US007657384B1

(12) **United States Patent**
Moses

(10) **Patent No.: US 7,657,384 B1**
(45) **Date of Patent: Feb. 2, 2010**

(54) **MANAGEMENT OF RESPONSE TO TRIGGERING EVENTS IN CONNECTION WITH MONITORING FUGITIVE EMISSIONS**

(75) Inventor: **Rex Moses**, Nassau Bay, TX (US)

(73) Assignee: **Environmental Analytics, Inc.**, Nassau Bay, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/692,764**

(22) Filed: **Mar. 28, 2007**

(51) **Int. Cl.**
G01N 30/00 (2006.01)
G06F 17/00 (2006.01)

(52) **U.S. Cl.** **702/24**; 702/23; 702/22; 702/26; 422/83; 422/94

(58) **Field of Classification Search** 702/24, 702/23, 22, 26
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,603,235 A * 7/1986 Crabbe, Jr. 379/290
5,099,437 A * 3/1992 Weber 702/187
5,206,818 A * 4/1993 Speranza 702/24
5,432,095 A * 7/1995 Forsberg 436/154
5,479,359 A * 12/1995 Rogero et al. 702/24
5,563,335 A * 10/1996 Howard 73/46
6,345,234 B1 * 2/2002 Dilger et al. 702/24
6,478,849 B1 11/2002 Taylor et al.
6,672,129 B1 1/2004 Frederickson et al.
6,722,185 B2 * 4/2004 Lawson et al. 73/40
7,017,386 B2 3/2006 Liu et al.
7,136,904 B2 11/2006 Bartek et al.
7,298,279 B1 * 11/2007 Badon et al. 340/605
7,369,945 B2 5/2008 Miller et al.
7,588,726 B1 * 9/2009 Mouradian et al. 422/83
2002/0178789 A1 * 12/2002 Sunshine et al. 73/31.06
2003/0012696 A1 1/2003 Millancourt
2003/0081214 A1 5/2003 Mestha et al.
2004/0005715 A1 * 1/2004 Schabron et al. 436/104
2004/0011421 A1 * 1/2004 Bartlett et al. 141/94
2004/0204915 A1 * 10/2004 Steinthal et al. 702/188
2004/0226345 A1 11/2004 McCoy et al.
2004/0258213 A1 12/2004 Beamon et al.
2005/0286927 A1 * 12/2005 Brenner 399/91
2006/0020186 A1 1/2006 Brister et al.
2006/0246592 A1 * 11/2006 Hashmonay 436/57
2008/0120043 A1 5/2008 Miller et al.

OTHER PUBLICATIONS

"2nd Annual Fugitive Emissions—Leak Detection and Repair Symposium"; ISA Technical Conference Brochure; Nov. 2002.
"Introducing the Allegro CX(TM) Field Computer"; Product Newswire (product announcement); Jun. 21, 2004.

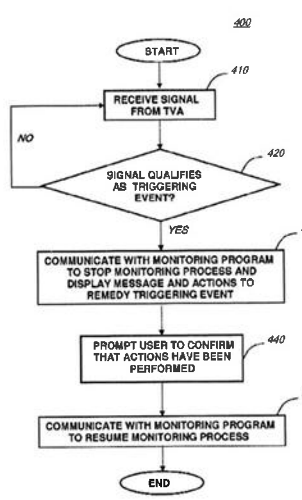
(Continued)

Primary Examiner—Hal D Wachsman
(74) *Attorney, Agent, or Firm*—Pramudji Wendt & Tran, LLP; Ari Pramudji

(57) **ABSTRACT**

Method for managing a response to a triggering event in connection with a fugitive emissions monitor of a component. In one implementation, the method may include determining whether an input is a triggering event. If the input is a triggering event, then a message regarding the triggering event and one or more actions to remedy the triggering event may be displayed. The method may further include displaying one or more queries to confirm that the actions have been completed.

16 Claims, 5 Drawing Sheets



OTHER PUBLICATIONS

"New from Accutech, Wireless Acoustic Monitor Field Units Make Fugitive Emissions Monitoring Compliance Easy"; Product Announcement/Description; Feb. 10, 2004.

"LDARManager™ Makes Fugitive Emission Monitoring A Breeze TISCOR launches its newest product for Leak Detection and Repair"; product announcement/description; Nov. 8, 2002.

Environmental Analytics, Inc. v. *TMX2, Inc. and LDAR Solutions, Ltd.*; Case 4:08-cv-03353; USDC, Southern District of Texas; First Amended Complaint; Dec. 10, 2008.

Office Action (Aug 4, 2009); U.S. Appl. No. 12/032,499 (Moses, et al).

* cited by examiner

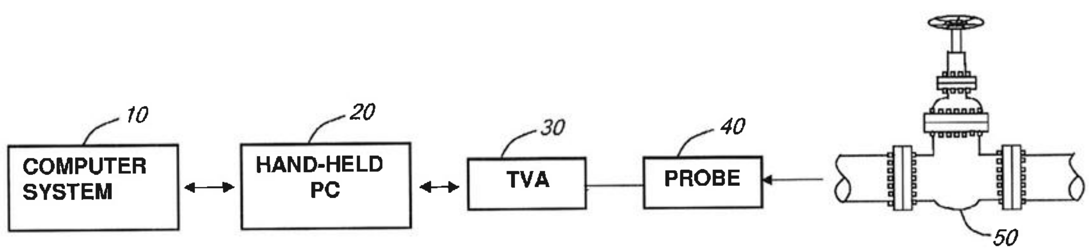
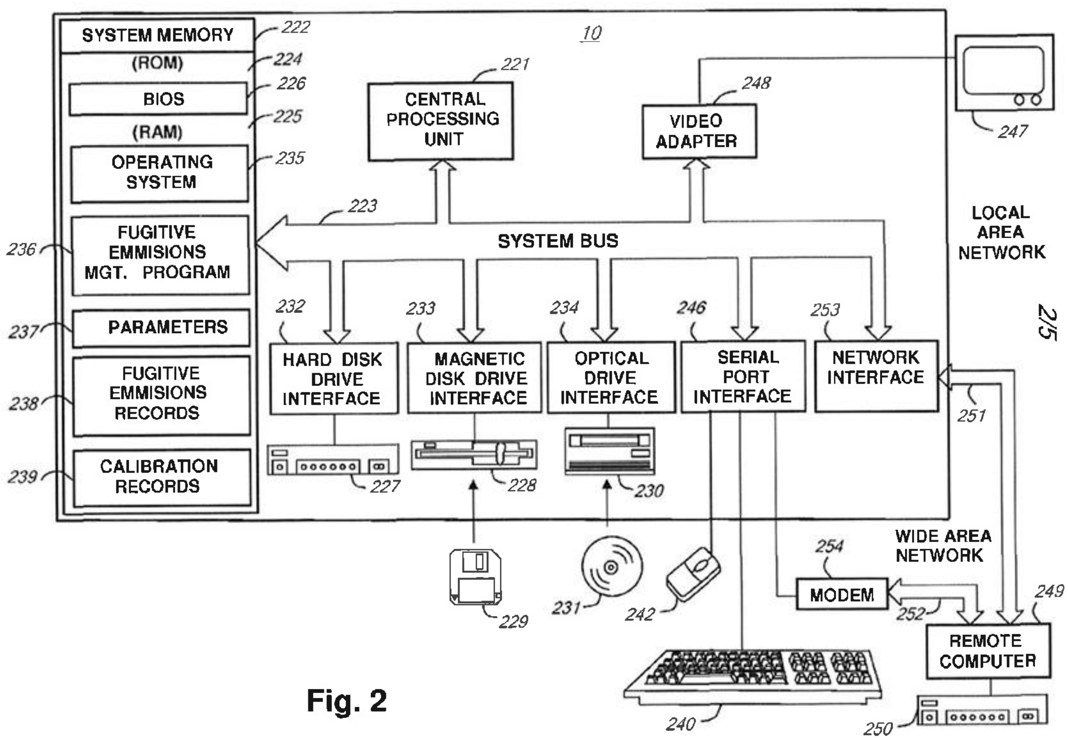


Fig. 1



SYSTEM MEMORY
222
10
(ROM)
224
BIOS
226
(RAM)
225
OPERATING SYSTEM
235
CENTRAL PROCESSING UNIT
221
VIDEO ADAPTER
248
247
FUGITIVE EMMISIONS MGT. PROGRAM
236
223
SYSTEM BUS
LOCAL AREA NETWORK
PARAMETERS
237
FUGITIVE EMMISIONS RECORDS
238
CALIBRATION RECORDS
239
232
233
234
246
253
HARD DISK DRIVE INTERFACE
MAGNETIC DISK DRIVE INTERFACE
OPTICAL DRIVE INTERFACE
SERIAL PORT INTERFACE
NETWORK INTERFACE
251
227
228
230
229
231
242
WIDE AREA NETWORK
254
MODEM
252
249
REMOTE COMPUTER
240
250

Fig. 2

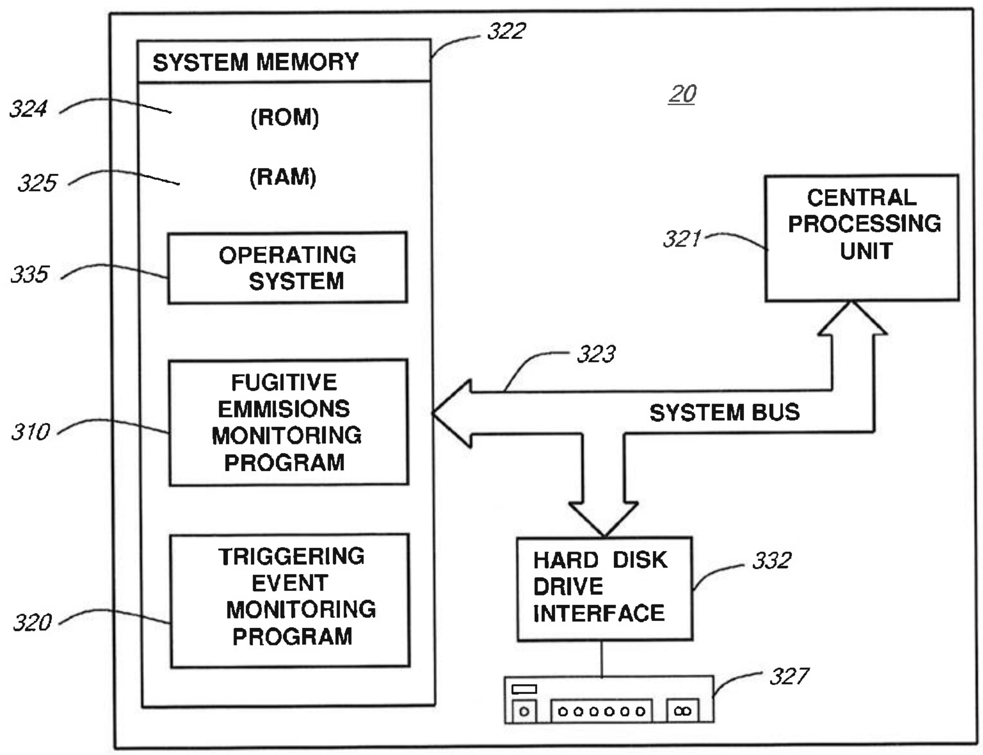

322
SYSTEM MEMORY
20
324
(ROM)
325
(RAM)
CENTRAL PROCESSING UNIT
321
335
OPERATING SYSTEM
323
FUGITIVE EMMISIONS MONITORING PROGRAM
SYSTEM BUS
310
TRIGGERING EVENT MONITORING PROGRAM
HARD DISK DRIVE INTERFACE
332
320
327

Fig. 3

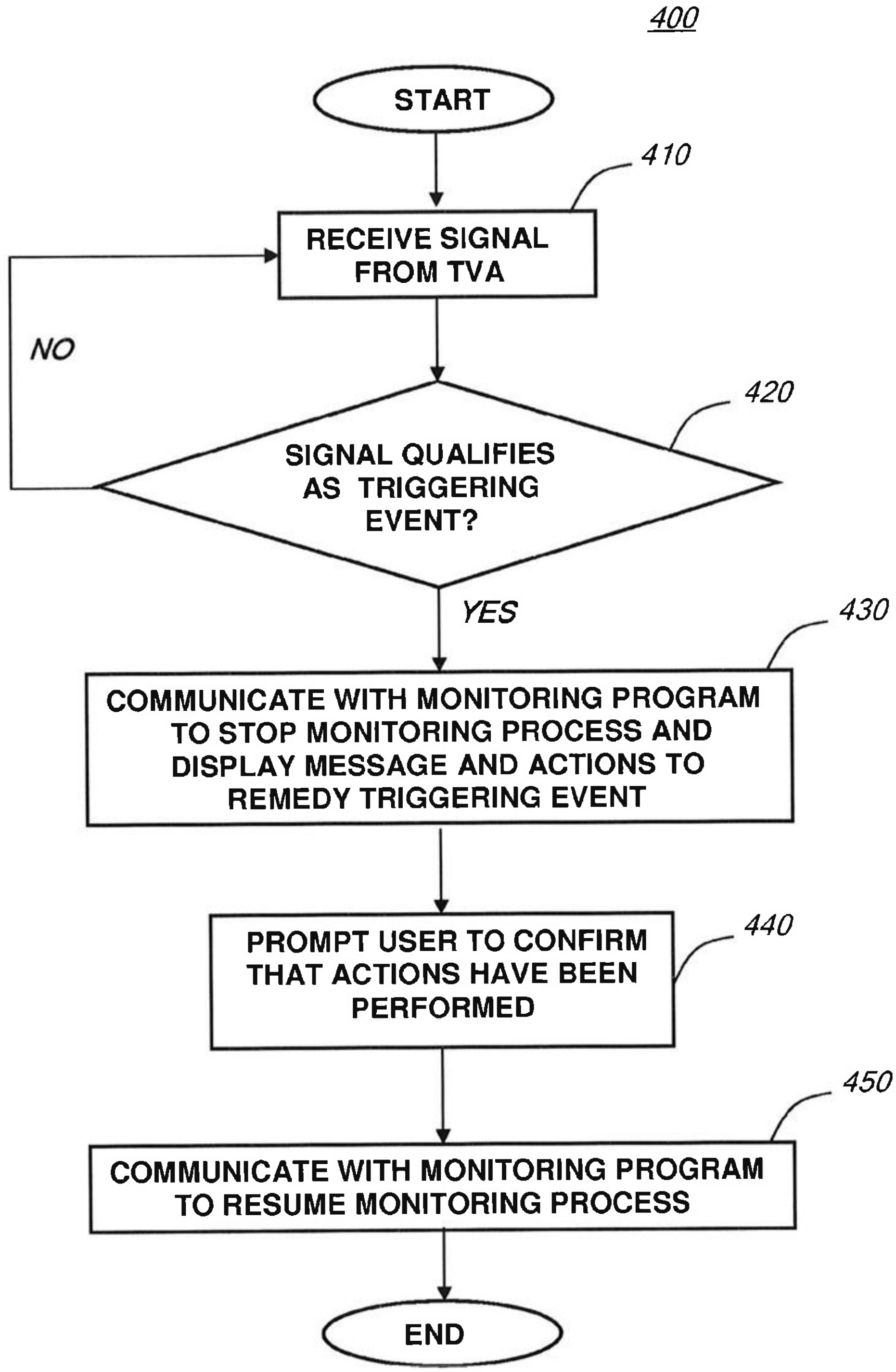

400
START
410
RECEIVE SIGNAL FROM TVA
NO
420
SIGNAL QUALIFIES AS TRIGGERING EVENT?
YES
430
COMMUNICATE WITH MONITORING PROGRAM TO STOP MONITORING PROCESS AND DISPLAY MESSAGE AND ACTIONS TO REMEDY TRIGGERING EVENT
440
PROMPT USER TO CONFIRM THAT ACTIONS HAVE BEEN PERFORMED
450
COMMUNICATE WITH MONITORING PROGRAM TO RESUME MONITORING PROCESS
END

