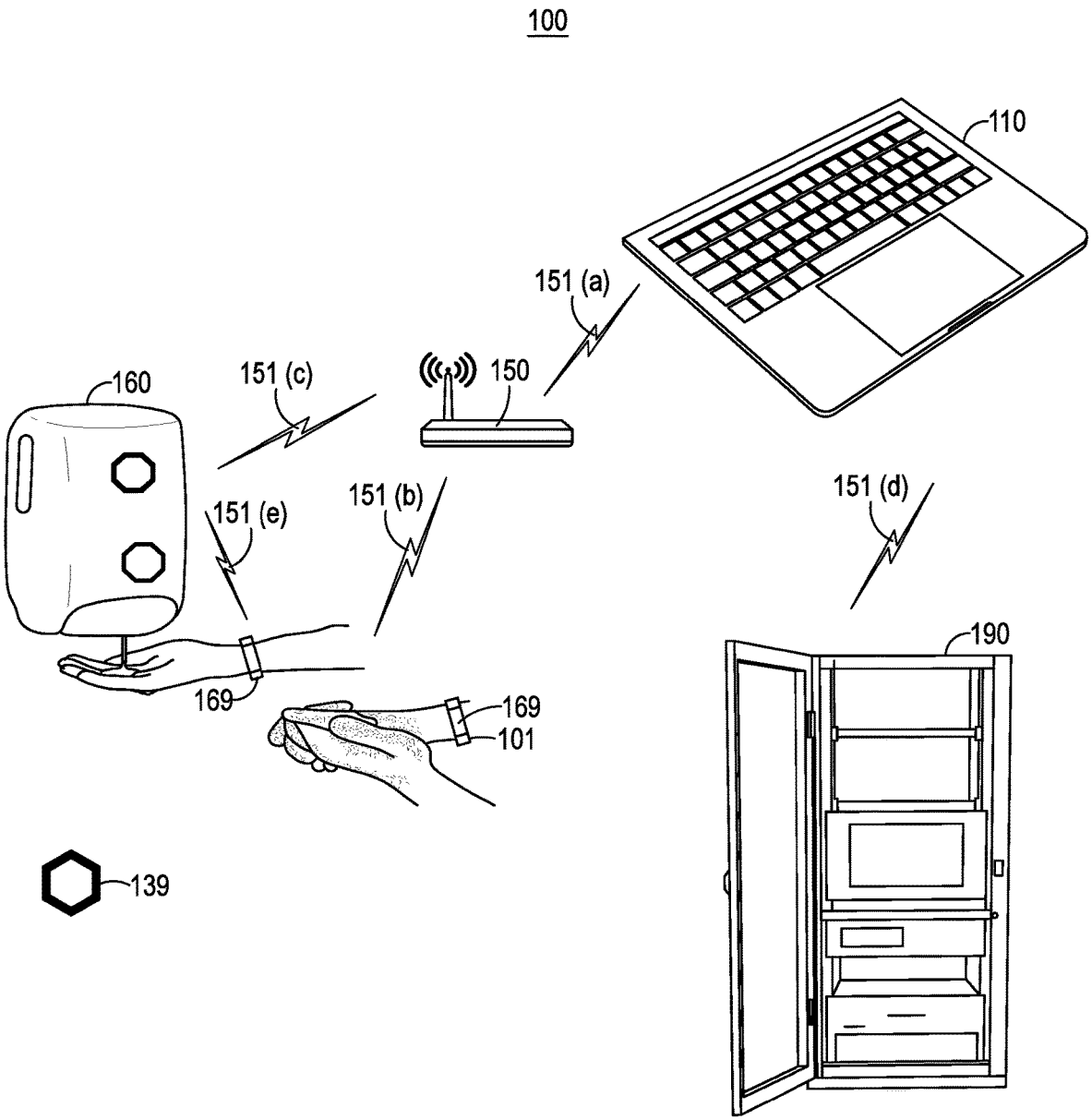


FIG. 1

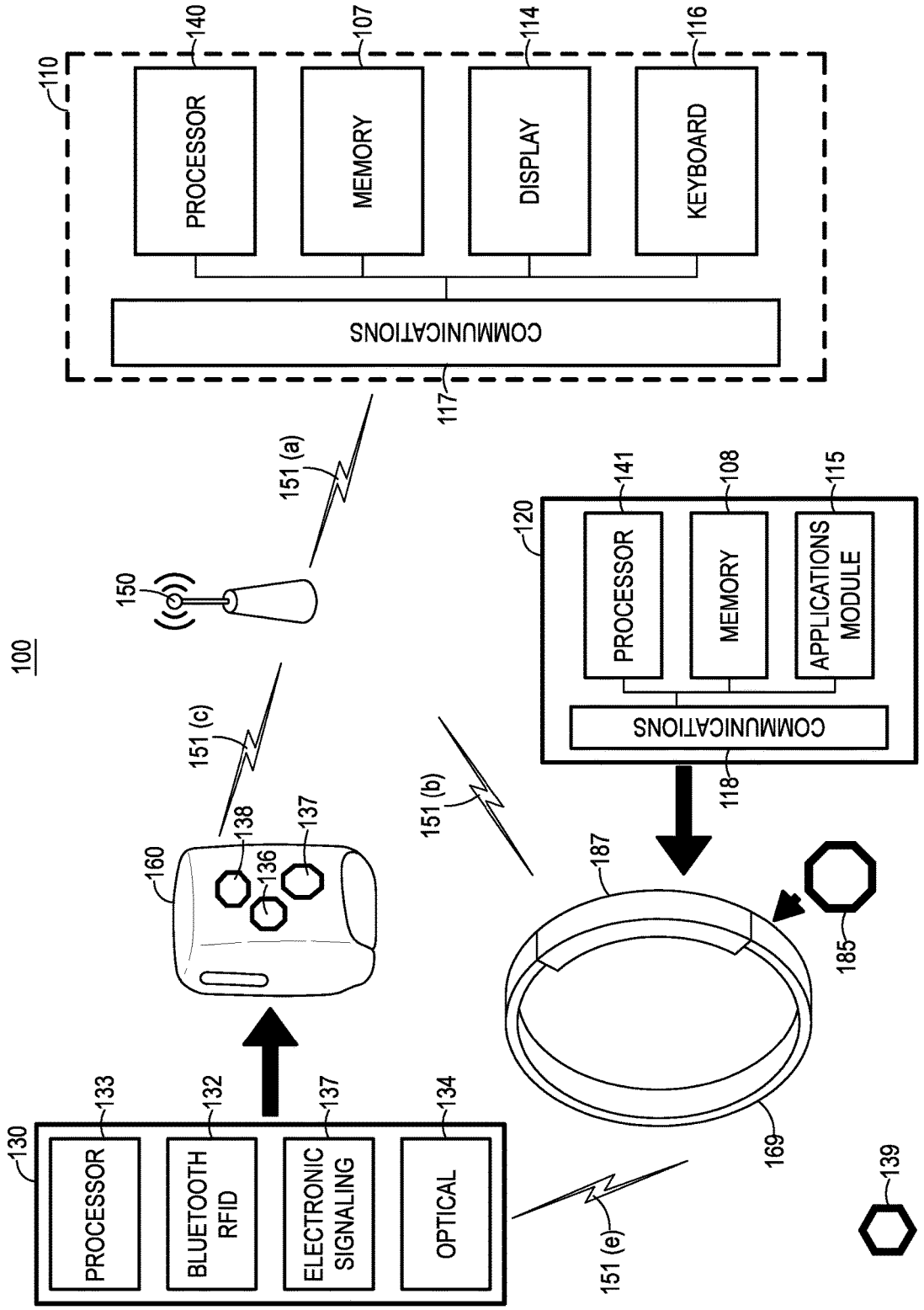

100
110
140
107
114
116
PROCESSOR
MEMORY
DISPLAY
KEYBOARD
COMMUNICATIONS
117
151 (a)
150
120
141
108
115
PROCESSOR
MEMORY
APPLICATIONS MODULE
COMMUNICATIONS
118
151 (b)
151 (c)
160
138
137
136
187
185
169
139
151 (e)
130
133
132
137