Fig. 4

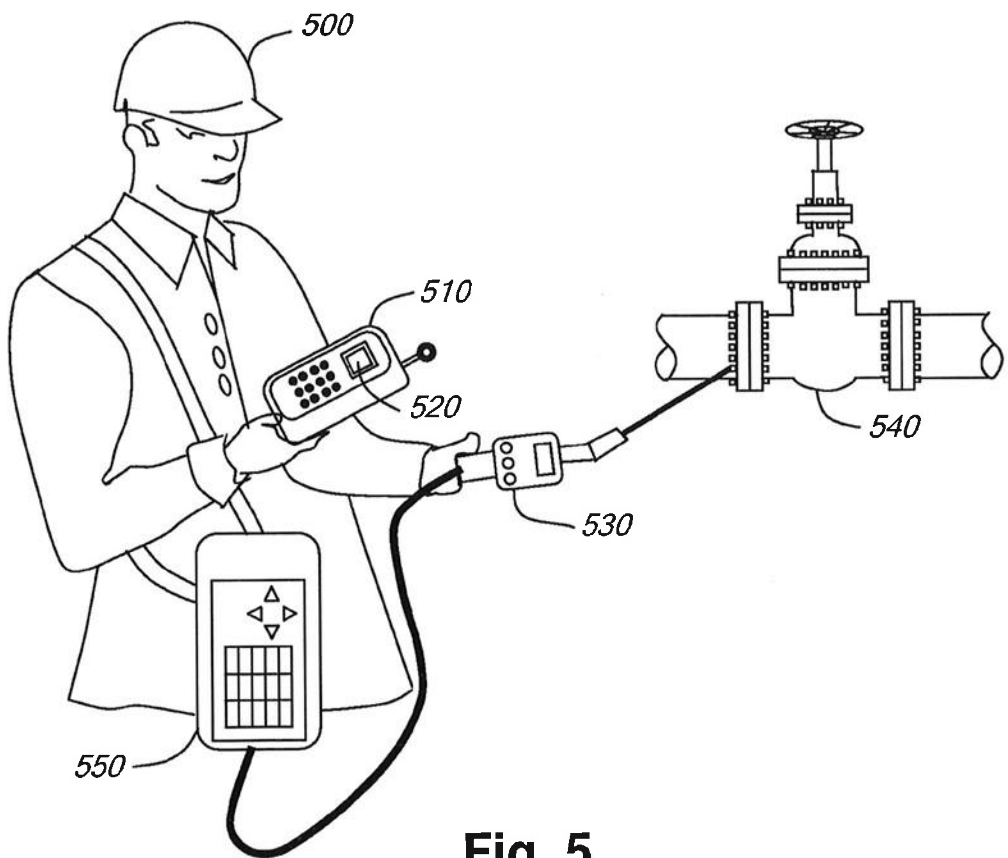


Fig. 5

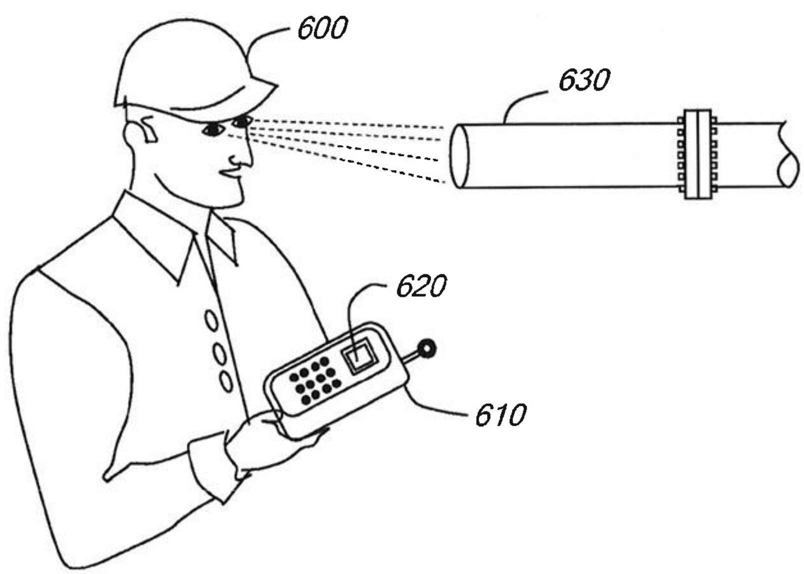


Fig. 6

MANAGEMENT OF RESPONSE TO TRIGGERING EVENTS IN CONNECTION WITH MONITORING FUGITIVE EMISSIONS

BACKGROUND

1. Field of the Invention

Implementations of various technologies described herein generally relate to monitoring fugitive emissions and management of response to triggering events in connection with monitoring fugitive emissions.

2. Description of the Related Art

Industrial plants that handle volatile organic compounds (VOCs) sometimes experience unwanted emissions of those compounds into the atmosphere from point sources, such as smokestacks, and non-point sources, such as valves, pumps, and/or vessels containing the VOCs. Emissions from non-point sources typically occur due to leakage of the VOCs from joints and/or seals and may be referred to herein as "fugitive emissions". Fugitive emissions from control valves typically occur as leakage through the packing set around the valve stem. Control valves used in demanding service conditions involving large temperature fluctuations and frequent movements of the valve stem commonly suffer accelerated deterioration of the valve stem packing set.

The United States Environmental Protection Agency (EPA) has promulgated regulations specifying maximum permitted leakage of certain hazardous air pollutants, such as benzene, toluene, 1,1,1-trichloroethane, from certain components, e.g., control valves, pump seals, compressor agitators, valves, pipe connectors and the like. As such, the regulations require facility operators to perform periodic surveys of the emissions from these components. The survey interval frequency may be monthly, quarterly, semiannual, or annual. If the facility operator can document that a certain percentage of the components with excessive leakage are below a prescribed minimum, the required surveys become less frequent. Thus, achieving a low percentage of leaking valves reduces the number of surveys required per year, which may result in large cost savings.

In addition to conducting the surveys, facility operators may be required to comply with an array of regulatory, safety and commercial parameters. For example, facility operators may be required to repair identified leaks on the components and generate reports with proper codes in compliance regulatory, safety and commercial parameters. As another example, facility operators may be required to maintain proper calibration on the toxic vapor analyzers used to monitor the leakage. Most, if not all, of the surveys and compliance are typically performed manually by technicians. Unfortunately, due to the wide array of compliance parameters, some of these parameters are often not met.

SUMMARY

Implementations of various technologies described herein are directed to a method for managing a response to a triggering event in connection with a fugitive emissions monitor of a component. In one implementation, the method may include determining whether an input is a triggering event. If the input is a triggering event, then a message regarding the triggering event and one or more actions to remedy the triggering event may be displayed. The method may further include displaying one or more queries to confirm that the actions have been completed.

In another implementation, the method may include receiving a signal from a toxic vapor analyzer for analyzing fugitive emissions, determining whether the signal qualifies as a triggering event, and displaying one or more actions to remedy the triggering event.

In yet another implementation, the method may include receiving an input based on an observation of a component being monitored for fugitive emissions or the environment surrounding the component, determining whether the input qualifies as a triggering event, and displaying one or more actions to remedy the triggering event.

In still another implementation, the method may include monitoring an amount of time that that has lapsed during the fugitive emissions monitor, determining whether the amount of time that has lapsed exceeds a predetermined value, and displaying a message indicating that the amount of time that has lapsed has exceeded the predetermined value, if the amount of time that has lapsed has exceeded the predetermined value.

In still yet another implementation, the method may include measuring a temperature of an environment in which the component is disposed, determining whether the measured temperature qualifies as a triggering event, and if the measured temperature qualifies as a triggering event, then displaying a message indicating the triggering event and one or more actions to remedy the triggering event.

In still another implementation, the method may include receiving a signal from the toxic vapor analyzer, determining whether the toxic vapor analyzer is in condition ready to be used based on the signal, and if the toxic vapor analyzer is not in condition ready to be used, then displaying one or more actions to be taken to put the toxic vapor analyzer in condition ready to be used.

The above referenced summary section is provided to introduce a selection of concepts in a simplified form that are further described below in the detailed description section. The summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter. Furthermore, the claimed subject matter is not limited to implementations that solve any or all disadvantages noted in any part of this disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

Implementations of various technologies will hereafter be described with reference to the accompanying drawings. It should be understood, however, that the accompanying drawings illustrate only the various implementations described herein and are not meant to limit the scope of various technologies described herein.

FIG. **1** illustrates a schematic diagram of an environment in which various technologies and techniques described herein may be implemented.

FIG. **2** illustrates a schematic diagram of a computer system that may be used in connection with implementations of various technologies described herein.

FIG. **3** illustrates a schematic diagram a handheld PC in which various technologies and techniques described herein may be implemented.

FIG. **4** illustrates a flow diagram of a method for managing a response to a triggering event in connection with a fugitive emissions monitor in accordance with implementations of various technologies and techniques described herein.

FIG. **5** illustrates a schematic diagram of a technician using a handheld PC having the triggering event monitoring program that operates in accordance with one implementation described with reference to FIG. **4**.

FIG. 6 illustrates a schematic diagram of a technician using a handheld PC having the triggering event monitoring program that operates in accordance with another implementation described with reference to FIG. 4.

DETAILED DESCRIPTION

The discussion below is directed to certain specific implementations. It is to be understood that the discussion below is only for the purpose of enabling a person with ordinary skill in the art to make and use any subject matter defined now or later by the patent "claims" found in any issued patent herein.

The following paragraphs generally describe one or more implementations of various techniques directed to managing a response to a triggering event in connection with a fugitive emissions monitor. In one implementation, a user, such as a technician, may use a probe to obtain an air sample from a component. The air sample may be transferred to a toxic vapor analyzer (TVA), which may then analyze, determine a parts per million (PPM) level corresponding to the air sample, convert the PPM level to a binary signal and send the signal to a handheld personal computer (PC), which contains a triggering event monitoring program. The triggering event monitoring program may then determine whether the binary signal qualifies as a triggering event. If it does, then the even monitoring program will display a message on the handheld PC indicating the triggering event and the steps that need to be taken to remedy the triggering event.

The various technologies and techniques for managing a response to a triggering event in connection with a fugitive emissions monitor in accordance with various implementations are described in more detail with reference to FIGS. 1-6 in the following paragraphs.

FIG. 1 illustrates an environment 100 in which various technologies and techniques described herein may be implemented. The environment 100 includes a computer system 10 that may include various applications and/or programs for managing and storing information pertaining to fugitive emissions detection. The computer system 10 will be described in more detail with reference to FIG. 2. The computer system 10 may be in communication with a handheld personal computer (PC) 20, which may commonly be referred to as a personal digital assistant (PDA). The handheld PC 20 will be described in more detail with reference to FIG. 3. In one implementation, the computer system 10 may be in communication with the handheld PC 20 through a wireless network, which may include Bluetooth technology, Spread Spectrum, Broadband, Wi-Fi and the like.

The handheld PC 20 may be in communication with a toxic vapor analyzer (TVA) 30, which may be configured to detect volatile organic chemicals, emissions gases, nitroaromatics, chemical warfare agents and the like. In one implementation, the TVA 30 is TVA-1000 available from The Foxboro Company out of Massachusetts, USA. However, it should be understood that some implementations may use other types of TVA's. The TVA 30 may include a probe 40 for receiving an air sample from a component 50, such as control valves, pump seals and the like. The TVA 30 may be in communication with the handheld PC 20 through a wireless network, which may include Bluetooth technology, Spread Spectrum, Broadband, Wi-Fi and the like.

FIG. 2 illustrates the computer system 10 in more detail in accordance to implementations of various technologies described herein. The computer system 10 may include a central processing unit (CPU) 221, a system memory 222 and a system bus 223 that couples various system components including the system memory 222 to the CPU 221. Although only one CPU is illustrated in FIG. 2, it should be understood that in some implementations the computer system 10 may include more than one CPU. The system bus 23 may be any of several types of bus structures, including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. By way of example, and not limitation, such architectures include Industry Standard Architecture (ISA) bus, Micro Channel Architecture (MCA) bus, Enhanced ISA (EISA) bus, Video Electronics Standards Association (VESA) local bus, and Peripheral Component Interconnect (PCI) bus also known as Mezzanine bus. The system memory 222 may include a read only memory (ROM) 224 and a random access memory (RAM) 225. A basic input/output system (BIOS) 226, containing the basic routines that help transfer information between elements within the computer system 10, such as during start-up, may be stored in the ROM 224.

The computer system 10 may further include a hard disk drive 227 for reading from and writing to a hard disk, a magnetic disk drive 228 for reading from and writing to a removable magnetic disk 229, and an optical disk drive 230 for reading from and writing to a removable optical disk 231, such as a CD ROM or other optical media. The hard disk drive 227, the magnetic disk drive 28. and the optical disk drive 230 may be connected to the system bus 223 by a hard disk drive interface 232, a magnetic disk drive interface 233, and an optical drive interface 234, respectively. The drives and their associated computer-readable media may provide nonvolatile storage of computer-readable instructions, data structures, program modules and other data for the computer system 10.

Although the computer system 10 is described herein as having a hard disk, a removable magnetic disk 229 and a removable optical disk 231, it should be appreciated by those skilled in the art that the computing system 100 may also include other types of computer-readable media that may be accessed by a computer. For example, such computer-readable media may include computer storage media and communication media. Computer storage media may include volatile and non-volatile, and removable and non-removable media implemented in any method or technology for storage of information, such as computer-readable instructions, data structures, program modules or other data. Computer storage media may further include RAM, ROM, erasable programmable read-only memory (EPROM), electrically erasable programmable read-only memory (EEPROM), flash memory or other solid state memory technology, CD-ROM, digital versatile disks (DVD), or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store the desired information and which can be accessed by the computer system 10. Communication media may embody computer readable instructions, data structures, program modules or other data in a modulated data signal, such as a carrier wave or other transport mechanism and may include any information delivery media. The term "modulated data signal" may mean a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media may include wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, RF, infrared and other wireless media. Combinations of any of the above may also be included within the scope of computer readable media.

A number of program modules may be stored on the hard disk, magnetic disk 229, optical disk 231, ROM 224 or RAM 225, including an operating system 235, a fugitive emissions management program 236, fugitive emissions parameters

237, fugitive emissions recordings 238 and calibration records 239. The operating system 35 may be any suitable operating system that may control the operation of a networked personal or server computer, such as Windows® XP, Mac OS® X, Unix-variants (e.g., Linux® and BSD®), and the like. The fugitive emissions management program 236 may be configured to manage the fugitive emissions parameters 237, the fugitive emissions recordings 238 and the calibration records 239. The fugitive emissions parameters 237 may be based on client specifications, safety hazards parameters, risk management parameters and regulatory/compliance protocols. The calibration records 239 may include calibration records for TVA's.

A user may enter commands and information into the computer system 10 through input devices such as a keyboard 240 and pointing device 242. The input devices may be connected to the CPU 221 through a serial port interface 246 coupled to system bus 223, but may be connected by other interfaces, such as a parallel port, game port or a universal serial bus (USB). A monitor 247 or other type of display device may also be connected to system bus 223 via an interface, such as a video adapter 248.

Further, the computer system 10 may operate in a networked environment using logical connections to one or more remote computers, such as a remote computer 249. Although the remote computer 249 is illustrated as having only a memory storage device 250, the remote computer 249 may include many or all of the elements described above relative to the computer system 10. The logical connections may be any connection that is commonplace in offices, enterprise-wide computer networks, intranets, and the Internet, such as local area network (LAN) 251 and a wide area network (WAN) 252.

When using a LAN networking environment, the computer system 10 may be connected to the local network 251 through a network interface or adapter 253. When used in a WAN networking environment, the computer system 10 may include a modem 254, wireless router or other means for establishing communication over a wide area network 252, such as the Internet. The modem 254, which may be internal or external, may be connected to the system bus 223 via the serial port interface 246. In a networked environment, program modules depicted relative to the computer system 10, or portions thereof, may be stored in a remote memory storage device 250. It will be appreciated that the network connections shown are exemplary and other means of establishing a communications link between the computers may be used.

The remote computer 249 may be another personal computer, a server, a router, a network PC, a peer device or other common network node. In one implementation, the remote computer 249 may be the handheld PC 20 described with reference to FIG. 1. As such, the handheld PC 20 may include many or all of the elements described above relative to the computer system 10. For example, in FIG. 3, the handheld PC 20 is illustrated as having a CPU 321, a system memory 322 and a system bus 323 that couples various system components to the CPU 321. The system memory 322 may include a read only memory (ROM) 324 and a random access memory (RAM) 325. The handheld PC 20 may further include a hard disk drive 327 for reading from and writing to a hard disk. The hard disk drive 327 may be connected to the system bus 323 by a hard disk drive interface 332. One difference between the computer system 10 and the handheld PC 20 is the various programs stored in memory. For example, the handheld PC 20 may include a fugitive emissions monitoring program 310 and a triggering event monitoring program 320. The fugitive emissions monitoring program 310 may be configured to identify the various components to be tested and accept readings from the TVA 30. The triggering event monitoring program 320 may be configured to manage responses to triggering events. The operation of the fugitive emissions monitoring program 310 and a triggering event monitoring program 320 will be described in more detail in the following paragraphs with reference to FIG. 4.

FIG. 4 illustrates a flow diagram of a method 400 for managing a response to a triggering event in connection with a fugitive emissions monitor in accordance with implementations of various technologies and techniques described herein. It should be understood that while the flow diagram indicates a particular order of execution of the operations, in some implementations, the operations might be executed in a different order. In one implementation, the method 400 may be performed by the triggering event monitoring program 320.

At step 410, a signal may be received by the handheld PC 20 from the TVA 30. The signal may be generated by the TVA 30 in response to receiving an air sample collected by the probe 40. Further, the signal may be transmitted wirelessly from the TVA 30 to the handheld PC 20. The air sample may be collected from a leak interface on a component, such as a control valve, pump seal and the like. In one implementation, upon receipt of the air sample, the TVA 30 may analyze the air sample, determine a parts per million (PPM) level for the air sample, convert the PPM level to a binary signal and send the binary signal to the triggering event monitoring program 320. The triggering event monitoring program 320 may then forward the binary signal to the fugitive emissions monitoring program 310.

At step 420, a determination is made as to whether the received signal qualifies as a triggering event. If the signal is determined as a triggering event, then the monitoring process is stopped and a message with a set of actions to remedy the triggering event may be displayed (step 430). In one implementation, the triggering event monitoring program 320 may communicate with the fugitive emissions monitoring program 310 to halt the monitoring process. At step 440, the triggering event monitoring program 320 may prompt a user, such as a technician, to confirm that the actions displayed in the previous step have been performed. At step 450, the monitoring process may be resumed. The triggering event monitoring program 320 may communicate with the fugitive emissions monitoring program 310 to resume the monitoring process.

In one implementation, if the received binary signal does not qualify as a triggering event, then the triggering event monitoring program 320 forwards the binary signal to the fugitive emissions monitoring program 310, which records the date, time and the corresponding PPM reading of the binary signal. On the other hand, if the received binary signal qualifies as a triggering event, then the triggering event monitoring program 320 forwards the actions that have been performed to remedy the triggering event to the fugitive emissions monitoring program 310 along with the binary signal.

The following table illustrates a number of triggering events, messages corresponding to those triggering events and a set of actions to remedy those triggering events.

Triggering Event	Message	Actions
PPM level corresponding to signal ex-	Leak! Report leak	Specific steps based on client location

-continued

Triggering Event	Message	Actions
ceeds a predetermined PPM level, e.g., 500 PPM		and specifications
No signal from TVA	TVA malfunction	Look for flame out, dead battery of TVA, H_2 refill
Background PPM level exceeds a predetermined value	Background PPM level exceeds maximum value	Notify client/ supervisor and obtain signature
Exceeds a predetermined PPM level, e.g., 10,000 PPM, for HRVOC	Leak! Report leak	Notify client/ supervisor and obtain signature
PPM level of a predetermined number of components is below a predetermined value	Notify client/supervisor	Notify client/ supervisor and obtain signature
A number of components in an area of a facility have exceeded a predetermined PPM level	Leaks! Report to client/ supervisor	Stop monitoring Report to client/ supervisor

FIG. 5 illustrates a schematic diagram of a technician **500** using a handheld PC **510** having the triggering event monitoring program **520** that operates in a manner described with reference to FIG. **4**. The technician **500** may use a probe **530** to obtain an air sample from a component **540**. The air sample may then be transferred to a toxic vapor analyzer (TVA) **550** attached to the back of the technician **500**. The TVA **550** may then analyze the air sample, determine a parts per million (PPM) level for the air sample, convert the PPM level to a binary signal and send the binary signal to the handheld PC **510**. The binary signal may then be processed according to the steps described with reference to FIG. **4**.

In one implementation, referring back to step **410**, the triggering event monitoring program **320** may receive a manual input from the technician, rather than a signal from the TVA **30**. The manual input may be based on an observation by the technician. Examples of such observation include audio visual olfactory (AVO) detection, open-ended line (OEL) detection, leaker tag, an alarm and the like. For such examples, the actions to remedy the triggering events may include requiring some input regarding the type and location of the observation, sending a notification to the client/supervisor and obtaining a signature.

FIG. **6** illustrates a schematic diagram of a technician **600** using a handheld PC **610** having the triggering event monitoring program **620** that operates in a manner described with reference to FIG. **4** and the above paragraph. The technician **600** may manually enter an input into the handheld PC **610** in response to his observation of the environment surrounding a component **630**. In response to receiving the input, the triggering event monitoring program **620** may determine whether the input qualifies as a triggering event. If the input is a triggering event, then the triggering event monitoring program **620** may display the steps to be taken to remedy the triggering event.

In another implementation, referring back to step **420**, in lieu of making a determination of a triggering event based on a signal from the TVA **30**, a determination of the triggering event may be made based on time. The following table provides examples of triggering events based on time.

Triggering Event	Message	Actions
Monitoring time for a component exceeds a predetermined amount of time	Monitoring time exceeds maximum time	Report excess time
Deployment time exceeds a predetermined amount of time	Deployment time exceeds maximum time	Report excess time
Allotted time to obtain a work permit exceeds a predetermined amount of time	Time to obtain work permit exceeds maximum time	Report excess time
Allotted time for lunch or break exceeds a predetermined amount of time	Lunch or break time exceeds maximum time	Report excess time

In yet another implementation, the determination of the triggering event may be based on climate, e.g., temperature. For example, a message may be displayed to the user with instructions to avoid a heat stroke or a frost bite. In this implementation, the user may be asked to provide information regarding the climate conditions. The triggering event monitoring program may then display certain steps to be taken to remedy the climate conditions.

In still yet another implementation, the triggering event monitoring program **620** may be configured to determine whether the TVA **30** has been properly calibrated. As such, at the beginning of each day, the calibration record of the TVA **30** may be transmitted wirelessly to the handheld PC **20**. The triggering event monitoring program **620** may then determine whether the calibration record meets the calibration requirements for that particular TVA **30**. If it is determined that the calibration record does not meet the calibration requirements, then the triggering event monitoring program **620** may display a message indicating to the technician that the TVA **30** has not been properly calibrated and the steps that need to be taken to properly calibrate the TVA **30**.

In other implementations, the triggering event monitoring program **620** may be configured to confirm a number of factors or events associated with the TVA **30** or the fugitive emissions monitor. The table below provides a number of possible events that may be determined using the triggering event monitoring program **620**.

Triggering Events	Message	Actions
Technician selects a TVA that does not include PID mode if needed for assigned components.	Select TVA with PID capabilities.	Prevent technician from using selected analyzer
Drift assessment for TVA does not match requirements	Improper drift assessment	Recalibrate TVA for proper drift assessment

-continued

Triggering Events	Message	Actions
Technician attempts to transfer monitoring data before conducting an end-of-day drift assessment.	End-of-day drift assessment is required before transferring	Perform drift assessment
No receipt of signal corresponding to technician code	No technician code	Enter technician code prior to deployment
No input for confirming date/time on handheld PC	Date/time on handheld PC must be confirmed before deployment	Confirm date/time on handheld PC
No input for confirming TVA identification number	No TVA ID	Enter TVA ID before deployment
Selection of a component located in a confined space	Display site specific protocol for monitoring components in confined spaces	Obtain signature of their fire watch.
Selection of a component that is difficult to monitor	Display site specific protocol for monitoring difficult to monitor component	Confirm protocol standards
Selection of a component that requires a ladder	Display site specific protocol for monitoring components with a ladder	Confirm protocol standards
Selection of a component that requires a man lift	Display site specific protocol for monitoring with a man lift	Confirm protocol standards
Selection of a component that requires a crane	Display site specific protocol for monitoring with a crane	Confirm protocol standards
Selection of a component that requires a scaffold	Display site specific protocol for monitoring with a scaffold.	Confirm protocol standards
Selection of a component that requires a harness and lanyard	Display site specific protocol for monitoring with a harness and lanyard.	Confirm protocol standards
Selection of a component that was previously labeled as difficult to find (DTF) and determined as a triggering event	Component need resolution	Confirm location and status of component
Tech is injured	Display site specific protocol for first aid treatment and map of first aid station	Record type of first aid obtained, details of injury, and person to whom reported
Technician has begun monitoring a component	Status bar indicating the amount of time that has lapsed and the minimum amount of time required	Cannot save reading until minimum time has been met
A leak is identified on a component having a diameter greater than a predetermined value	Monitor longer and status bar is reset to capture additional time	Cannot save reading until additional monitoring time has been met

Various implementations described herein are configured to identify triggering events and guarantee technician awareness of the triggering events by intervening in the operation of the underlying program and displaying a pre-set array of alerts, instructions and action steps to be taken. In this manner, various implementations described herein may ensure proper assessment of the triggering events on the part of the technician by prompting the appropriate response to an array of questions and then comparing the responses given against the set of appropriate responses. In addition, various implementations described herein may ensure sufficient documentation of the assessment and the required action steps. The alert, awareness and assessment loop may ensure the technician's proper response to a triggering event according to a previously designated set of protocols, instructions, checklists and/or timelines. Various implementations described herein may also document the successful completion of each step along with the technician's assessment of any relevant circumstance associated with the triggering events and follow up steps. In the end, the triggering event monitoring program may report the circumstances and final result of each intervention to a software program that enables management to review and respond appropriately to each intervention.

It should be understood that the various technologies described herein may be implemented in connection with hardware, software or a combination of both. Thus, various technologies, or certain aspects or portions thereof, may take the form of program code (i.e., instructions) embodied in tangible media, such as floppy diskettes, CD-ROMs, hard drives, or any other machine-readable storage medium wherein, when the program code is loaded into and executed by a machine, such as a computer, the machine becomes an apparatus for practicing the various technologies. In the case of program code execution on programmable computers, the computing device may include a processor, a storage medium readable by the processor (including volatile and non-volatile memory and/or storage elements), at least one input device, and at least one output device. One or more programs that may implement or utilize the various technologies described herein may use an application programming interface (API), reusable controls, and the like. Such programs may be implemented in a high level procedural or object oriented programming language to communicate with a computer system. However, the program(s) may be implemented in assembly or machine language, if desired. In any case, the language may be a compiled or interpreted language, and combined with hardware implementations.

While the foregoing is directed to implementations of various technologies described herein, other and further implementations may be devised without departing from the basic scope thereof, which may be determined by the claims that follow. Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

What is claimed is:

1. A method for managing a response to a fugitive emissions monitor of a component, comprising:

determining whether a signal from a toxic vapor analyzer (TVA) has been received;

if no signal from the TVA has been received, then determining that the TVA has malfunctioned;

displaying a message indicating that the TVA has malfunctioned due to a flame out and a first instruction to determine the status of a flame inside the TVA; and

displaying one or more queries to confirm that the first instruction has been performed.

2. The method of claim **1**, wherein the signal is a binary signal.

3. The method of claim **1**, further comprising displaying a second instruction to determine the status of a battery of the TVA.

4. The method of claim **1**, further comprising displaying a third second instruction to refill the TVA with H_2.

5. The method of claim **1**, further comprising displaying a second instruction to provide a remedy for addressing the flame out.

6. A method for managing a response to a fugitive emissions monitor of a component, comprising:

determining whether a parts per million (PPM) level of an air sample detected by a toxic vapor analyzer (TVA) exceeds a predetermined amount;

if it is determined that the PPM level of the air sample exceeds the predetermined amount, then displaying a message indicating an existence of a leak on the component and a set of instructions to notify a supervisor and obtain a signature of the supervisor; and

displaying one or more queries to confirm that the set of instructions has been performed.

7. A method for monitoring a component for fugitive emissions, comprising:

calculating a first amount of time to monitor the component;

determining whether a deflection in a signal received from a toxic vapor analyzer has occurred while the component is being monitored during the first amount of time; and

if the deflection in the signal has occurred, then displaying a first message to instruct an operator to monitor the component for a second amount of time at the conclusion of the first amount of time.

8. The method of claim **7**, wherein the first amount of time is based on the type, size or specific characteristics of the component.

9. The method of claim **7**, wherein the second amount of time is based on the type, size or specific characteristics of the component.

10. The method of claim **7**, further displaying a second message that indicates an amount of time that has lapsed while monitoring the component.

11. The method of claim **7**, further comprising:

receiving a reading regarding the component;

determining whether the second amount of time has lapsed; and

if the second amount of time has not lapsed, then displaying a second message to indicate that the reading is not stored.

12. The method of claim **7**, wherein the second amount of time is measured from the time at which the deflection in the signal is determined after the conclusion of the first amount of time.

13. The method of claim **7**, wherein the first message is displayed at the end of the first amount of time.

14. The method of claim **7**, wherein the second amount of time is measured from a last increase in parts per million (PPM) level detected during the second amount of time.

15. The method of claim **14**, wherein the second amount of time is configured to ensure that the deflection in the signal is completely measured.

16. The method of claim **7**, wherein the deflection in the signal represents an elevated parts per million (PPM) reading.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,657,384 B1
APPLICATION NO. : 11/692764
DATED : February 2, 2010
INVENTOR(S) : Rex Moses

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 2, line 57:
should read -- "FIG. 3 illustrates a schematic diagram of a handhald PC in"
instead of "FIG. 3 illustrates a schematic diagram a handheld PC in"

Column 3, lines 24-25:
should read in part -- "qualifies as a triggering event. If it does, then the event monitoring program ..."
instead of "qualifies as a triggering event. If it does, then the even monitoring program ..."

Column 4, line 3:
should read in part -- "...The system bus 223 may be any of"
instead of "...The system bus 23 may be any of"

Signed and Sealed this
Eighteenth Day of October, 2011

David J. Kappos

David J. Kappos
Director of the United States Patent and Trademark Office

US007750502B1

(12) **United States Patent**
Haun et al.

(10) **Patent No.: US 7,750,502 B1**
(45) **Date of Patent: Jul. 6, 2010**

(54) **PORTABLE WEATHER RESISTANT FLOW METER SYSTEM**

(75) Inventors: **Darrell N. Haun**, Sugar Land, TX (US); **Donald N. Haun**, Stafford, TX (US)

(73) Assignee: **Solarcraft, Inc.**, Stafford, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **12/396,984**

(22) Filed: **Mar. 3, 2009**

(51) **Int. Cl.**
H02J 9/00 (2006.01)

(52) **U.S. Cl.** **307/64**; 307/66

(58) **Field of Classification Search** 307/64, 307/66

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,335,730 A * 8/1994 Cotham, III 166/374
5,757,283 A * 5/1998 Janoska 340/870.16
2003/0192675 A1* 10/2003 Cosley et al. 165/104.32
2006/0239777 A1* 10/2006 Martin 405/128.15
2007/0010916 A1* 1/2007 Rodgers et al. 700/295
2007/0171888 A1* 7/2007 Adams 370/346

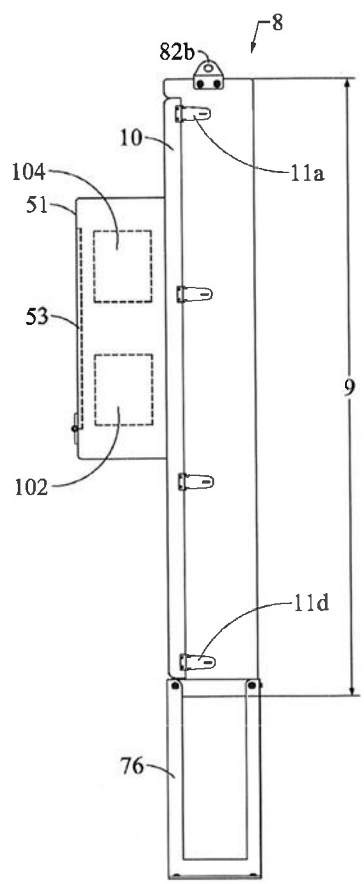
* cited by examiner

Primary Examiner—Fritz M Fleming
(74) *Attorney, Agent, or Firm*—Buskop Law Group, PC; Wendy Buskop

(57) **ABSTRACT**

A portable, weather resistant flow control system with a flow controller contained within an enclosure that includes a rigid body preventing deformation of the enclosure during transport and a door with a seal providing proving protection from harsh weather and environmental conditions, where the system includes a power charger for powering a remote terminal, a wireless communication unit, and back up batteries.

10 Claims, 3 Drawing Sheets



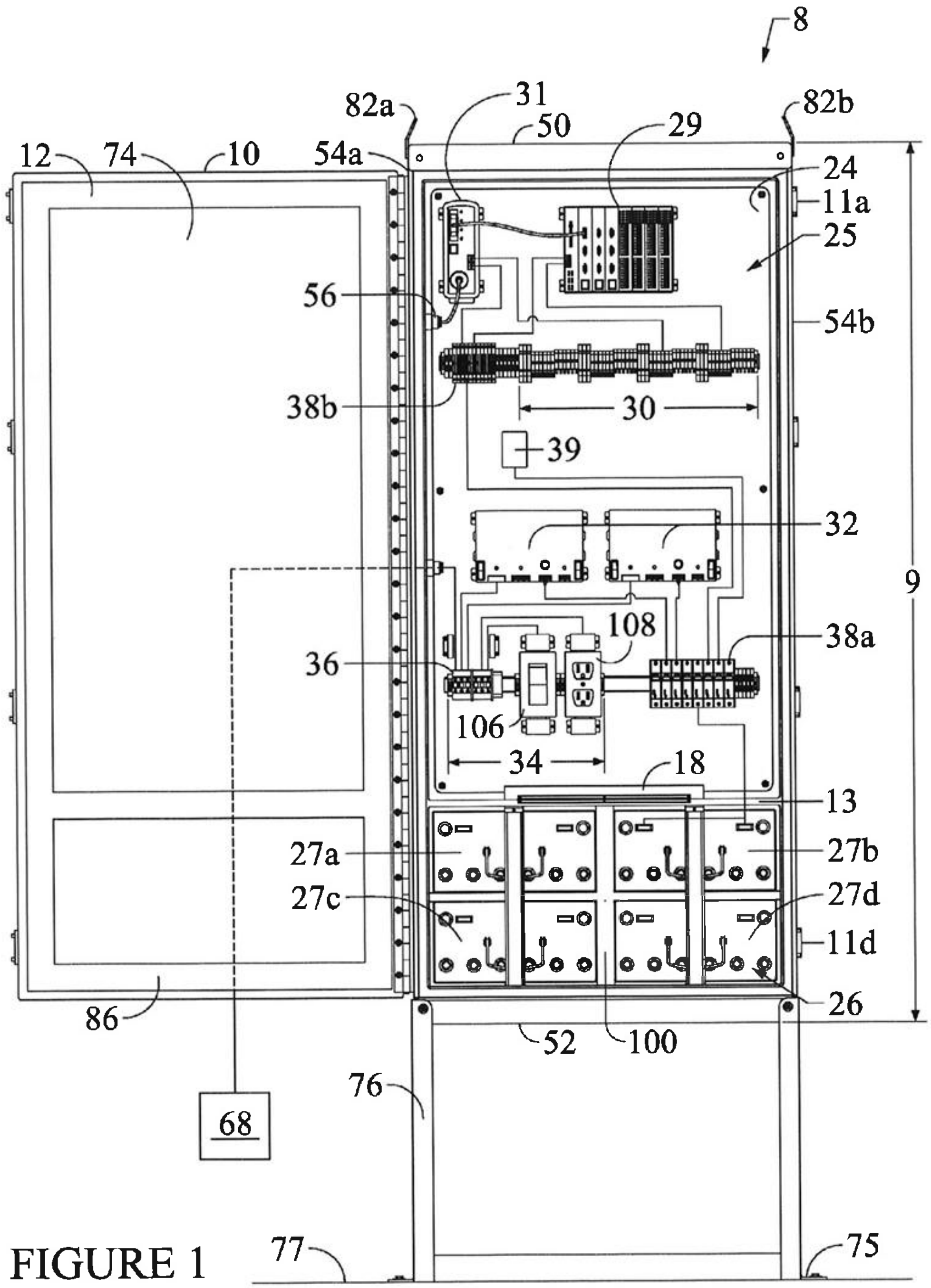

8
82a
31
82b
50
29
12
74
10
54a
24
11a
25
56
54b
38b
30
39
32
9
108
38a
36
106
34
18
13
27a
27b
27c
27d
11d
26
86
52
100
76
68
77
75