134
PROCESSOR
BLUETOOTH RFID
ELECTRONIC SIGNALING
OPTICAL

FIG. 2

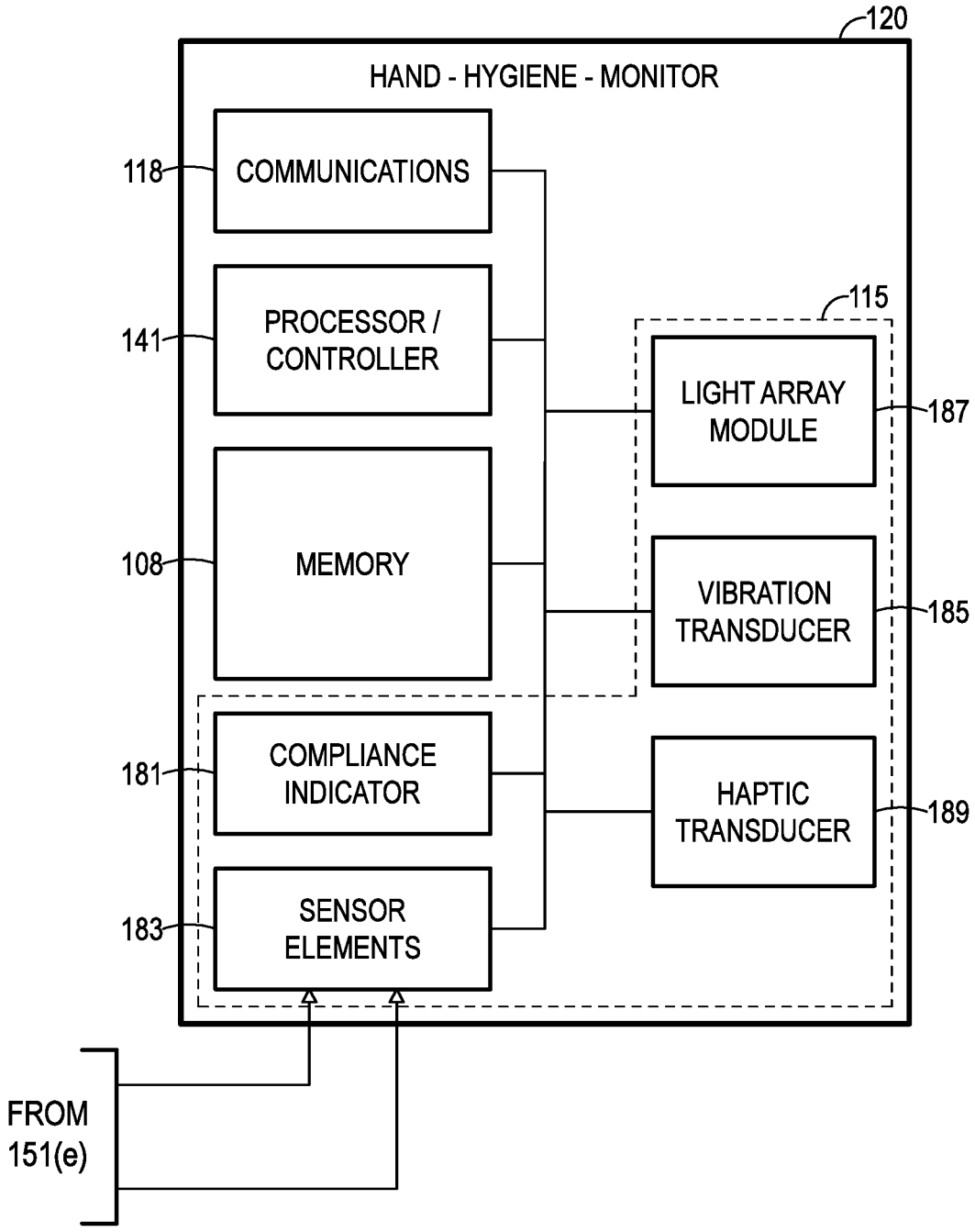

120
HAND - HYGIENE - MONITOR
118
COMMUNICATIONS
141
PROCESSOR / CONTROLLER
108
MEMORY
181
COMPLIANCE INDICATOR
183
SENSOR ELEMENTS
115
LIGHT ARRAY MODULE
187
VIBRATION TRANSDUCER
185
HAPTIC TRANSDUCER
189
FROM 151(e)

FIG. 3

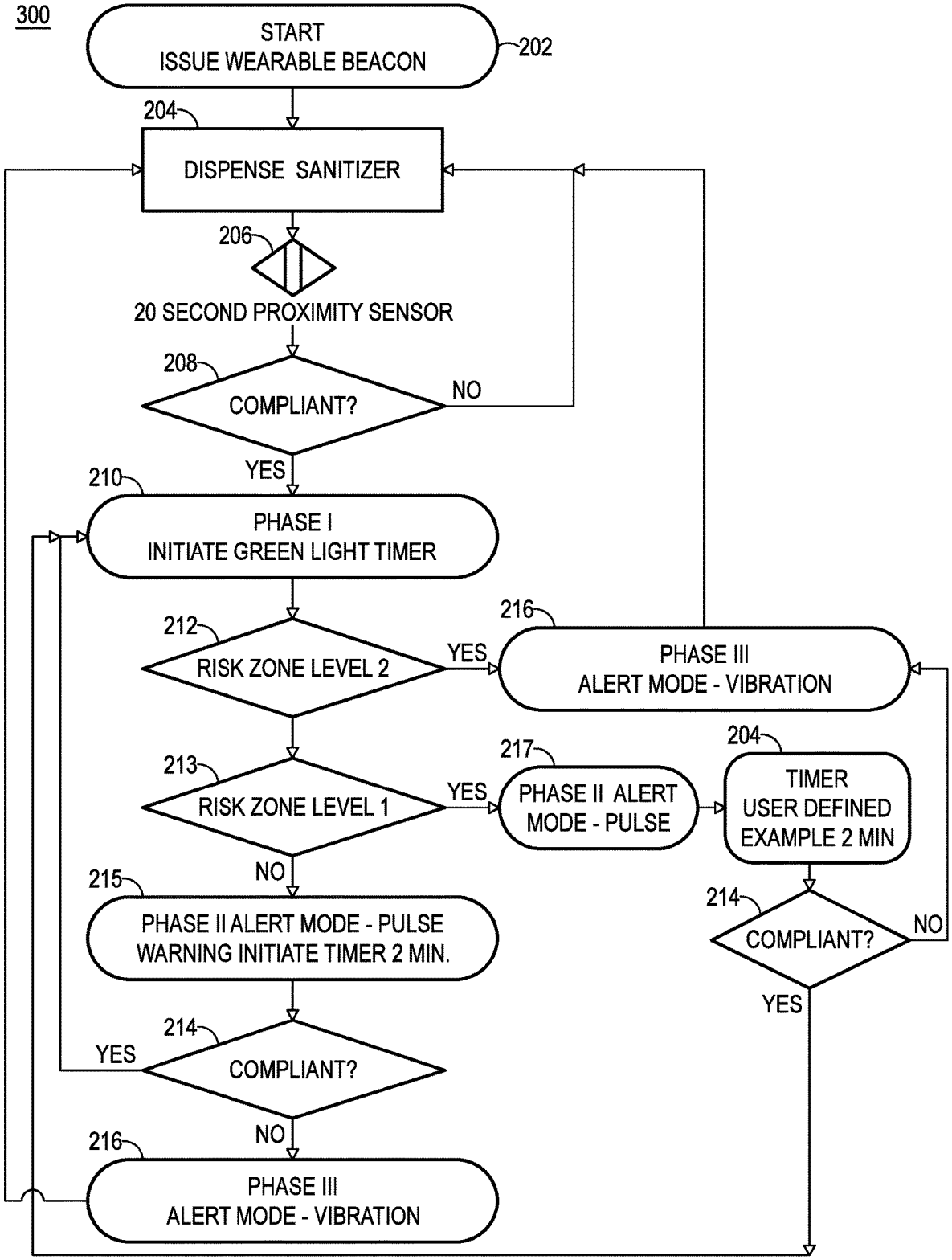

300
START
ISSUE WEARABLE BEACON
202
204
DISPENSE SANITIZER
206
20 SECOND PROXIMITY SENSOR
208
COMPLIANT?
NO
YES
210
PHASE I
INITIATE GREEN LIGHT TIMER
212
RISK ZONE LEVEL 2
YES
216
PHASE III
ALERT MODE - VIBRATION
213
RISK ZONE LEVEL 1
YES
217
PHASE II ALERT
MODE - PULSE
204
TIMER
USER DEFINED
EXAMPLE 2 MIN
NO
215
PHASE II ALERT MODE - PULSE
WARNING INITIATE TIMER 2 MIN.
214
COMPLIANT?
NO
YES
214
YES
COMPLIANT?
NO
216
PHASE III
ALERT MODE - VIBRATION

FIG. 4

SYSTEM AND METHOD FOR INSURING HAND-HYGIENE COMPLIANCE

CROSS-REFERENCE TO RELATED APPLICATIONS

This nonprovisional patent application claims the priority benefit under 35 U.S.C. 120 for U.S. provisional patent application Ser. No. 63/043,320, filed on Jun. 24, 2020, the entire disclosure of which is hereby incorporated by reference.

FIELD OF INVENTION

The present invention relates to devices, software systems, and methods for insuring hand-hygiene compliance to reduce the risk of spreading virus and bacterial infection.

BACKGROUND

Almost 1 in 10 individuals worldwide become ill and 420,000 die from consuming contaminated food or water each year. In the U.S. alone, 48 million people get sick, 128,000 are hospitalized, and 3,000 lose their lives to foodborne illnesses. Not to mention person to person contagions. There are 31 notable foodborne bacteria, viruses, parasites, toxins, and chemicals that cause food and water contamination globally. The following pathogens often cause foodborne illnesses; *Campylobacter, Clostridiums, Cyclospora cayetanensis, E. coli, Listeria, Monocytogenes, Norovirus, Salmonella, Staphylococcus aureus*, and SARS-CoV-2 virus (COVID-19).

Due to COVID-19, the US economy has lost trillions of dollars and more than 50 million jobs. To recover economically and without harm businesses large and small have to refocus on their Prime Directive, the reacquisition of customers and their customer's safety. More than ever people want to feel safe. As a business owner its not going to be enough to tell customers how much you care about their safety. Retail food establishments must comply with the Food and Drug Administration (FDA) 2017 Food Code in TFER for minimum food safety rules. State health services are requiring Certified Food Manager Programs, to accredit food manager training programs that specifically include the frequency of a food handler's hand washing regime. In fact food manager training and certification has become a standard of the food industry as well as a regulatory standard throughout the United States, many including that handwashing be performed at timing intervals dependent on various customer servicing factors. Thus food establishment owners to have a hedge against liability exposure they need to demonstrate an effective, no-nonsense tangible mitigation, that is both certified and records proof of compliance.