FIGURE 1

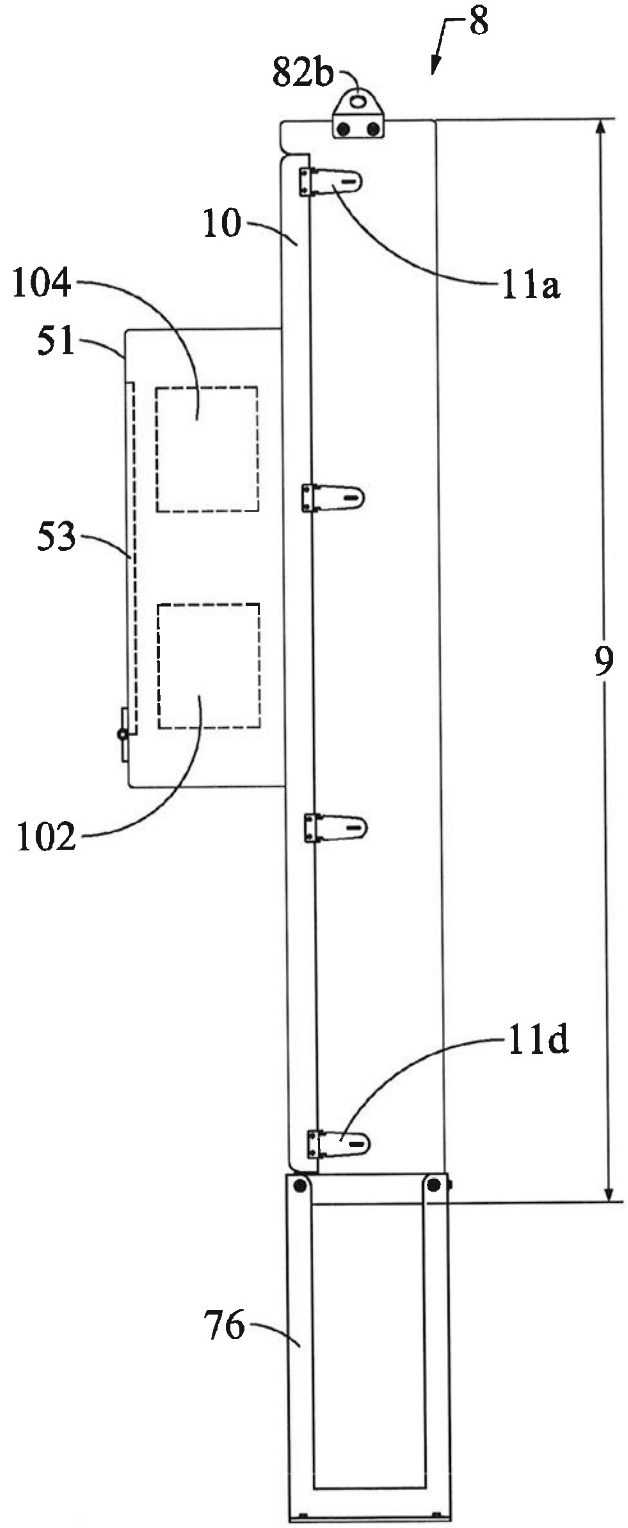
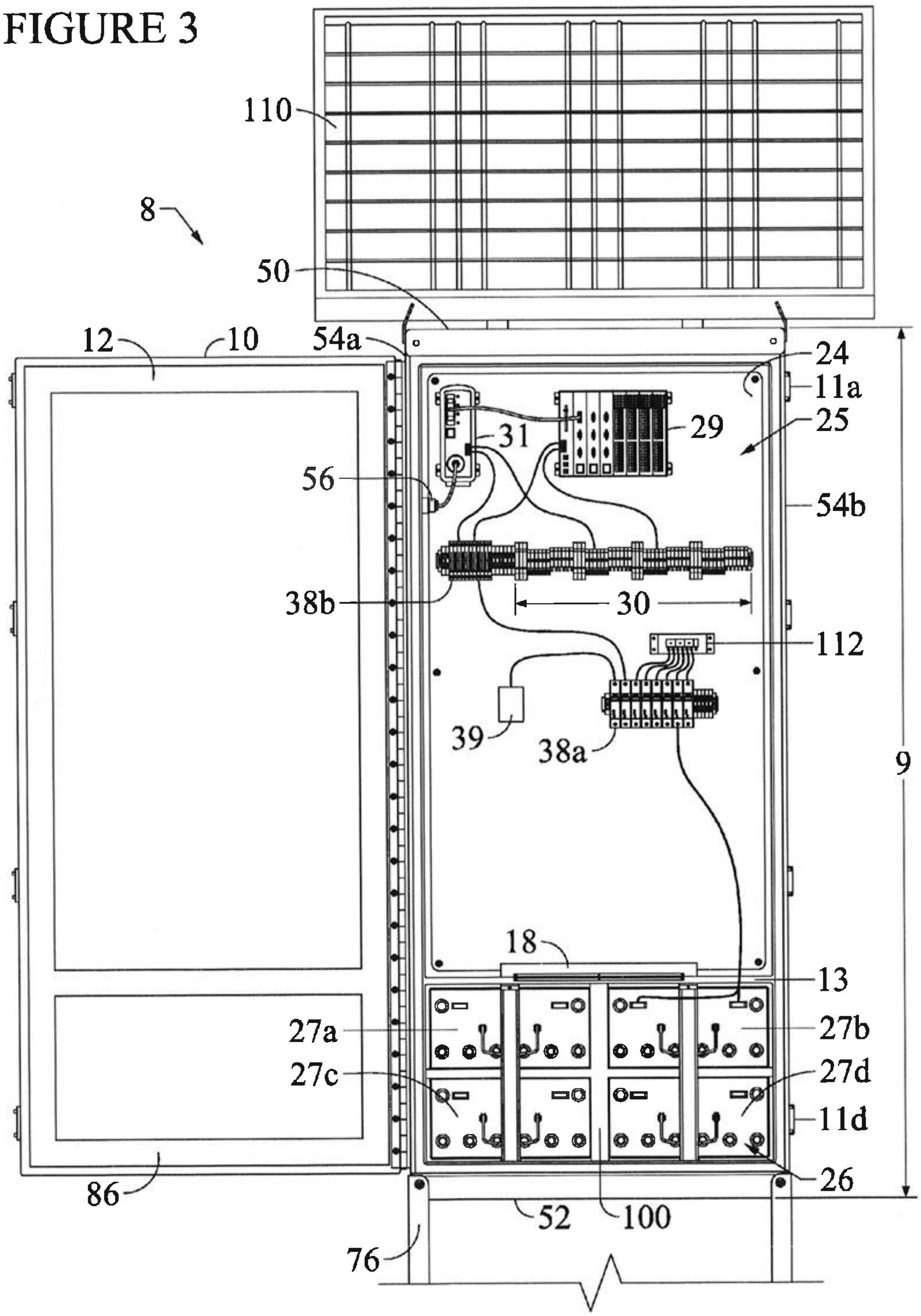


FIGURE 2

FIGURE 3


110
8
50
12
10
54a
24
11a
31
29
25
56
54b
38b
30
112
9
39
38a
18
13
27a
27b
27c
27d
11d
26
86
52
100
76

PORTABLE WEATHER RESISTANT FLOW METER SYSTEM

FIELD

The present embodiments generally relate to a flow meter system that is tough, weather resistant and liftable without deformation for use in the field, particularly in harsh environments such as the Arctic or Saudi Arabia.

BACKGROUND

A need exists for a sturdy flow meter system that is factory built and pre-installed for immediate use in the field.

A further need exists for a highly reliable flow meter system with a remote terminal unit for easy and fast communication in the field without needing a lot of technical support crew in a hazardous environment.

The present embodiments meet these needs.

BRIEF DESCRIPTION OF THE DRAWINGS

The detailed description will be better understood in conjunction with the accompanying drawings as follows:

FIG. **1** illustrates a front view of a flow meter enclosure with the door open.

FIG. **2** illustrates a view of the door including a door extension in accordance with certain embodiments of the present invention.

FIG. **3** illustrates a front view of on embodiment in accordance with the present invention including a solar array as a source of power.

The present embodiments are detailed below with reference to the listed Figures.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Before explaining the present system in detail, it is to be understood that the system is not limited to the particular embodiments and that it can be practiced or carried out in various ways.

The present embodiments relate to a portable weather resistant flow control system.

The system includes a flow control enclosure, which can be made from powder coated metal.

The flow control enclosure can have a body and a movable door that can be adapted to engage the body. The body can generally be a rectangular box with the movable door hinged to the body overlapping the walls of the rectangular box. The movable door can be removable from the body and attachable to the body with a plurality of fasteners, such as two fasteners, for two opposing walls.

The body that is square or rectangular can have five walls each having an outer side and an inner side. One of the walls forms a base.

The body can further be oval or circular in shape then only two or three walls would be used with one wall being for the bottom or base.

In an embodiment, at least one movable door fastener can be used to secure each wall to the movable door.

In one embodiment the body can be about 54 inches high, about 54 inches wide and about 28 inches deep. The body can be made from a power coated aluminum, which can have an aluminum thickness of between about ⅛ to about ⅜ inches.

The movable door can be the same height and width as the body, but can have an overhanging lip of up to several inches enabling the movable door to cover the open portion of the body and cover part of any wall that forms the portions of the body engaging the movable door. The movable door can be powder coated aluminum with an aluminum thickness of about ⅛ inches to about 3/16 inches.

The movable door can include a door extension for providing access to some components within the enclosure without requiring the movable door to be unlatched exposing every element to a potentially harsh environment.

A seal such as a rubber gasket that can have about a width of about 1 inch, a thickness of about 0.25 inches and can be fastened to the movable door to provide a weather tight sealing engagement with the body, so that no water, steam, sand or other undesirable materials get inside the enclosure.

A flow controller can be positioned within the door extension, but can also be disposed within the body. An example of a flow controller can be a unit available from Daniels™ of Houston, Tex. or a unit available from Fisher Scientific.

A remote terminal unit "RTU" monitoring controller can also be disposed in the door extension. In one embodiment the RTU monitoring controller can include a voltmeter for determining the voltage generated by a solar array.

The flow controller can be positioned on a back plane and can further be bolted to the plane. Parts of the flow controller can be removed from the back plane for repair if needed.

The back plane can be removably secured to the body of the enclosure and can be secured to the back of the enclosure.

A pedestal can be used for maintaining the flow control enclosure above a surface such as the ground, in case of flooding so none of the tanks or equipment are exposed to drifting sands, flood waters or other elements including wildlife.

A first lifting eye can be riveted, welded or bolted to a first wall of the body and a second lifting eye can be similarly connected to a second wall opposite the first lifting eye. This configuration can enable a crane, such as a pedestal crane to lift the portable weather resistant flow control system with all the equipment mounted in it without deforming the flow control enclosure. Non-deforming lifting of such heavy and calibrated equipment without damage is an amazing feat and is needed in the field.

In another embodiment, a flange can be riveted, welded or bolted to one of the walls. The flange can encircle the walls, like a small frame on top of the body. The flange can also be used to support the first and second lifting eyes. The flange can also have lifting holes drilled in it for lifting of the portable weather resistant flow control system without the lifting eyes.

A foldable tray can be mounted to the body on the inside for supporting a computer. The foldable computer tray can be sized to accommodate portable computing devices such as lap tops. The foldable tray can fold out from the body providing a unique space saving feature.

The system can provide continuous low voltage power to other field sources from an A/C power source. If the AC source fails, the system can continue to operate using the batteries for at least about 48 hours.

Turning now to the Figures, FIG. **1** depicts a portable self contained weather resistant low voltage flow control system having an flow control enclosure **8** including a body **9** with a movable door **10** mounted atop a pedestal **76**. The pedestal **76** can include pedestal flanges **75** for mounting the flow control enclosure on a surface **77**. The movable door **10** is illustrated in the open position, but can be closed and secured with movable door fasteners **11***a*, **11***b*, **11***c*, **11***d*. A seal **12** can be located on the inner side of the movable door **10**, which can provide a means for keeping elements such as sand and rainwater out of the interior of the flow control enclosure **8**.

The body **9** can includes a top **50**, a bottom **52** and sides **54***a*, **54***b*. Each of the top **50**, bottom **52** and sides **54** *a*, **54***b* can be covered completely or partially with insulation **74**.

A bulkhead **13** can be disposed in the body **9** forming a top compartment **25** and a bottom compartment **26**. At least two batteries **27***a*, **27***b* can be disposed within bottom compartment **26**. Batteries **27***a*, **27***b*, **27***c*, **27***d* are shown stored in the bottom compartment **26** and can fit into respective spaces formed by separator **100**. The bottom compartment **26** can be sealed by bottom seal **86** on the movable door **10**.

A back plane **24** can be mounted to at least the bulkhead **13** within the top compartment **25** for supporting electronics equipment.

The flow control system can provide about 12 volts to about 24 volts of power continuously to the remote terminal unit **29** and the wireless communication unit **31** while providing continuous communication for at least intermittent monitoring of field equipment.

An input/output (I/O) termination assembly **30** can be mounted to the back plane **34**, wherein the IO termination assembly **30** can provide connections for at least one piece of field equipment to a remote terminal unit **29**. The connected piece of field equipment can provide measurements or data for storage on the remote terminal unit **29** and transmission by the wireless communications unit **31**.

The wireless communications unit **31** can be mounted to the back plane **24** and can be connected to the wireless communication unit **31**. The wireless communication unit **31** can take data from the remote terminal unit **29** and transmits that data, via radio frequencies, to receivers located remotely from the flow control enclosure **8**.

An A/C terminal assembly **34** can be connected to an external A/C power source **68** through a surge protector **36** in order to protect the A/C terminal assembly **34** from power surges. The A/C terminal assembly **34** can further be mounted to the back plane **24** for receiving and distributing a continuous flow of A/C current from an A/C power source **68** to at least one uninterruptable power supply **32** (DC-UPS).

At least one uninterruptable power supply **32** can be mounted to the back plane **24** for providing between about 10 volts to about 30 volts of DC power to at least two batteries **27***a*, **27***b*. The uninterruptable power supply **32** can be connected to the batteries through a low voltage distribution block **38***a*.

The low voltage distribution block **38***a* can be mounted to the back plane **24** and can be in communication with a second low voltage distribution block **38***b*. The second low voltage distribution **38***b* block can provide power to the wireless communications unit **31** and the remote terminal unit **29**.

A DC-DC converter **39** mounted to the back plane **24** can also communicate with the voltage distribution block **38***a*.

At least two removable lifting eyes **82***a*, **82***b* can be secured to the enclosure for lifting of the flow control enclosure **8** by a crane.

A foldable computer tray **18** can be located in the upper compartment **25** and can provide a means for supporting a portable computer such as a lap top.

FIG. **1** also shows a switch **106**, which can be in communication with the AC terminal assembly **34** and the uninterruptable power supply **32** DC-UPS.

An outlet **108** is illustrated in communication with the AC terminal assembly **34**. The outlet can be about a 110 volts to about a 220 volts outlet.

In another embodiment, the wireless communication unit **31**, remote terminal unit **29**, I/O termination assembly **30**, the uninterruptable power supply **32**, the A/C terminal assembly **34**, the surge protector **36**, the low voltage distribution block **38***a* and the converter **39** disposed on the back plane **24** can be in a sealed watertight, water resistant top compartment.

In another embodiment, a ground fault interrupter **56** can be disposed between the AC terminal assembly **34** and the uninterruptable power supply **32** DC-UPS.

FIG. **2** illustrates a side view of the flow control enclosure **8** with body **9** and movable door **10** in a closed position mounted on pedestal **76**. A door extension **51** can be seen in the movable door **10**. The door extension can include a viewing port **53**. The viewing port **53** can further include a hinged surface which can provides access to the interior of the door extension. The movable door **10** can be attached to the body **9** of the flow control enclosure **8** with fasteners **11***a*, **11***d*, as shown in this Figure.

The door extension **51** can be adapted to house a remote terminal unit monitoring controller **102**, such as one made by Bristol, which can be in communication with the remote terminal unit **29**. The door extension **51** can also house a flow controller **104**, such as Daniel 2358A or one made by Omni Products, Inc., which can be in communication with the A/C terminal assembly **34** and at least one piece of field equipment.

In an embodiment, the remote terminal unit monitoring controller **102** can further comprise a volt meter for tracking voltage produced by the solar array. An example of a volt meter can be a Morningstar Sunsaver **10** solar controller ss-10L-24 volt.