Liu, et al, US Pub., 20200005623, discloses a system and method for detecting hand hygiene compliance, where a healthcare provider may wear an electronically controlled wristband. This system interacts with a stationary controller that is integrated with or proximate to a hand cleaning agent dispenser. Specifically, its stationary controller may determine whether hand cleaning agent (such as sanitizer, soap, or the like) has been dispensed, and the wristband may determine whether the hand movements were sufficient, e.g., the hand movements were for at least a predetermined amount of time. However Liu, et al, do not use time as and indication or a requirement that washing had become mandatory. In the food handling industry, time is a large factor in considering the Poisson distribution nature of manner of the increase of probability that a food handler will become contaminated the longer the interval between washings. Thus, time, as a parameter that determines the interval of time a food handler should be viewed as a necessity if food borne illnesses are to be minimized.

Kolavennu, et al US Pub., 20200074836, discloses methods and systems for stationing procedural compliance of staff in a food handling facility. The system may include a plurality of sensors positioned adjacent a hand washing station. Each of the plurality of sensors may be configured to provide a corresponding sensor output signal that is indicative of whether a person is washing their hands at the hand washing station or not; dwelling at the hand washing station for a predetermined length of time; and departing from the hand washing station. However as in Liu, et al, Kolavennu, et al also do not use time as a parameter that determines the length of time a food handler has been active in handling food before its necessary and vital to wash their hands. It fails to monitor the act of washing hands as a reset of the time interval before another handwashing is required.

What is needed is a device, system and method that stations time as a parameter where the system and method determines the length of time a food handler has been active in handling food before its necessary to wash their hands. This is vital to remain compliant with the local institutional policies, as well as local, state and federal rules on handwashing compliance. Verification and certification of handwashing intervals will add to reducing food born contagions, increase consumer confidence, help reduce insurance premiums, insure compliance with policy and law and reduce lawsuits.

SUMMARY OF THE INVENTION

The invention addresses the above according to the following objects: (1) it offers a dynamic real time visual and haptic alert of hand sanitization compliance for a user based on time intervals, (2) it results in the behavior modification of the user, (3) provides compliance with sanitary policies and procedures, and (4) notifies compliance for the management of its sanitization policy and protocols. The forgoing alert portion of the invention provides a feature, embodied in a wristband, cuff, badge, hat, necklace, or button. Each of these embodiments are accessible to management via computer display devices (e.g., desk top lap tops, smart phones), as well as other forms of real time signaling to the wearer of the device, as well as a casual observer or other interested persons, such as a customer or coworker.

The system incorporates user defined tasks and roles, timing of handwashing protocols, and events that require handwashing relative to a worker's tasks and roles. Both active and passive triggers alert the food handler and its management of the status of procedural hygiene compliance and identification of users, including, but are not limited to using: lights, audible sounds, vibrations and other haptic sequential stimuli to create a kinesthetic communication or 3D touch, to create an experience of touch by applying forces, vibrations, or motions to the user as may be useful in practice or training.

The system and methods disclosed herein apply to high risk sanitizing service zones. In total the systems and methods employed improve sanitization in the hospitality, food handling/processing, retail industries, hospitals, emergency rooms, science and technology laboratories, child care centers, schools, maid services, and other occupations that require high levels of cleanliness, to insure health, welfare of workers, customers, patients and students, to insure con-

sumer confidence, as well as improving the quality of sanitary conditions or product and services, while reducing potential legal liability.

In one embodiment, a hand-hygiene-monitor includes: a wearable vibration and visual alert beacon configured for attachment to a user, which communicates with a computer, the computer programmed to station an interval of time, i.e., a time between a start time and a stop time, wherein the start time is determined by a user event, such as handwashing and/or the initiation of a transmission by an associated cleanser dispenser, and the stop time determined by a computer programmed according with a prescribed interval period.

In another embodiment a system for stationing hand-hygiene includes: one or more sensors positioned at a hand washing station, each of the sensors configured to provide a corresponding sensor output signal when a person is within the proximity of the washing station or un-sanitized areas or apparatuses. When a user is in the proximity of a sanitizing station, a signal indicative of when the person arrives and departs the station, wherein each of said arrival or departure results in a colored display of an indicator; and wherein the person's departure from the handwashing station optionally transmits (1) a first signal to (a) a computer, wherein the computer resets a first color on the wearable vibration and visual alert beacon indicator or (b) a first alternative signal to the hand-hygiene-monitor to reset a first color on the hand-hygiene-monitor **160** indicator, and (2) a first alternative signal to the computer, which sets an interval clock that runs, until a fixed time has elapsed, before transmitting a second signal to the hand-hygiene-monitor, which sets the hand-hygiene-monitor indicator to a second color.

In another embodiment, the hand-hygiene-monitor includes a display referred to as a "Green Mode" for a limited amount of time, after which "Vibration Mode" initiates a reminder to the wearer to wash and sanitize their hands at a washing station.

In yet another embodiment when the a wearable vibration and visual alert beacon is activated by an RFID transmitting device or receives an infrared signal, by way of example and not limitation, the hand-hygiene-monitor will initiate a signal to an automatic detergent dispensing device to allow a sanitizer to flow. Upon maintaining proximity to the washing station for an interval of time the hand-hygiene-monitor indicator resets to Green Mode.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a computer system for maintaining a sanitized facility in accordance with an embodiment of the present invention.

FIG. **2** is a computer system for maintaining a sanitized facility in accordance with an embodiment of the present invention.

FIG. **3** is a hand-hygiene-monitor **160** wearable vibration and visual alert beacon in accordance with an embodiment of the present invention.

FIG. **4** is a flow chart illustrating the sequencing of events for maintaining a sanitized facility in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

In the figures to be discussed the blocks and arrows represent functions of the process according to embodiments of the present invention which may be implemented as processors, computers, computer executable code, and/or electrical circuits and associated wires or data buses, which transport electrical signals. Alternatively, one or more associated arrows may represent communication (e.g., data flow) between software routines, particularly when the present method or apparatus of the present invention is implemented as a digital process.

As shown in FIG. **1** and FIG. **2**, system **100** is accessible to a plurality of users whose hygiene is time dependent due to their specialized work related activities, such as managers of hospitality, food handling/processing, retail industries, hospitals, emergency rooms, science and technology laboratories, child care centers, schools, maid services, and other occupations each equipped with a browser, that may include an application specific dashboard to display and control the various modes of operation as disclosed herein.

FIG. **1** and FIG. **2** illustrate system **100** in accordance with an embodiment of the present invention for stationing hand-hygiene including: a wireless wrist band **169** having one or more of a visual, audible or vibratory indicator, in communication **151** (*b*) with a computer processor **110** and a washing station **162**. The monitor **160** includes therein a first sensor **136** output signal activated when, dependent on the expiration of a timed interval, an individual wearing the wristband **169** enters a zone proximal to the monitor **160**. The entry activates a second sensor **137** output signal when the individual engages in a sanitation activity, such as washing their hands. A third sensor **138** output signal is activated when the individual departs the zone, the second sensor **137** and the third sensor **138** output remain in communication with a processor that logs data indicative that a hand-hygiene protocol has been achieved. The processor thereupon communicates with the wristband to effectuate one or more conditions: a) changing a color on the wristband visual indicator, b) changing a previous state of the wristband vibrator, and optionally c) changing a color, or d) the status of an audibly emitting a tone from one or more of the wristband, monitor, or transducer and indicators situated in other locations.

The monitor **160** may also include further an electronic clock to determine the expiration of a lapsed period of time during hand washing dependent on the worker-role of the wearer of the wristband.

The system **100** further including a timer which is programmed in computer **110**, the expiration of which is dependent on the third sensor output signal being sent to the computer processor **110** specifying when the individual must return to the monitor for a subsequent sanitation process.

The system **100** includes a local-area-network (LAN) **150** and Internet communication facility. Communications link **151**(*a*) connects computer **110** through a local network **150**, which (a) communicates **151**(*b*) with the hand-hygiene-monitor **160**, attached to a user **101** and (b) which communicates **151**(*c*) with a washing station **162** having a sanitizing dispenser.

As shown in a preferred embodiment, FIG. **1** and FIG. **2**, the system **100** includes and a cloud based network via the communication link **151** (*d*) to a remote server **190**. The LAN **150** and the Internet allow system-wide communication between the local computer **110** (which includes keyboards, inputs from remote sensing devices, and communications facilities) and output devices (which include printers, disk drives, communication facilities), each configured by software (processor executable code), hardware, firmware, and/or combinations thereof, for accumulating,

processing, administering and analyzing data, records and other information pertinent to the objects of the present invention.

"Computer," such as reference **110**, refers to a computing device that includes a processor **133**, **140**, **141**, which contain an arithmetic logic unit (ALU), which perform arithmetic and logical operations, and a control unit, which extracts instructions (e.g., software, programs or code) from memory and decodes and executes them, calling on the ALU when necessary.

A "Memory," referenced as **107**, **108** herein, refers to one or more devices capable of storing data. Memory **107**, **108** may take the form of one or more media drives, random-access memory (RAM), read-only memory (ROM), programmable read-only memory (PROM), erasable programmable read-only memory (EPROM), or electrically erasable programmable read-only memory (EEPROM) chips, by way of further non-limiting example only. Memory may be internal or external to an integrated unit including a processor or a computer. The computer may include a display, **114**, **115**, a keyboard, **116**, and a communications module, **117**, **118**.

The term "server," as used herein, generally refers to a computer or device communicatively coupled to a network that manages network resources. For example, a file server **190** is a computer and storage device dedicated to storing files, while a database server is a computer system that processes database queries. A server may refer to a discrete computing device, or may refer to the program that is managing resources rather than an entire computer.

In FIG. **1** and FIG. **2**, other hardware configurations may be used in place of, or in combination with non-transitory computer-readable mediums for execution by a processor, for example software code to implement an embodiment of the invention. The elements illustrated herein may also be implemented as discrete hardware elements. As would be appreciated, the inventive system described herein terminals for inputting data or may be a hardware configurations, such as a dedicated logic circuits, integrated circuits, Programmable Array Logic (PAL), Application Specific Integrated Circuit (ASIC), that provides known outputs in response to known inputs.

The sub-module **130**, discloses one embodiment of a washing station that incorporates hand-hygiene monitor **160**, which includes various functionality controlled via processor **133**. In one non limiting mode the processor **133** communicates with sensors **136**, **137**, **138** (referred to as first, second and third sensor, respectively) located in the hand-hygiene-monitor **160**. Electronic sensor signaling **137** also communicates with the LAN **150** via communications link **150** (*c*) in response to computer **110** communications.

Communication link **151**(*e*) represents one or more types of communication, between the dispenser function of the hand-hygiene-monitor **160**, the data dependent on proximity sensors (see FIG. **2**, **136**, **137**, **138**, which may be transmitted in various electronic forms, as for example RF, RFID and generally devices that utilize capacitance or inductive fields, or optical, as for example infrared, respectively.

There are one or more modes of communication to and from the hand-hygiene-monitor **160** having a wearable vibration and visual alert beacon, such as RF transmission, blue tooth technology, RFID or infrared. In each case both the hand-hygiene-monitor **160** and its dispenser function utilize specific technology to effectuate communications when the wearer of the wristband **169** come within an approximate distance of the monitor. In the case of blue tooth, sub-module **132** communicates with a corresponding blue tooth device (not shown) embedded in the hand-hygiene-monitor **160**, serviced by communication module **118**. Likewise an optional infrared receiver/transmitter **134** would communicate with a receiver/transmitter sub-module embedded in the hand-hygiene-monitor **160**. In similar fashion and functionality, an RFID receiver/transmitter within one non limiting embodiment communicates with a receiver/transmitter sub-module embedded in the hand-hygiene-monitor **160** via communications **118**.

When an interval of time, as established by a computer **110**, has been reached, an RF signal is received by the hand-hygiene-monitor **160**, which causes the applications module **115** in module **120** to actuate a vibrator **185**. A light in the hand-hygiene-monitor **160**, such as an LED array **187** will have been or will illuminate, such as in the color red. Upon completion of a hand washing, the vibrator **185** will cease to vibrate and the color of the light will change, such as to the color green.

In one embodiment, system **100** and process **300** (FIG. **4**) communicate with LAN system **150** configured with software to carry out the functions as detailed in FIGS. **1**, **2**, **3**, and the process detailed in FIG. **4**.

FIG. **3** further discloses one non-limiting embodiment of the electronic components incorporated in the functional module **120** that are used to effectuate the process **300** for insuring the operation of the wearable vibration and visual alert beacon **160**. A sensor element receiver is enabled via the communications **118** or independently as in the case of the RFID receiver or the infrared optical receiver. RF communications to and from the computer and the hand hygiene-monitor **160** may be received by the communications module **118**. The module **120**, also includes processor **141**, a memory **108**, programmed to control a compliance module that determines the state of the light array module **187**, the vibration transducer **185** and an optional haptic transducer **189**.