FIG. **2** also illustrates second lifting eye **82***b*, which can provide a balanced means for lifting and moving the flow control enclosure **8**.

FIG. **3** illustrates another embodiment of the present invention utilizing solar power. A solar array **110** is illustrated in communication with the flow control enclosure **8**.

Like the previous embodiment, a body **9** can be mounted on a pedestal **76**. The body **9** can have a top **50**, a bottom **52** and walls **54***a*, **54***b*. The body can be enclosed by a movable mounted door **10**. The movable door **10**, which can include a seal **12** and a bottom seal **86** for providing a weather tight seal with the body **9**. The movable door **10** can be secured shut with movable door fasteners **11***a*, **11***b*, **11***c*, **11***d*.

Like the previous embodiment, a bulkhead **13** can separate a top compartment **25** and a bottom compartment **26**, with at least two batteries **27***a*, **27***b* disposed within bottom compartment **26**. Batteries **27***a*, **27***b*, **27***c*, **27***d* are shown stored in the bottom compartment **26** and can fit into respective spaces formed by the separator **100** which can form up to about 8 spaces for about 8 batteries. The bottom compartment **26** can be sealed by bottom seal **86** on the movable door **10**.

The top compartment **25** can include a back plane **24**, which can be mounted to at least the bulkhead **13** within the top compartment **25** for supporting electronic equipment. A wireless communication unit **31** can be mounted to the back plane **24**, wherein the wireless communication unit **31** can be in connection with the at least two batteries **27***a*, **27***b*.

The remote terminal unit **29**, the wireless communication unit **31**, and the input/output (I/O) termination assembly **30** can work in much the same way as described with respect to FIG. **1**, such as for storing and transmitting data received from pieces of equipment in the field. The remote terminal unit **29** can be mounted to the back plane **24** and can be in communication with the wireless communication unit **31** and the at least two batteries.

The I/O termination assembly **30** can be mounted to the back plane **24**, wherein the I/O termination assembly **30** can provide connections for at least one piece of field equipment to the remote terminal unit **29**. The remote terminal unit **29** can be mounted on the back plane **24** and can communicate data to the wireless communication unit **31** for transmission via radio frequency.

A solar controller **112** can be in communication with a low voltage distribution block **38***a*, which can be mounted to the back plane **24**. The low voltage distribution block **38***a* can receive power from a solar array **110** and can distribute power to a DC-DC converter **39**, the batteries **27***a*, **27***b*, **27***c*, **27***d* and to a second low voltage distribution block **38***b*. The second low voltage distribution block **38***b* can power the remote terminal unit **29**, the wireless communications unit **31**, and the batteries **27***a*, **27***b*, **27***c*, **27***d*.

A DC-DC converter **39** can be mounted to the back plane **24** and can be connected to the low voltage distribution block **38***a*.

In an embodiment, a ground fault interrupter **56** can be in communication with the wireless communication unit **31**.

In an embodiment, the solar array (**110**) can supply between about 10 volts to about 30 volts of power using photovoltaics. Photovoltaics is generally known as the field of technology and research related to the application of solar cells for energy by converting sunlight directly into electricity. This is extremely beneficial due to the growing demand for clean sources of energy and the manufacture of solar cells and photovoltaic arrays has expanded dramatically in recent years

These embodiments provide a durable flow control enclosure, which further has an advantage in that no external source of power is required. The solar array generates enough power to operate the system.

In an embodiment, the remote terminal unit monitoring controller can have an indicator, which can be illuminating. In additional embodiments, the indicator can provide illuminations, sounds, visuals, or other means of providing an indication when the solar array is charging, when a load is disconnected or combinations thereof.

While these embodiments have been described with emphasis on the embodiments, it should be understood that within the scope of the appended claims, the embodiments might be practiced other than as specifically described herein.

What is claimed is:

1. A portable self contained weather resistant low voltage flow control system comprising:

a. an enclosure comprising a body with a movable door;

b. a bulkhead disposed in the body forming a top compartment and a bottom compartment;

c. at least two batteries disposed within bottom compartment;

d. a back plane mounted to at least the bulkhead within the top compartment for supporting electronic equipment;

e. a wireless communications unit mounted to the back plane, wherein the wireless communication unit is in connection with the at least two batteries;

f. a remote terminal unit mounted to the back plane in communication with the wireless communication unit and the at least two batteries;

g. an input/output (I/O) termination assembly mounted to the back plane, wherein the I/O termination assembly provides connections for at least one piece of field equipment to the remote terminal unit;

h. at least one uninterruptable power supply mounted to the back plane for providing between 10 volts to 30 volts of DC power to the at least two batteries;

i. an A/C terminal assembly mounted to the back plane for receiving and distributing a continuous flow of A/C current from an external A/C power source to the at least one uninterruptable power supply;

j. a surge protector mounted to the back plane for protecting the A/C terminal assembly from power surges from the A/C power source;

k. a low voltage distribution block mounted to the back plane in communication with the at least one uninterruptable power supply;

l. a DC-DC converter mounted to the back plane and connected to the low voltage distribution block; and

m. at least two removable lifting eyes secured to the enclosure for lifting of the enclosure by a crane;

n. at least one movable door fastener to secure the movable door to the enclosure, wherein the movable door comprises a door extension and wherein the door extension is adapted to house a remote terminal unit monitoring controller in communication with a flow controller in communication with the A/C terminal assembly and at least one piece of field equipment; and wherein the door extension has a viewing port in communication with the A/C terminal assembly and at least one piece of field equipment;

wherein the flow control system provides 12 volts to 24 volts of continuous power to the remote terminal unit and the wireless communication unit while providing continuous communication for at least intermittent monitoring of field equipment.

2. The system of claim **1**, wherein the wireless communication unit, remote terminal unit, I/O termination assembly, the uninterruptable power supply, the A/C terminal assembly, the surge protector, the low voltage distribution block and the converter disposed on the back plane are in a sealed watertight, water resistant top compartment.

3. The system of claim **1**, wherein a seal is disposed in the bottom compartment forming a sealed watertight compartment for the at least 2 batteries and up to 8 batteries.

4. The system of claim **1**, further comprising a ground fault interrupter disposed between the A/C terminal assembly and the uninterruptable power source.

5. The system of claim **1**, further comprising a switch disposed between the A/C terminal assembly and the uninterruptable power source.

6. The system of claim **1**, further comprising an outlet plug disposed between the A/C terminal assembly and the uninterruptable power source.

7. A portable self contained weather resistant low voltage flow control system comprising:

a. at least two batteries;

b. a wireless communications unit in communication with the at least two batteries;

c. a remote terminal unit in communication with the wireless communication unit and the at least two batteries;

d. an input/output (I/O) termination assembly providing connections for field equipment to the remote terminal unit;

e. a remote terminal unit monitoring controller for monitoring and regulating a solar panel and for providing 10 volts to 30 volts of DC power to charge the at least two batteries;

f. a solar array for receiving and distributing a continuous flow of electrical current to the remote terminal unit monitoring controller;

g. a low voltage distribution block in communication with solar controller; and

h. a DC-DC converter connected to the low voltage distribution block;

i. an enclosure comprising a body with a movable door, an A/C terminal assembly mounted in the enclosure, and at least one movable door fastener to secure the movable door to the enclosure, wherein the movable door comprises a door extension and wherein the door extension is adapted to house a remote terminal unit monitoring controller in communication with a flow controller in communication with the A/C terminal assembly and at least one piece of field equipment;

wherein the system provides continuous low voltage power to the remote terminal unit and the wireless communication unit to provide continuous communication for at least intermittent monitoring of field units.

8. The system of claim **7**, wherein the solar array supplies between 10 volts to 30 volts of power using photovoltaics.

9. The system of claim **7**, wherein the remoter terminal unit monitoring controller further comprises at least one volt meter for tracking voltage produced by the solar array.

10. The system of claim **9**, wherein the remote terminal unit monitoring controller further comprises at least an indicator for illuminating when the solar array is charging, when a load is disconnected or combinations thereof.

* * * * *

US007840366B1

(12) United States Patent
Moses et al.

(10) **Patent No.: US 7,840,366 B1**

(45) **Date of Patent: Nov. 23, 2010**

(54) **CALIBRATION MANAGEMENT FOR VOLATILE ORGANIC COMPOUND DETECTOR**

(75) Inventors: **Rex Moses**, Nassau Bay, TX (US); **Kevin Moses**, League City, TX (US); **Bradley O'Keefe**, Houston, TX (US)

(73) Assignee: **Environmental Analytics, Inc.**, Nassau Bay, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 111 days.

(21) Appl. No.: **12/032,499**

(22) Filed: **Feb. 15, 2008**

Related U.S. Application Data

(60) Provisional application No. 60/890,396, filed on Feb. 16, 2007.

(51) **Int. Cl.**
G01D 18/00 (2006.01)

(52) **U.S. Cl.** **702/85**; 702/23; 702/182

(58) **Field of Classification Search** 702/85, 702/22–24, 104, 137, 119, 182–183, 187; 95/1–3, 8; 96/18, 19; 73/1.01, 1.02, 1.06, 73/23.31, 23.21, 23.2; 204/194, 400, 401, 204/431, 228.1, 228.6, 229.8; 324/601–603; 340/501, 502, 517, 531, 605, 632, 634; 431/13–16, 431/22, 24, 26

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

H572	H *	2/1989	Hansen	356/439
5,206,818	A	4/1993	Speranza	
5,356,594	A *	10/1994	Neel et al.	422/54
6,478,849	B1 *	11/2002	Taylor et al.	95/11
6,545,278	B1 *	4/2003	Mottier et al.	250/339.13
6,672,129	B1 *	1/2004	Frederickson et al.	73/1.06
6,722,185	B2	4/2004	Lawson et al.	
7,017,386	B2 *	3/2006	Liu et al.	73/1.03
7,136,904	B2	11/2006	Bartek et al.	
7,369,945	B2	5/2008	Miller et al.	
2003/0012696	A1 *	1/2003	Millancourt	422/83
2003/0081214	A1 *	5/2003	Mestha et al.	356/402
2004/0226345	A1 *	11/2004	McCoy et al.	73/40.7
2004/0258213	A1 *	12/2004	Beamon et al.	379/9
2005/0000981	A1 *	1/2005	Peng et al.	222/3

(Continued)

OTHER PUBLICATIONS

Environmental Analytics, Inc. v. TMX2, Inc. and LDAR Solutions, Ltd.; Case 4:08-cv-03353; USDC, Southern District of Texas; First Amended Complaint; Dec. 10, 2008.

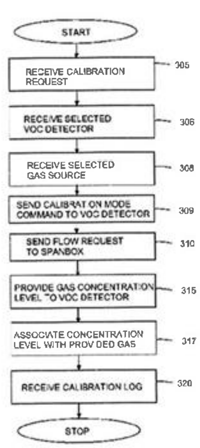
(Continued)

Primary Examiner—Mohamed Charioui
Assistant Examiner—Ricky Ngon
(74) *Attorney, Agent, or Firm*—Pramudji Law Group PLLC; Ari Pramudji

(57) **ABSTRACT**

A method for calibrating a volatile organic compound (VOC) detector. In one implementation, an initiation request may be received indicating a gas concentration level amount to be used for calibrating a VOC detector. A gas may be provided to the VOC detector according to the gas concentration level amount. The VOC detector may be provided with the gas concentration level amount. A calibration log may be received from the VOC detector. The calibration log may comprise an identifier of the VOC detector, the gas concentration level amount, and a date indicating when the VOC detector received the gas concentration level amount and the gas according to the gas concentration level amount.

25 Claims, 4 Drawing Sheets



U.S. PATENT DOCUMENTS

2006/0020186	A1 *	1/2006	Brister et al.	600/345
2007/0000310	A1 *	1/2007	Yamartino et al.	73/40.7
2008/0120043	A1	5/2008	Miller et al.	

OTHER PUBLICATIONS

"2nd Annual Fugitive Emissions—Leak Detection and Repair Symposium"; ISA Technical Conference Brochure; Nov. 2002.

"Introducing the Allegro CX(TM) Field Computer"; Product Newswire (product announcement); Jun. 21, 2004.

"New from Accutech, Wireless Acoustic Monitor Field Units Make Fugitive Emissions Monitoring Compliance Easy"; Product Announcement/Description; Feb. 10, 2004.

"LDARManager™ Makes Fugitive Emission Monitoring a Breeze TISCOR launches its newest product for Leak Detection and Repair"; product announcement/description; Nov. 8, 2002.