The process for insuring hand-hygiene compliance is initiated by computer **110** in the execution of various programs using proprietary or non-proprietary software and network protocols, and over other public and/or private computer networks. Furthermore, although preferred embodiments include human-machine interface displays and applets that are capable of running in standard browsers, the invention may be practiced using native human machine interface applications that run directly under the host computers' operating systems (e.g., MICROSOFT® WINDOWS® operating system, Windows NT, UNIX® operating system, macOS Apple™ operating system, LINUX® operating system, iPhones, Androids, and the like).

In one embodiment, the system FIG. **2** and an associated process **300** is shown in FIG. **4**, which includes: the wearable vibration and monitor **160** configured for physical and electronic connection to a user **101**, which communicates with computer **110**, the computer programmed to set an interval of time, i.e., a time between a start time and a stop time, wherein the start time is determined by a user event, such as the most recent handwashing and/or the initiation of a transmission by the hand hygiene module **160**, and the stop time defined by a computer programmed according to a prescribed interval period and activity of the user.

In another embodiment the system FIG. **2**, and a process **300** as shown in FIG. **4**, includes: signaling by one or more proximity sensors **136**, **137**, **138** positioned at the hand hygiene-monitor **160**, wherein the sensors are configured to provide corresponding sensor output signals when a person is within the proximity of the hand hygiene-monitor **160**. The signals are indicative of the person arriving and depart-

ing the hand hygiene-monitor **160**, wherein each of said arrival or departure times causes the hand-hygiene-monitor **160** indicator to change colors; and wherein the person's departure from the hand hygiene-monitor **160** optionally results in transmitting (1) a signal to (a) a computer, wherein the computer resets a first color on the wristband **169** light array module **187** or (b) a first alternative signaling directly to the hand-hygiene-monitor **160** light array module **187** resetting a first color on the wristband **169**; and (2) a first alternative signaling to the computer, resulting in setting an interval clock that runs, until a fixed time has elapsed, before transmitting a second signal to the wristband **169**, resulting in setting the state of the wearable vibration and visual alert light array module **187** to a second color.

In another embodiment, the system including wearable vibration and monitor **160** also includes the wearable display ini wristband **169**, wherein the light array module **187** remains in a state referred to as a "Green Mode" for a limited amount of time, after which a second state, referred to as a "Vibration Mode," initiates a reminder to the user to wash and sanitize their hands at a washing station that includes the dispenser part of the hand hygiene-monitor **160**.

In another embodiment, after remaining at the hand hygiene-monitor **160** dispenser for at least a specified amount of time, determined by a management policy programmed into to computer **110** program, a timer is reset for a subsequent specified period of time, before necessitating the utilization of the hand-hygiene-monitor **160** to notify the user of the requirement for washing its hands.

In another embodiment, if the hand-hygiene-monitor **160** light array module **187** is not reset successfully after a length of time, the light array module **187** state will change from a "Green Mode" to "Red Mode."

In yet another embodiment when the hand-hygiene-monitor **160** is activated by an RFID transmitting device or receives an infrared signal, by way of example and not limitation, then the hand-hygiene-monitor **160** will initiate a signal to an automatic detergent dispensing device to allow a sanitizer to flow. Upon maintaining proximity to the washing station for an interval of time the hand-hygiene-monitor **160** light array module **187** resets to Green Mode.

Each installation of the system **100** will allow management of a business to determine specific rules and permissions for each defined roles, responsibilities and authorizations within an organization. Representative settings would include washing intervals, lessened or heightened risk zones and active zones, as well as entry into and exit of active zones.

In another embodiment two primary types of installations are referred to as Type 1 and Type 2: the former designating users who would not be anticipated to contact food and the latter users having contact with food as a primary function. By way of example, a Front of House Type 1 may be at a retail location or at a check in/check out desk at a hotel. Management could further have defined rules as managers, clerks and custodial workers. Food & Beverage Type 2 may exist at a restaurant, hotel or cruise ship. Varying defined roles could include food handlers, servers, bartenders, bussers/food-runners hostesses and dishwashers.

As shown in FIG. **4**, a Phase 1 Green Mode **210** would be adjustable for each role. For example, a check-in clerk in a hotel or cashier in a retail organization may be assigned to wash their hands every 30 minutes for 20 seconds. Whereas a food server in a restaurant may be required to wash their hands every 20 minutes for 20 seconds. While the hand-hygiene-monitor **160** is in Mode **210**, it would indicate or emit a green light visible to the wearer and anyone within an approximate distance, such as 25 feet.

A Phase 2 Alert Mode+Pulse **217** may be optionally adjustable for each role and this would be the mode, within which the hand-hygiene-monitor **160** would display the green light plus emit a vibration to alert the wearer that they have entered into a predefined countdown mode. By way of example and not limitation, a wearer may have 2 minutes to wash hands and upon a successful hand washing sequence as determined by the system, the hand-hygiene-monitor **160** returns to Phase 1 Green Mode **210**.

A Phase 3 RED Mode+Vibrate **216**, may optionally be utilized where the hand-hygiene-monitor **160** displays a red light and the vibrator **185** vibrates constantly notifying user that they must proceed directly to a hand washing station before contact with any surfaces or other individuals. Upon a successful hand washing sequence the hand-hygiene-monitor **160** light array module **187** and vibrator **185** would return to the Phase 1 Green Mode **210**.

In most applications there would be at least two risk zones a Level I **213** and Level II **212**. By way of example, and not limitation, an interior garbage receptacle or food storage area or Level II **212** risk zone, exit/entry to premises, a lavatory or laboratory, each having a proximity sensor **139** (see, FIG. **2**). By way of another example, if a wearer of the inventive device exited a restaurant, either front entry or rear, and accessed a dumpster, then as soon as they re-entered the premises, there would be an automatic activation of Mode **216**

In a further overview, the process **300** is carried out via a program, which includes code for establishing risk zones defined by remote proximity sensors installed in the zones. By way of example, and not limitation, the process and associated code initiates queries if the wearer of a wristband **169** is in a level 1 zone, and if the wearer is in a level 1 zone then a more fully described below, initiating a phase II alert mode that allows the processor to send a vibration pulse. In yet another non limiting example, the process **300** and associated code determines the passage of an interval of time\, whereupon the processor initiates a query communicated to a hand sanitation compliance module, and if the compliance is returned as negative, then the wearer of the wristband **169** is notified as to its entry into a Phase III alert mode by the vibration of a vibrator embedded in the wristband.

To expand on the foregoing, the system and associated process establishes such risk zones, such as by way of example, the Level I **213** risk zones where remote proximity sensors **139** (FIG. **1**) are installed in the zones. At decision point **213** the process **300** queries if the user **101** is in a level 1 zone, and if they are then, a phase II alert mode with vibration pulse **217** is initiated. After an interval of time determined by a set time **219**, a query is made as to hand sanitation compliance **214**. If the compliance is negative or NO, then the user **101** enters the Phase III alert mode with vibration **216**. I the user **101** is compliant at **214**, then the user **191** reverts to the state at **210**.

These proximity sensors upon contact with the hand-hygiene-monitor **160**, would communicate directly with the computer **110** or via the hand-hygiene-monitor **160**. The communication triggers the hand-hygiene-monitor **160** to initiate a Phase 2 Alert Mode+Pulse **217**. By way of example and not limitation, a Level I **213** risk zone could be a sanitation area within a building. Dropping something in a garbage can would not activate P2AM+P **217**, but moving the garbage can away from a sensor would activate the Mode **217**, but still allow the user ample time to exit the building

or to a reach a sanitization station, such as dispenser **162** without triggering the Mode **216**.

In another embodiment Level II **212** risk zones, would represent Fail Safe Zones where the proximity sensors **139** automatically trigger the Mode **216** state forcing a wristband **169** wearer to proceed directly to a hand-hygiene-monitor **160**; and upon completion of a successful hand washing sequence, the hand-hygiene-monitor **160** would receive a signal to return to Phase 1 Green Mode **210**.

A Visual AZ is defined as any area that after a validated completion of a handwashing event, a Visual Confirmation or feedback response would be initiated. By way of example and not limitation, any location, such as a guest at dining room table, when a customer may depart the table. The table and associated seating area would be (1) cleaned, (2) with a sanitizer and (3) by the user **101**. When the sanitization process completes (1,2,3), the hand-hygiene monitor **160** would send a signal to the computer **110** to send a signal to illuminate the under-lighting at the table. The lighting would visually indicate to observers, such as a hostess and approaching customers that that the table and area have been sanitized. The process optionally would synchronize the user **101** wristband **169** and hand-hygiene-monitor **160** associated with the particular table, and/or send an indication to the computer **110** or remote server **190** that the table is ready for seating of guests. Other such applications may include analogous maid services in cleaning hotel rooms, bathrooms, maintenance of hospital facilities, surgical centers, and laboratories.

In one embodiment a Non-Visual mode is defined as any area or section that only indicates status to a computer **110** programmed dashboard, and not a visual indicator at a particular table, area or section. By way of example and not limitation, a bar with seating for 20 customers, includes a section timer and/or one or more motion sensors visible on a computer programmed dashboard visible to a bartender, bar-back, busser, hostess or manager. A Green (Sanitization Event Completed within Time Parameter), Yellow (Guest Seated) and Red (Time Parameter Exceeded) Dashboard could alert, approved users **101** triggering a required job function with hand-hygiene-monitor **160** message "Sanitize Section 6 of Main Bar."

In another embodiment a Permission Based Zone includes, by way of example, a dishwashing station where only a busser or steward is authorized to enter the sanitized side of a dishwashing station, if a user is in Phase 1 Green Mode **210**, if a Non Approved User/Role/Phase triggers Permission Based Violation, a user Immediately enters Mode **216**, Dashboard is alerted, the incident is tracked, management is alerted with a message for example, "Dishwash Area Sanitization Chain Violated," as by way of example, "John Smith Not Approved."

Again, referring to FIG. **4**, the process **300** is performed by the system described in FIG. **2**, wherein the operation of the sequencing of events may be distributed among the computer **110**, the hand-hygiene-monitor **160** processors **133**, **140** and **141** respectively. Note as previously described, sub-module **130** discloses one non limiting embodiment of the invention, which includes various functionality controlled via processor **133**. The process **300** starts at step **202**, by dispensing a sanitizer, step **204**, in the presence of a user **101** (FIG. **1**) wearing wristband **169**.

Until the passage of a fixed period of time, compliance step **208** is unsatisfied and the loop **202**, **204**, **206** **208**, **212**, **216** operates continuously.

Following compliance, for a fixed interval of time by way of example the user **101** enters Phase 1—Green Mode **210**. The amount of time is predetermined by a User Defined Parameter set by management policy.

If Level 1 **213** Risk Zone, indicates Yes, then the user enters Phase 2—Alert Mode+Pulse **217**. If "Yes," then the user enters Phase 2—Alert Mode+Pulse Mode **217**. The user **101** must then initiate a hand washing sanitization sequence within the User Defined Parameter. Upon compliance, based on a preset time **219** or automatically, the user **101** returns to P1GM. If at Level 1 the indication is NO, then the user enters Phase 2—Alert Mode+Pulse, step **215**. If User initiates handwashing within User Defined Parameter preset time it returns to Mode **210**. If User does not initiates handwashing within User Defined Parameter, determined at decision point **214**, then the user **101** reverts Phase 3—Red Mode+Vibrate, step **216**. User must then initiate handwashing immediately to return to Phase 1 Mode **210**.

If user does not trigger any Risk Zones, the user enters Phase 2 for a predetermined User Defined Parameter and prior to expiration of that User Defined Parameter. Upon a visual alert the user must initiate hand washing or the system automatically enters Phase 3—Red Mode+Pulse step **216**. If user initiates handwashing within User Defined Parameter, a preset visual alert returns to Mode **210**.

Still another feature of the invention allows for conventional modes of computer **110** communications such as by way of example: traditional email, texting and in program chat. Traditional email allows for the user (or staff member) to communicate with an individual outside of the program such as other managers or corporate management. This feature allows for the attachment of certain records from the repository, as regards compliance. An example may be to send a specific record for further discussion, or to schedule training.

In still another embodiment, the invention contains a 'task' management feature, which serves multiple purposes. Tasks may be manually entered, and this allows managers access to a dashboard of sanitizing related activities and tasks displayed by the visual presentation.

While the foregoing invention has been described with reference to the above embodiments, additional modifications and changes can be made without departing from the spirit of the invention.