* cited by examiner

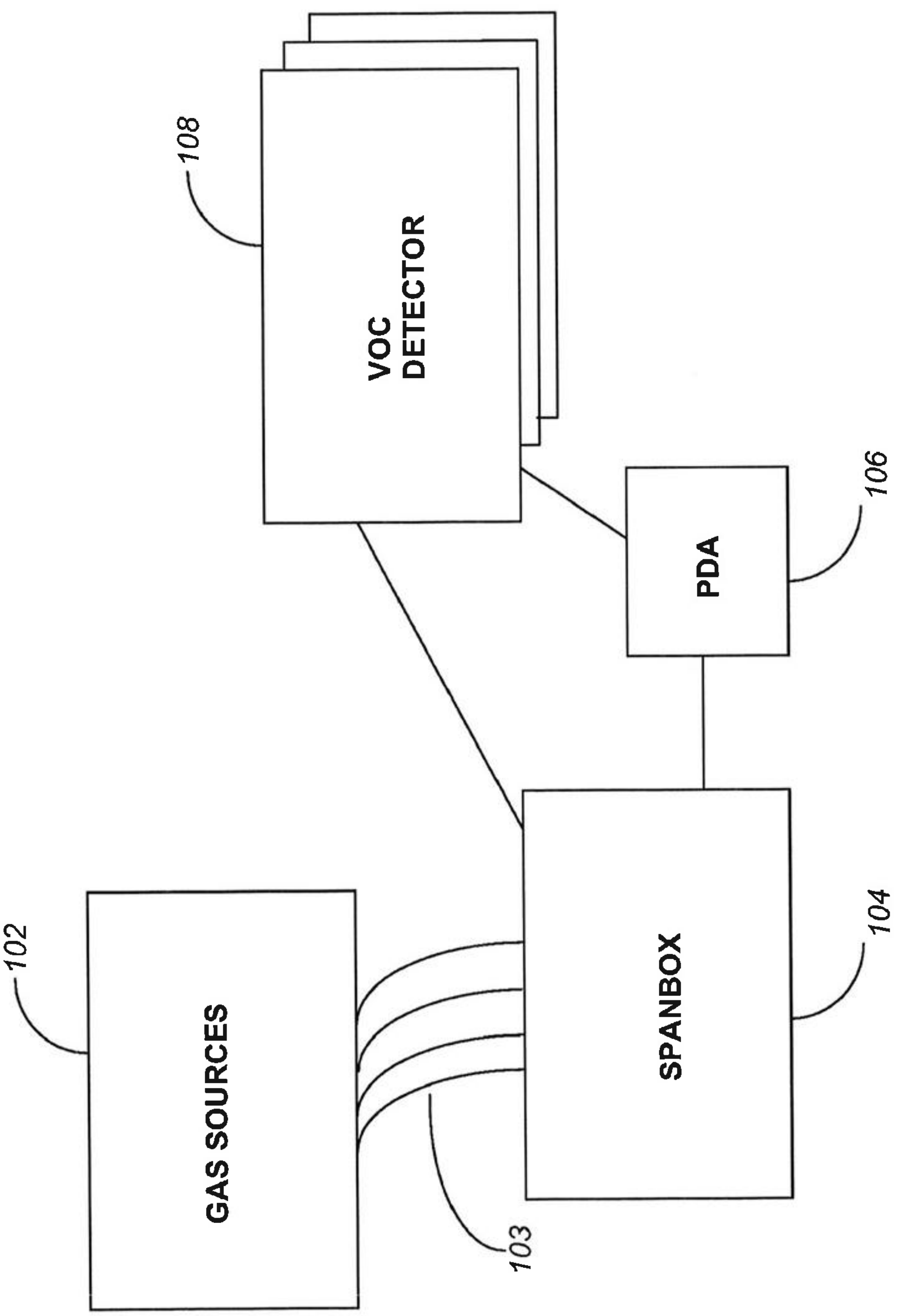


Fig. 1

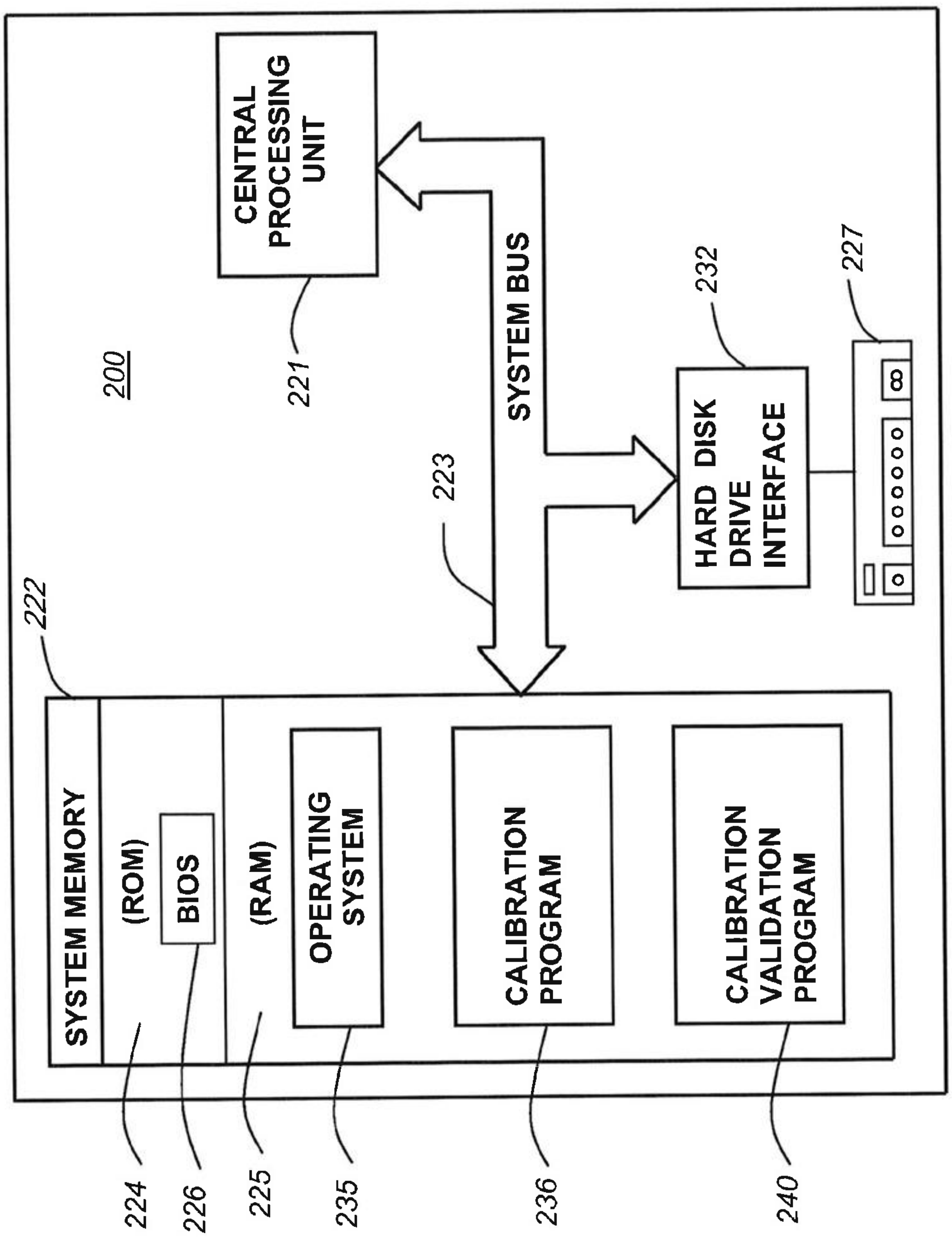

200
CENTRAL PROCESSING UNIT
221
SYSTEM BUS
223
HARD DISK DRIVE INTERFACE
232
227
222
SYSTEM MEMORY
(ROM)
BIOS
(RAM)
OPERATING SYSTEM
CALIBRATION PROGRAM
CALIBRATION VALIDATION PROGRAM
224
226
225
235
236
240

Fig. 2

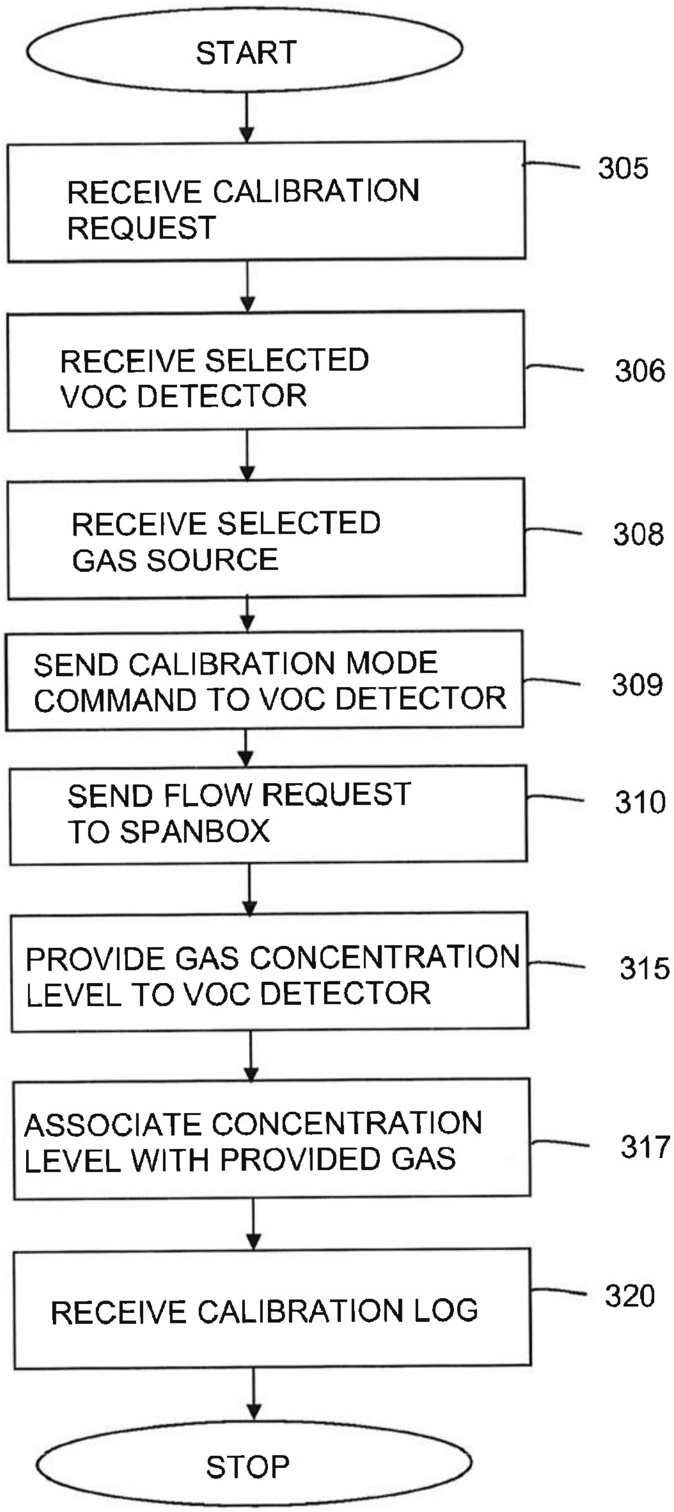

START
RECEIVE CALIBRATION REQUEST
305
RECEIVE SELECTED VOC DETECTOR
306
RECEIVE SELECTED GAS SOURCE
308
SEND CALIBRATION MODE COMMAND TO VOC DETECTOR
309
SEND FLOW REQUEST TO SPANBOX
310
PROVIDE GAS CONCENTRATION LEVEL TO VOC DETECTOR
315
ASSOCIATE CONCENTRATION LEVEL WITH PROVIDED GAS
317
RECEIVE CALIBRATION LOG
320
STOP

Fig. 3

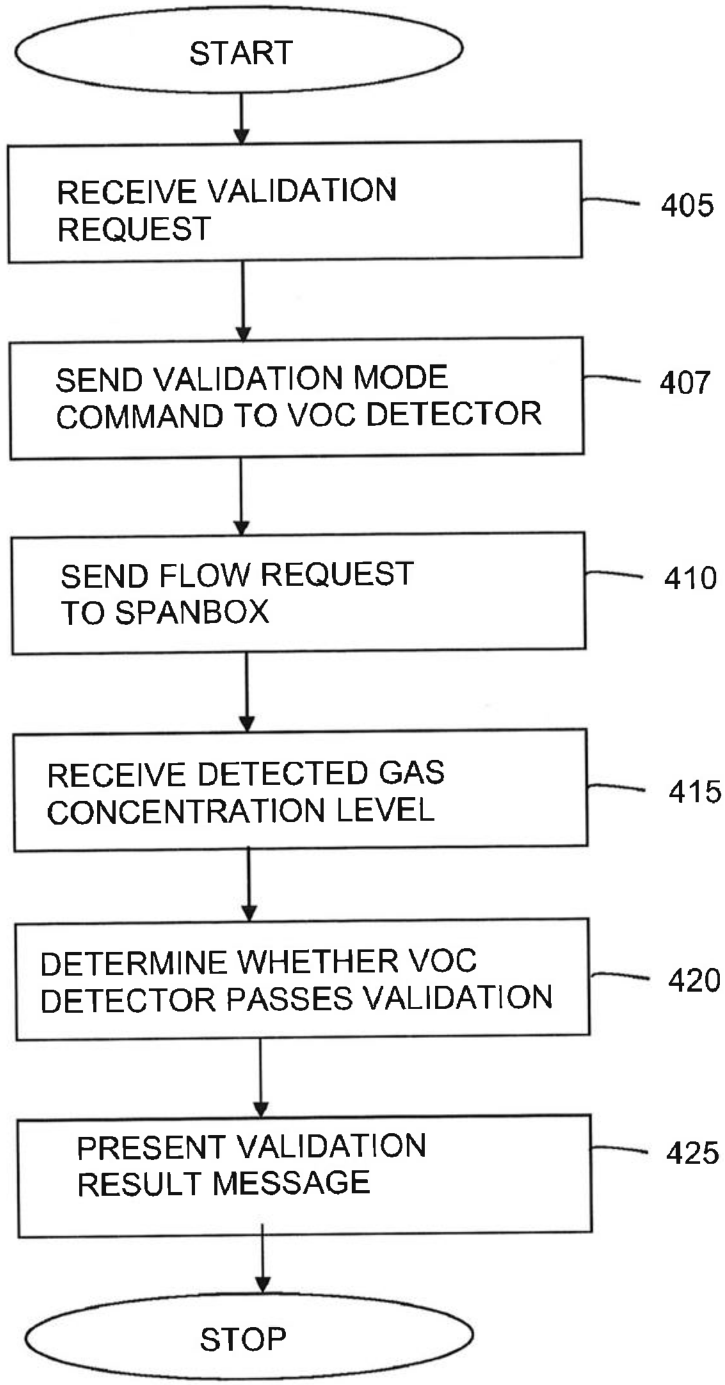

START
RECEIVE VALIDATION REQUEST
405
SEND VALIDATION MODE COMMAND TO VOC DETECTOR
407
SEND FLOW REQUEST TO SPANBOX
410
RECEIVE DETECTED GAS CONCENTRATION LEVEL
415
DETERMINE WHETHER VOC DETECTOR PASSES VALIDATION
420
PRESENT VALIDATION RESULT MESSAGE
425
STOP

Fig. 4

CALIBRATION MANAGEMENT FOR VOLATILE ORGANIC COMPOUND DETECTOR

RELATED APPLICATIONS

This application claims priority to U.S. Provisional Patent Application No. 60/890,396, filed Feb. 16, 2007, titled CALIBRATION OF VOLATILE ORGANIC COMPOUND DETECTOR, and the entire disclosure of which is herein incorporated by reference.

BACKGROUND

1. Field of the Invention

Implementations of various technologies described herein are directed to volatile organic compound (VOC) detection and to various methods and/or systems for managing the calibration of VOC detectors.

2. Description of the Related Art

The following descriptions and examples do not constitute an admission as prior art by virtue of their inclusion within this section.

Industrial plants that handle volatile organic compounds (VOCs) sometimes experience unwanted emissions of those compounds into the atmosphere from point sources, such as smokestacks, and non-point sources, such as valves, pumps, and/or vessels containing the VOCs. Emissions from non-point sources typically occur due to leakage of the VOCs from joints and/or seals and may be referred to herein as "fugitive emissions". Fugitive emissions from control valves typically occur as leakage through the packing set around the valve stem. Control valves used in demanding service conditions involving large temperature fluctuations and frequent movements of the valve stem commonly suffer accelerated deterioration of the valve stem packing set.

The United States Environmental Protection Agency (EPA) has promulgated regulations specifying maximum permitted leakage of certain hazardous air pollutants, such as benzene, toluene, 1,1,1-trichloroethane, from certain hardware or fixtures, e.g., control valves. Fugitive emissions are typically monitored using a VOC detector, which may also be referred to as a vapor analyzer. Government regulations require that VOC detectors used in the testing of valves and other components in petrochemical processing or manufacturing facilities be calibrated at various intervals. These calibration activities must be documented and records made available for inspection for up to five years. If the calibrations are not performed, or if they are performed but not documented, the facility owner can be fined and/or suffer other regulatory sanctions.

SUMMARY

Described herein are implementations of various technologies for managing the calibration of a VOC detector. In one implementation, an initiation request may be received indicating a gas concentration level amount to be used for calibrating a VOC detector. A gas may be provided to the VOC detector according to the gas concentration level amount. The VOC detector may be provided with the gas concentration level amount. A calibration log may be received from the VOC detector. The calibration log may comprise an identifier of the VOC detector, the gas concentration level amount, and a date indicating when the VOC detector received the gas concentration level amount and the gas according to the gas concentration level amount.

In another implementation, a validation request may be received indicating a gas concentration level amount. Gas may be provided to the VOC detector according to the gas concentration level amount. A detection message indicating a concentration level of gas detected by the VOC detector may be received. The calibration of the VOC detector may be validated based on the gas concentration level amount and the concentration level of gas detected by the VOC detector.

The above referenced summary section is provided to introduce a selection of concepts in a simplified form that are further described below in the detailed description section. The summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter. Furthermore, the claimed subject matter is not limited to implementations that solve any or all disadvantages noted in any part of this disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

Implementations of various technologies will hereafter be described with reference to the accompanying drawings. It should be understood, however, that the accompanying drawings illustrate only the various implementations described herein and are not meant to limit the scope of various technologies described herein.

FIG. **1** illustrates a schematic diagram of a VOC detector calibration system in accordance with one or more implementations of various technologies described herein.

FIG. **2** illustrates a schematic diagram of a personal digital assistant (PDA) in accordance with one or more implementations of various technologies described herein.

FIG. **3** illustrates a flow diagram of a method for calibrating a VOC detector in accordance with implementations of various technologies and techniques described herein.

FIG. **4** illustrates a flow diagram of a method for validating the calibration of a VOC detector in accordance with implementations of various technologies and techniques described herein.

DETAILED DESCRIPTION

The discussion below is directed to certain specific implementations. It is to be understood that the discussion below is only for the purpose of enabling a person with ordinary skill in the art to make and use any subject matter defined now or later by the patent "claims" found in any issued patent herein.

The following paragraphs generally describe one or more implementations of various techniques directed to calibrating a volatile organic compound (VOC) detector. In one implementation, the VOC detector calibration system includes a VOC detector and a spanbox in communication with a personal digital assistant (PDA).

In operation, a user selects the VOC detectors to be calibrated from a list of available VOC detectors presented on the PDA. The user may further select a set of gas-cylinders to be used in the calibration according to a 4-point set of qualifying criteria. The VOC detectors may then be calibrated according to device-specific calibration methods.

In general, calibration involves providing gas with a specific methane level into the VOC detectors, and identifying the specific level to the VOC detector. The spanbox provides the gas containing the specific methane level from cylinders connected to the spanbox, to the VOC detectors.

After calibration, the VOC detectors may be checked to ensure proper detection. Again, the spanbox provides the gas with specific methane level into the VOC detectors. The VOC detectors determine the methane content of the gas, and signal the detected methane level to the PDA. The software on the PDA compares the detected level to the actual level and determines whether the VOC detectors pass the validation.

Validation may be based on the accuracy within which the VOC detectors detect the actual methane levels. Further, the validation may be based on an average of detected methane levels over several trials. Alternately, the validation may be based on how much time it takes for the VOC detectors to detect the actual level of methane in the gas. One or more implementations of various techniques for calibrating a VOC detector and validating the calibration of the VOC detector will now be described in more detail with reference to FIGS. **1-5** in the following paragraphs.

FIG. **1** illustrates a block diagram of a VOC detector calibration system **100** in accordance with one or more implementations of various technologies described herein. The calibration system **100** may include one or more gas sources **102**, a spanbox **104**, a PDA **106**, and one or more VOC detectors **108**.

The gas sources **102** may be configured to provide gas to the calibration system **100**. The gas sources **102** may provide different concentrations of gas over each of the gas lines **103** to the spanbox **104**. For example, the gas sources **102** may provide a methane gas concentration of 100 parts-per-million (PPM) over a first gas line, a concentration of 550 PPM over a second gas line, 750 PPM over a third gas line, etc.

The spanbox **104** may be configured to facilitate the delivery of gas to the VOC detector **108**. The gas sources **102** may be coupled to the spanbox **104** via one or more gas lines **103**. In one implementation, each gas line **103** may provide a different concentration of methane gas to the spanbox **104**. Accordingly, the spanbox **104** may select a specific gas concentration from among the gas lines **103**, and provide the selected gas concentration to the VOC detectors **108**. Although various implementations described herein are with reference to methane gas, it should be understood that in some implementations, other types of gas may be used, such as hexane, propane, carbon tetrachloride, and the like.

Further, although various implementations are described with reference to a spanbox **104** providing gas to the VOC detector **108**, it should be understood that in some implementations, the gas may be delivered directly to the VOC detector **108** without use of a spanbox **104**. For example, the delivery of the gas to the VOC detector **108** may be performed manually, using bags, containers, and the like.

The spanbox **104** may be in communication with the PDA **106**, which is described in more detail in FIG. **2**. The spanbox **104** may also be coupled to the VOC detectors **108**. The PDA **106** may be in communication with the spanbox **104** and the VOC detectors **108**. Communication between the PDA **106** and the spanbox **104** or the VOC detectors **108** may occur over wired or wireless connections. In one implementation, the PDA **106** communicates with the spanbox **104** over a serial cable, and with the VOC detector **108** via Bluetooth communications.