We claim:

1. A system for hand-hygiene comprises:

a wireless wristband having one or more of a visual, audible or vibratory indicator, in communication with a processor and a hand hygiene monitor, the monitor having therein a first sensor output signal activated when an individual wearing the wristband enters an entered zone of a plurality of zones, the entered zone proximal to the monitor; and a second sensor output signal activated when the individual engages in a sanitation activity, and a third sensor output signal when the individual departs the entered zone, the second sensor and the third sensor output in communication with the processor that logs data indicative that a hand-hygiene protocol has been achieved, and whereupon the processor communicates with the wristband to effectuate one or more conditions: a) changing a color on the wristband visual indicator, b) changing a previous state of the wristband vibrator, and optionally c) changing the color on the wristband visual indicator, or d) emitting a tone from one or more of the wristband, monitor, or an audible or a vibratory transducer situated in other locations, wherein:

the plurality of zones are each assigned to one of multiple risk zones, the multiple risk zones each associated with a risk level associated with a respective zone;

an alert is activated upon an expiration of a timed interval or upon entry of the wristband into a predefined zone of the plurality of zones;

a type of the alert is assigned based on the risk level associated with the predefined zone; and

the one or more conditions are dependent the risk level associated with entered zone.

2. The system in claim **1** further including a timer, wherein the timer counts down a timed interval, the timed interval based on a predetermined time from when the individual engaged in a previous sanitation activity to signal when the individual must return to the monitor for a subsequent sanitation process.

3. A process for controlling an operation of a wearable wristband having therein a vibrator and visual alert comprises:

enabling a wearable transceiver of the wearable wristband to establish an electronic or optical communication between one or more sensors of the wearable wristband and a computer;

activating an alert, the alert being at least one of the vibrator and the visual alert, upon an expiration of a timed interval or upon entry of the wearable wristband into a predefined zone of a plurality of defined zones;

assigning each of the plurality of defined zones to one of multiple risk zones, the multiple risk zones each associated with a risk level associated with a respective zone;

assigning a type of the alert based on the risk level associated with the predefined zone;

dependent on a proximity of a wearer of the wristband to a hand hygiene monitor, automatically dispensing a sanitizing agent to the wearer of the wristband;

deactivating the state of at least one of the vibrator and the visual alert; and

resetting the timed interval after the wearer is detected being proximate to the hand hygiene monitor.

4. The process in claim **3** wherein the timed interval is dependent on a worker-role of the wearer of the wristband.

5. The process in claim **3** further including turning on a light visible to the wristband wearer and others within a prescribed distance.

6. The process in claim **3** further including turning on a colored light and a vibration alert dependent on a worker-role of the wearer of the wristband as upon entry to the predefined zone that initiates a predefined countdown mode, prior to dispensing a sanitizing agent.

7. The process in claim **3** further including a predefined countdown mode that allows, dependent on a worker-role, a fixed time to sanitize hands, the fixed time based on a prior hand washing sequence performed by the wearer.

8. The process in claim **3** further including a hand washing sequence dependent on a worker-role of the wearer of the wristband.

9. The process in claim **3** further including, dependent on a worker-role of the wearer, alerting the wearer of the wristband by emitting a first colored light and vibration of the wristband indicating that the wearer must proceed to a washing station before further contacting food, surfaces or other individuals.

10. The process as in claim **3**, including code for establishing at least two hygiene risk zones.

11. The process as in claim **3**, including establishing the predefined zones defined by remote proximity sensors installed in the predefined zones.

12. The process as in claim **3**, including initiating one or more queries if the wearer of a wristband is in a level 1 zone, and if the wearer is in a level 1 zone then initiating a phase II alert mode that generates a vibration pulse in the wearable wristband.

13. The process as in claim **3**, including determining the passage of an interval of time, whereupon initiating a query communicated to a hand sanitation compliance module, and if compliance is negative, then the wearer of the wristband is notified as to its entry into a Phase III alert mode by vibration of the vibrator embedded in the wristband.

14. A non-transitory computer-readable medium for execution by a processor comprising code for:

maintaining hand-hygiene by controlling an operation of a wearable vibration and visual alert including: the processor, a memory, and a program for enabling one or more sensors and a wearable transceiver for establishing one of electronic or optical communication between the processor, a hand hygiene monitor and the wearable transceiver for controlling one or more of: 1) a light array, 2) a haptic transducer;

wherein one or more sensors are positioned at the hand hygiene monitor, each of the sensors configured to provide an output signal according to an individual's entry into an entered zone, of a plurality of zones, establishing a proximity to the hand hygiene monitor, the signal indicating a time the individual enters and departs the entered zone, wherein each of said zone entry or departure of the individual from the entered zone initiates a visual indicator; and optionally transmitting one or more signals when the individual departs from the entered zone to: (1) to alert the processor to reset one or more of: a) a color on the visual indicator, b) a vibrator; c) to reset a color on the hand-hygiene-monitor indicator; (2) to alert the processor to initiate an interval clock that operates for a preset time, prior to transmitting a signal to the hand-hygiene-monitor, which sets the hand-hygiene-monitor indicator to an alternative color, wherein:

the plurality of zones are each assigned to one of multiple risk zones, the multiple risk zones each associated with a risk level associated with a respective one of the plurality of zones;

the one or more conditions are dependent the risk level associated with entered zone;

an alert is activated upon an expiration of a timed interval or upon entry of the wristband into a predefined zone of the plurality of zones; and

a type of the alert is assigned based on the risk level associated with the predefined zone.

15. The non-transitory computer-readable medium for execution by a processor as in claim **14**, including code for initiating queries if the wearer of a wristband is in a level I zone, and if the wearer is in a level I zone then then, initiating a phase II alert mode that allows the processor to send a vibration pulse.

16. The non-transitory computer-readable medium for execution by a processor as in claim **14**, including code for determining the passage of an interval of time, whereupon initiating a query communicated to a hand sanitation compliance module, and if the compliance is negative, then the wearer of the wristband is notified as to its entry into a Phase III alert mode by the vibration of a vibrator embedded in the wristband.

17. The non-transitory computer-readable medium for execution by a processor as in claim 14, including code for initiating sending a signal to the processor to illuminate under-lighting at a specific location.

18. The non-transitory computer-readable medium for execution by a processor as in claim 14, including code for initiating a section timer and one or more of motion sensors visible on a computer programmed dashboard visible to other employed personnel.

19. The non-transitory computer-readable medium for execution by a processor as in claim 14, including code for initiating sending a signal to a dishwashing station to limit only a busser or steward as authorized personnel to enter a sanitized side of a dishwashing station.

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