The VOC detectors **108** may be configured to detect volatile organic chemicals, emissions gases, nitro-aromatics, chemical warfare agents and the like. In one implementation, the VOC detectors **108** are TVA-1000's available from The Foxboro Company of Massachusetts, USA. However, it should be understood that some implementations may use other types of VOC detectors.

FIG. **2** illustrates a schematic diagram of a PDA **200** in accordance with one or more implementations of various technologies described herein. The PDA **200** may include a central processing unit (CPU) **221**, a system memory **222** and a system bus **223** that couples various system components including the system memory **222** to the CPU **221**. Although only one CPU is illustrated in FIG. **2**, it should be understood that in some implementations the PDA **200** may include more than one CPU. The system bus **223** may be any of several types of bus structures, including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. By way of example, and not limitation, such architectures may include Industry Standard Architecture (ISA) bus, Micro Channel Architecture (MCA) bus, Enhanced ISA (EISA) bus, Video Electronics Standards Association (VESA) local bus, and Peripheral Component Interconnect (PCI) bus also known as Mezzanine bus. The system memory **222** may include a read only memory (ROM) **224** and a random access memory (RAM) **225**. A basic input/output system (BIOS) **226**, containing the basic routines that help transfer information between elements within the PDA **200**, such as during start-up, may be stored in the ROM **224**.

The PDA **200** may further include a hard disk drive **227** for reading from and writing to a hard disk. The hard disk drive **227** may be connected to the system bus **223** by a hard disk drive interface **232**. The drives and their associated computer-readable media may provide nonvolatile storage of computer-readable instructions, data structures, program modules and other data for the PDA **200**.

The PDA **200** may further include computer-readable media that may be accessed by the CPU **221**. For example, such computer-readable media may include computer storage media and communication media. Computer storage media may include volatile and non-volatile, and removable and non-removable media implemented in any method or technology for storage of information, such as computer-readable instructions, data structures, program modules or other data. Computer storage media may further include RAM, ROM, erasable programmable read-only memory (EPROM), electrically erasable programmable read-only memory (EEPROM), flash memory or other solid state memory technology, CD-ROM, digital versatile disks (DVD), or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store the desired information and which can be accessed by the CPU **221**.

Communication media may embody computer readable instructions, data structures, program modules or other data in a modulated data signal, such as a carrier wave or other transport mechanism and may include any information delivery media. The term "modulated data signal" may mean a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media may include wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, RF, infrared and other wireless media. Combinations of any of the above may also be included within the scope of computer readable media.

A number of program modules may be stored on ROM **224** or RAM **225**, including an operating system **235**, a calibration program **236** and a calibration validation program **240**. The operating system **235** may be any suitable operating system that may control the operation of a networked personal or server computer, such as Windows® XP, Mac OS® X, Unix-variants (e.g., Linux® and BSD®), and the like. The calibration program **236** will be described in more detail with reference to FIG. **3** in the paragraphs below. Similarly, the calibration validation program **240** will be described in more detail with reference to FIG. **4** in the paragraphs below.

It should be understood that the various technologies described herein may be implemented in connection with hardware, software or a combination of both. Thus, various technologies, or certain aspects or portions thereof, may take the form of program code (i.e., instructions) embodied in tangible media, such as floppy diskettes, CD-ROMs, hard drives, or any other machine-readable storage medium wherein, when the program code is loaded into and executed by a machine, such as a computer, the machine becomes an apparatus for practicing the various technologies. In the case of program code execution on programmable computers, the computing device may include a processor, a storage medium readable by the processor (including volatile and non-volatile memory and/or storage elements), at least one input device, and at least one output device. One or more programs that may implement or utilize the various technologies described herein may use an application programming interface (API), reusable controls, and the like. Such programs may be implemented in a high level procedural or object oriented programming language to communicate with a computer system. However, the program(s) may be implemented in assembly or machine language, if desired. In any case, the language may be a compiled or interpreted language, and combined with hardware implementations.

For example, the various technologies described herein may be implemented in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network, e.g., by hard-wired links, wireless links, or combinations thereof. In a distributed computing environment, program modules may be located in both local and remote computer storage media including memory storage devices.

FIG. **3** illustrates a flow diagram of a method **300** for calibrating a VOC detector in accordance with implementations of various technologies and techniques described herein. It should be understood that while the flow diagram indicates a particular order of execution of the operations, in some implementations, the operations might be executed in a different order. In one implementation, the method **300** may be performed by the calibration program **236**.

Before validation, the VOC detector **108** may need to be warmed up for a pre-determined time period. In one implementation, the calibration program **236** may measure the amount of time in the warm-up period and store the time. A determination may be made as to whether the warm-up period is sufficient for the VOC detector **108**. For example, if the warm-up period is equal to or greater than a pre-determined amount of time, e.g., 30 minutes, the VOC detector **108** may be deemed as having passed. Alternatively, if the warm-up period is less than the predetermined amount, then the VOC detector may be deemed as having failed.

At step **305**, a calibration request may be received by the PDA **106**. In one implementation, the calibration request may be a request from a user operating the PDA **106**. The calibration request may specify a gas concentration level to be used for calibrating the VOC detector **108**.

At step **306**, a VOC detector selection may be received by the PDA **106**. In one implementation, the calibration program **236** may be configured to present a list of VOC detectors **108** that are available for calibration. Accordingly, a user operating the PDA **106** may select one of the VOC detectors **108** to be calibrated.

At step **308**, a gas source **102** selection may be received by the PDA **106**. In one implementation, the calibration program **236** may be configured to present a list of gas sources **102** that are available for calibration. Accordingly, a user operating the PDA **106** may select one or more of the gas sources **102** to provide the gas for calibrating the VOC detector selected at step **306**.

At step **309**, a calibration mode command may be sent to the VOC detector **108**. In response to the command, the VOC detector **108** may be configured to send a calibration log to the PDA **106** after the calibration is complete.

At step **310**, a flow request may be sent to the spanbox **104**. The flow request may include the gas concentration level amount specified in the calibration request received in step **305**. In response, the spanbox **104** may provide a gas with the specified gas concentration level to the VOC detector **108**.

At step **315**, the calibration program **236** may provide the VOC detector **108** with the gas concentration level amount. In one implementation, the VOC detector **108** may combust the gas provided by the spanbox **104** to derive an electronic signature. At step **317**, the VOC detector **108** may internally store a record that associates the electronic signature of the combusted gas with the gas concentration level amount. At step **320**, a calibration log may be received from the VOC detector **108** by the calibration program **236** that includes an identifier of the VOC detector **108**, e.g., a serial number, the gas concentration level amount, and a date and or time that the calibration takes place. The calibration log may be stored on the PDA **106** or another device. Advantageously, by storing the calibration log digitally, typical recordation errors that may otherwise incur regulatory sanctions can be avoided.

In one implementation, one or more VOC detectors **108** may be selected at step **306** and steps **310-320** may be repeated for each selected VOC detector. Further, calibrating a VOC detector typically requires multiple gas concentration level specifications. As such, steps **310-320** may be repeated for each gas concentration level specification on each VOC detector **108** selected at step **306**.

FIG. **4** illustrates a flow diagram of a method **400** for validating the calibration of a VOC detector **108** in accordance with implementations of various technologies and techniques described herein. It should be understood that while the flow diagram indicates a particular order of execution of the operations, in some implementations, the operations might be executed in a different order. In one implementation, the method **400** may be performed by the calibration validation program **240**.

At step **405**, a validation request may be received by the PDA **106**. In one implementation, the validation request may be a request from a user operating the PDA **106**. The validation request may specify a gas concentration level to be used for validating the calibration of the VOC detector **108**.

At step **407**, a validation mode command may be sent to the VOC detector **108**. In response to receiving the command, the VOC detector **108** may be configured to analyze the gas concentration level and send the detected gas concentration level to the PDA **106**.

At step **410**, a flow request may be sent to the spanbox **104**. The flow request may include the gas concentration level amount specified in the validation request received in step **405**. In response to receiving the flow request, the spanbox **104** may provide a gas with the specified gas concentration level to the VOC detector **108**.

In one implementation, the VOC detector **108** operating in the validation mode may analyze the gas provided by the spanbox **104**, and send a signal specifying the concentration of gas detected to the PDA **106**. At step **415**, the PDA **106** may receive a detection message indicating the concentration level of gas detected by the VOC detector **108**. In one implementation, the validation program **240** may be configured to measure the amount of time it would take the VOC detector **108** to detect a gas concentration level within a specified range of the actual gas concentration level.

At step **420**, the validation program **240** may determine whether the VOC detector **108** passes the validation test. In one implementation, determining whether the VOC detector **108** passes the validation test may be based on whether the detected gas concentration level is within a specified range of the actual gas concentration level. In another implementation, determining whether the VOC detector passes the validation test may be based on whether gas concentration level detected by the VOC detector is within a specified range of the gas concentration level amount within a specified time period. The specified range, the specified percentage and/or the specified time periods may be user specified. For example, the specified percentage may be 90 percent. In one implementation, the VOC detector **108** may be calibrated and validated three times and an average of the variance between the detected gas concentration level is calculated. In this implementation, the validation test may be based on whether the detected gas concentration level is within a specified percentage of a known gas.

At step **425**, the validation program **240** may present a validation result message. If the VOC detector **108** passes the validation test, the validation program **240** may present a validation success message. If the VOC detector **108** does not pass the validation test, the validation program **240** may present a validation failure message.

In one implementation, the validation program **240** may store the result of the validation test. The stored result may also include an identifier of the VOC detector **108** validated, the concentration level of the gas provided for the validation test, and a date and/or time of the validation.

Although implementations of various technologies described herein are described with reference to a PDA, it should be understood that some implementations may be operational with other types of computing systems, such as laptop devices, personal computers, multi-processor systems, microprocessor-based systems, programmable consumer electronics, minicomputers, and the like.

While the foregoing is directed to implementations of various technologies described herein, other and further implementations may be devised without departing from the basic scope thereof, which may be determined by the claims that follow. Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

What is claimed is:

1. A method for calibrating a volatile organic compound (VOC) detector, comprising:

receiving an initiation request indicating a gas concentration level amount to be used for calibrating a VOC detector, wherein the VOC detector is configured to test whether valves and other components in petrochemical facilities are leaking;

providing gas according to the gas concentration level amount to the VOC detector;

providing the VOC detector with the gas concentration level amount via a wireless connection; and

receiving a calibration log from the VOC detector via the wireless connection, wherein the calibration log comprises an identifier of the VOC detector, the gas concentration level amount, an electronic signature of the provided gas, a date indicating when the VOC detector received the gas concentration level amount and the gas according to the gas concentration level amount, wherein the electronic signature is derived by combusting the provided gas.

2. The method of claim **1**, further comprising associating the electronic signature with the gas concentration level amount.

3. The method of claim **1**, further comprising:

presenting a list of available VOC detectors; and

receiving a selection for the VOC detector.

4. The method of claim **1**, further comprising sending a flow request to a spanbox to provide gas to the VOC detector.

5. The method of claim **4**, further comprising:

presenting a list of available gas sources;

receiving a selection for one or more gas sources, wherein the spanbox provides gas from one of the selected gas sources.

6. The method of claim **1**, further comprising:

receiving a validation request indicating the gas concentration level amount used for calibrating the VOC detector;

providing gas according to the gas concentration level amount to the VOC detector;

receiving a detection message indicating the concentration level of gas detected by the VOC detector; and

validating the calibration of the VOC detector based on the gas concentration level amount and the concentration level of gas detected by the VOC detector.

7. The method of claim **6**, wherein validating the calibration of the VOC detector comprises determining whether the VOC detector passes a validation test based on the detected concentration level of gas, and the gas concentration level amount.

8. The method of claim **7**, further comprising displaying a message indicating whether the VOC detector passes the validation test.

9. The method of claim **6**, wherein validating the calibration of the VOC detector comprises determining whether the detected concentration level is within a specified percentage of the gas concentration level amount.

10. The method of claim **6**, wherein validating the calibration of the VOC detector comprises determining whether the detected concentration level is within a specified range of the gas concentration level amount and that the VOC detector detects the detected concentration level within a specified time period.

11. The method of claim **6**, further comprising storing a validation record indicating an identifier of the VOC detector, a result indicating whether the VOC detector passes the validation test, and a date indicating when the VOC detector is validated.

12. The method of claim **6** wherein the gas concentration level is based on the electronic signature of the provided gas.

13. The method of claim **1**, wherein the initiation request is received by a Personal Digital Assistant (PDA).

14. The method of claim **13**, wherein the gas concentration level is provided by the PDA.

15. The method of claim **1**, wherein the gas is provided by a spanbox.

16. A method for validating a calibration of a volatile organic compound detector (VOC detector), comprising:

receiving a validation request indicating a gas concentration level amount;

providing gas according to the gas concentration level amount to the VOC detector, wherein the VOC detector is configured to test whether valves and other components in petrochemical facilities are leaking;

receiving a detection message indicating a concentration level of gas detected by the VOC detector via a wireless connection, wherein the detected gas concentration level is based on an electronic signature of the provided gas, and wherein the electronic signature is derived by combusting the provided gas; and

validating the calibration of the VOC detector based on the gas concentration level amount and the concentration level of gas detected by the VOC detector.

17. The method of claim 16, wherein validating the calibration of the VOC detector comprises determining whether the VOC detector passes a validation test based on whether the detected gas concentration level is within a specified percentage of the actual gas concentration level.

18. The method of claim 17, further comprising displaying a message indicating whether the VOC detector passes the validation test.

19. The method of claim 16, wherein validating the calibration of the VOC detector comprises determining whether the detected concentration level is within a specified percentage of the gas concentration level amount.

20. The method of claim 16, wherein validating the calibration of the VOC detector comprises determining whether the detected concentration level is within a specified range of the gas concentration level amount and that the VOC detector detects the detected concentration level within a specified time period.

21. The method of claim 16, further comprising storing a validation record indicating an identifier of the VOC detector, a result indicating whether the VOC detector passes the validation test, and a date indicating when the VOC detector is validated.

22. A system for calibrating a volatile organic compound (VOC) detector, comprising:

a processor; and

a memory having stored thereon computer-executable instructions which, when executed by a computer, cause the computer to:

receive an initiation request indicating a gas concentration level amount to be used for calibrating a VOC detector, wherein the VOC detector is configured to test whether valves and other components in petrochemical facilities are leaking;

provide gas according to the gas concentration level amount to the VOC detector;

provide the VOC detector with the gas concentration level amount via a wireless connection; and

receive a calibration log from the VOC detector via the wireless connection, wherein the calibration log comprises an identifier of the VOC detector, the gas concentration level amount, an electronic signature of the provided gas and a date indicating when the VOC detector is calibrated with the gas concentration level amount, wherein the electronic signature is derived by combusting the provided gas.

23. The system of claim 22, wherein the memory further comprises computer-executable instructions which, when executed by a computer, cause the computer to:

associate the electronic signature with the gas concentration level amount.

24. The system of claim 22, wherein the memory further comprises computer-executable instructions which, when executed by a computer, cause the computer to:

receive a validation request indicating the gas concentration level amount used for calibrating the VOC detector;

provide gas according to the gas concentration level amount to the VOC detector;

receive a detection message indicating the concentration level of gas detected by the VOC detector;

validate the calibration of the VOC detector based on the gas concentration level amount and the concentration level of gas detected by the VOC detector; and

display a message indicating whether the VOC detector passes the validation test.

25. The system of claim 24 wherein the gas concentration level is based on the electronic signature of the provided gas.

* * * * *

US008034290B1

(12) United States Patent
Skiba et al.

(10) Patent No.: US 8,034,290 B1
(45) Date of Patent: Oct. 11, 2011

(54) REIGNITING FLAME IN VOLATILE ORGANIC COMPOUND DEVICE

(75) Inventors: Leo Skiba, Nassau Bay, TX (US); Rex Moses, Nassau Bay, TX (US); Keith Adams, Galveston, TX (US); Jack Clark, Houston, TX (US); Bradley O'Keefe, Houston, TX (US); Kevin Moses, League City, TX (US); Andrew Reiter, Houston, TX (US)

(73) Assignee: LDARtools, Inc., League City, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 819 days.

(21) Appl. No.: 11/668,367

(22) Filed: Jan. 29, 2007

(51) Int. Cl.

G01N 27/00	(2006.01)
G01N 7/00	(2006.01)
G01N 21/00	(2006.01)
G01N 31/00	(2006.01)
G01N 33/00	(2006.01)
G01N 31/12	(2006.01)

(52) **U.S. Cl.** **422/54**; 422/83; 422/94

(58) **Field of Classification Search** 422/54, 422/94

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,853,455 A *	12/1974	Riordan et al.		431/80
3,985,509 A *	10/1976	Trone et al.		422/54
4,346,055 A *	8/1982	Murphy et al.		422/54
H572 H	2/1989	Hansen		
5,206,818 A	4/1993	Speranza		
5,356,594 A	10/1994	Neel et al.		
6,341,287 B1	1/2002	Sziklai et al.		
6,438,535 B1	8/2002	Benjamin et al.		
6,478,849 B1	11/2002	Taylor et al.		
6,545,278 B1	4/2003	Mottier et al.		
6,609,090 B1	8/2003	Hickman et al.		
6,672,129 B1	1/2004	Frederickson et al.		
6,680,778 B2	1/2004	Hinnrichs et al.		
6,722,185 B2	4/2004	Lawson et al.		
7,017,386 B2	3/2006	Liu et al.		
7,103,610 B2	9/2006	Johnson et al.		

(Continued)

FOREIGN PATENT DOCUMENTS

WO 2006-022648 A1 3/2006

OTHER PUBLICATIONS

Palo Wireless: Bluetooth Resource Center. "Bluetooth Tutorial—Specifications", [online]. [retrieved on Dec. 23, 2009]. Retrieved from: Internet Archive Wayback Machine (Jan. 5, 2006).*

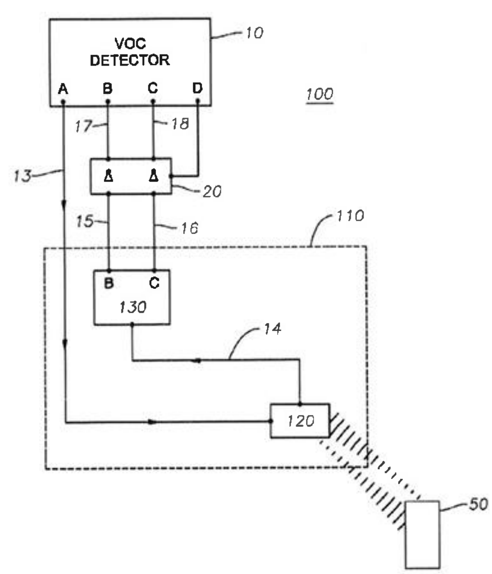
(Continued)

Primary Examiner — Jill Warden
Assistant Examiner — Charles D Hammond
(74) *Attorney, Agent, or Firm* — Pramudji Law Group PLLC; Ari Pramudji

(57) **ABSTRACT**

Reigniting a flame in a volatile organic compound (VOC) detector in the event that the flame has gone out. In one implementation, a signal is received at a handheld personal computer indicating that a flame in the VOC detector has gone out. The flame in the VOC detector may then be reignited using the handheld personal computer and a Bluetooth enabled device facilitating communication between the handheld personal computer and the VOC detector.

26 Claims, 3 Drawing Sheets



U.S. PATENT DOCUMENTS

7,136,904 B2	11/2006	Bartek et al.	
7,369,945 B2	5/2008	Miller et al.	
7,588,726 B1 *	9/2009	Mouradian et al.	422/83
7,657,384 B1	2/2010	Moses	
7,840,366 B1	11/2010	Moses et al.	
2002/0026339 A1	2/2002	Frankland et al.	
2002/0080032 A1	6/2002	Smith et al.	
2002/0094498 A1 *	7/2002	Rodriguez-Rodriguez et al.	431/18
2003/0012696 A1	1/2003	Millancourt	
2003/0081214 A1	5/2003	Mestha et al.	
2003/0085714 A1	5/2003	Keyes et al.	
2004/0226345 A1	11/2004	McCoy et al.	
2004/0258213 A1	12/2004	Beamon et al.	
2005/0000981 A1	1/2005	Peng et al.	
2005/0053104 A1	3/2005	Kulp et al.	
2006/0020186 A1	1/2006	Brister et al.	
2006/0235611 A1	10/2006	Deaton et al.	
2006/0286495 A1 *	12/2006	Roussel	431/24
2007/0000310 A1	1/2007	Yamartino et al.	
2008/0021717 A1	1/2008	Kaartinen et al.	
2008/0063298 A1	3/2008	Zhou et al.	
2008/0092625 A1	4/2008	Hinnrichs	
2008/0120043 A1	5/2008	Miller et al.	

OTHER PUBLICATIONS

Environmental Analytics, Inc. v. *TMX2, Inc. and LDAR Solutions, Ltd.*; Case 4:08-cv-03353; USDC, Southern District of Texas; First Amended Complaint; Dec. 10, 2008.

"2nd Annual Fugitive Emissions—Leak Detection and Repair Symposium"; ISA Technical Conference Brochure; Nov. 2002.

"Introducing the Allegro CX(TM) Field Computer"; Product Newswire (product announcement); Jun. 21, 2004.

"New from Accutech, Wireless Acoustic Monitor Field Units Make Fugitive Emissions Monitoring Compliance Easy"; Product Announcement/Description; Feb. 10, 2004.

"LDARManager™ Makes Fugitive Emission Monitoring A Breeze TISCOR launches its newest product for Leak Detection and Repair"; product announcement/description; Nov. 8, 2002.

Office Action (Aug. 4, 2009); U.S. Appl. No. 12/032,499 (Moses, et al).

Response to Office Action (Jul. 13, 2010); Office Action (Apr. 14, 2010); Response/Amendment After Final (Mar. 29, 2010); Final Office Action (Jan. 29, 2010); Response to Office Action (Nov. 4, 2009); and Office Action (Aug. 4, 2010); U.S. Appl. No. 12/032.499 (Moses, et al).

Office Action (Sep. 27, 2010); U.S. Appl. No. 12/133,920 (Moses, et al).

Response After Final (May 23, 2011), Final Office Action (Mar. 22, 2011), Response to Office Action (Dec. 27, 2010); U.S. Appl. No. 12/133.920 (Moses, et al).

Sylvers, Eric; Wireless: The story of 'WI'—Technology—International Herald Tribune; Apr. 2006; http://www.nytimes.com/2006/04/17/technology/17iht-wireless18.1550306.html?pagewanted=print (retrieved May 17, 2011).

Office Action (May 27, 2011); U.S. Appl. No. 12/474,504 (Bolinger, et al.).

* cited by examiner

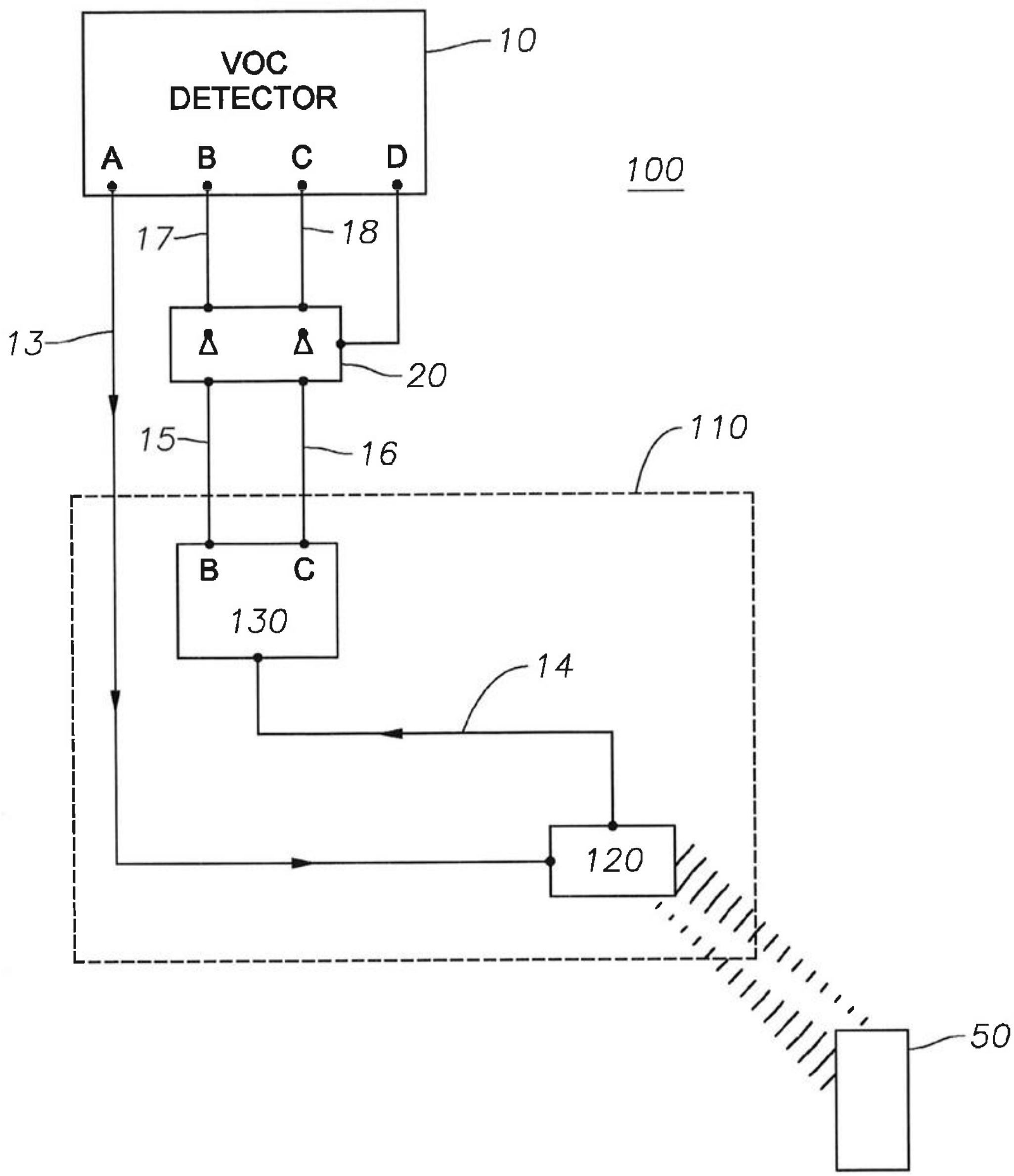


Fig. 1

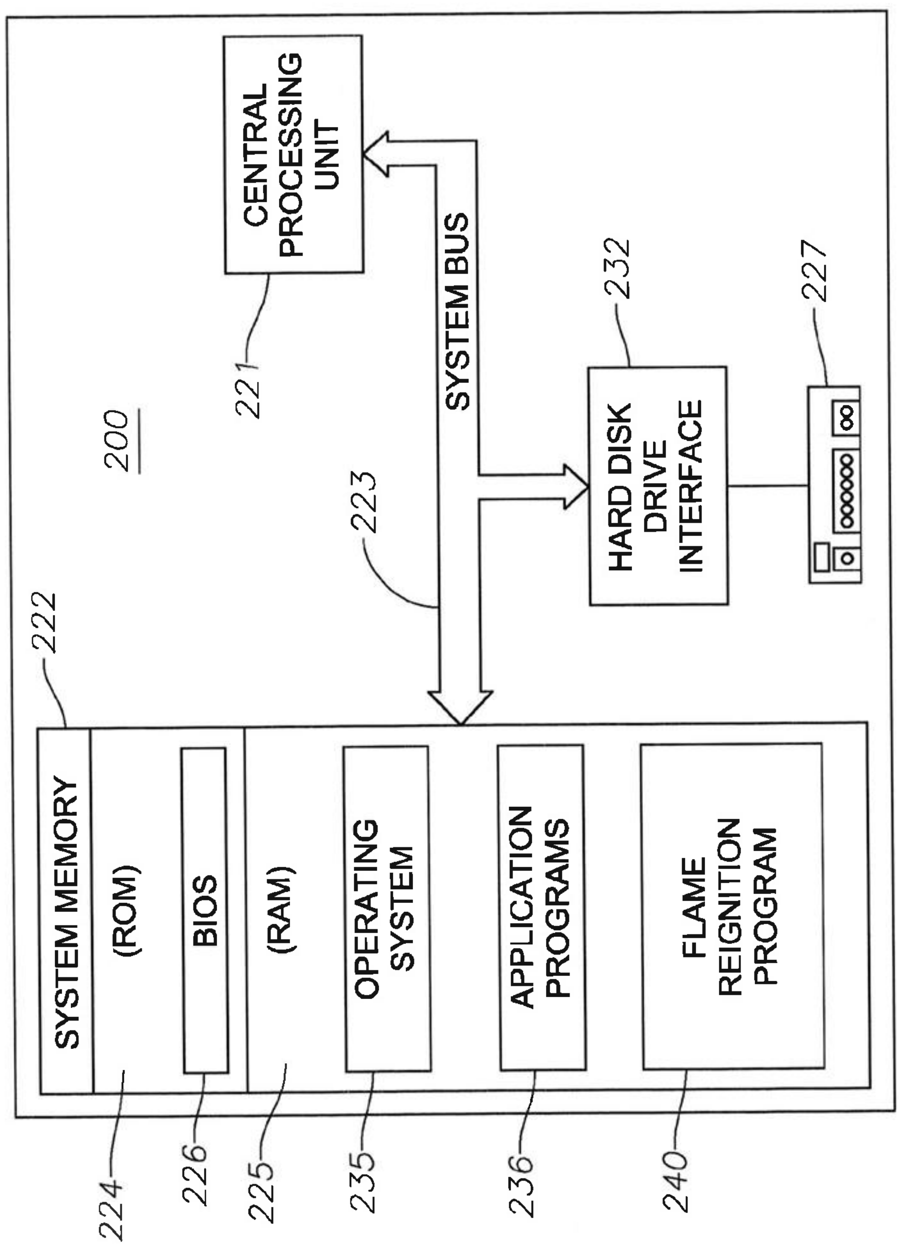

200
CENTRAL PROCESSING UNIT
221
SYSTEM BUS
223
HARD DISK DRIVE INTERFACE
232
227
222
SYSTEM MEMORY
(ROM)
BIOS
(RAM)
OPERATING SYSTEM
APPLICATION PROGRAMS
FLAME REIGNITION PROGRAM
224
226
225
235
236
240

Fig. 2

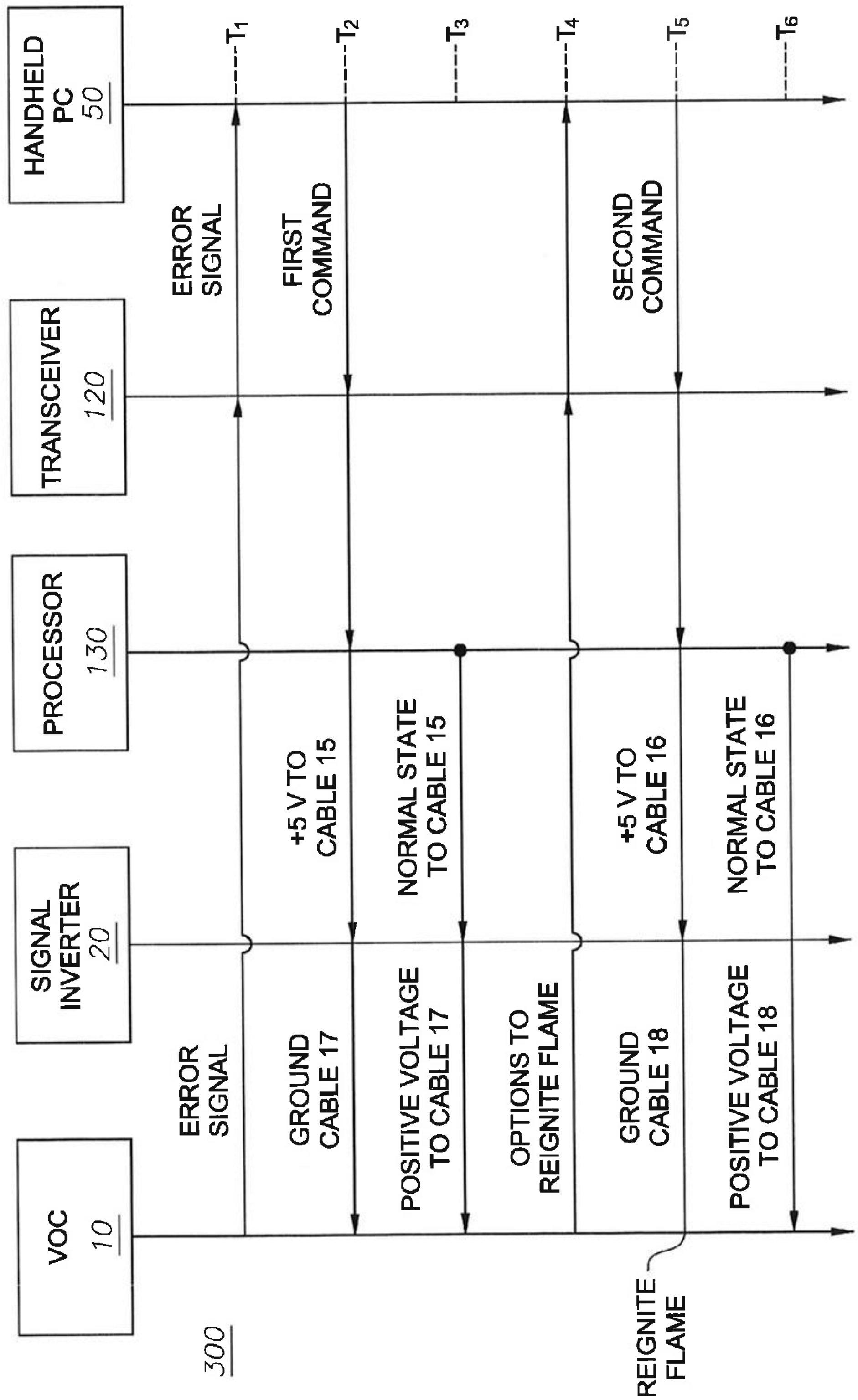

HANDHELD PC 50
TRANSCEIVER 120
PROCESSOR 130
SIGNAL INVERTER 20
VOC 10
300
T1
T2
T3
T4
T5
T6
ERROR SIGNAL
FIRST COMMAND
SECOND COMMAND
+5 V TO CABLE 15
NORMAL STATE TO CABLE 15
+5 V TO CABLE 16
NORMAL STATE TO CABLE 16
ERROR SIGNAL
GROUND CABLE 17
POSITIVE VOLTAGE TO CABLE 17
OPTIONS TO REIGNITE FLAME
GROUND CABLE 18
POSITIVE VOLTAGE TO CABLE 18
REIGNITE FLAME

Fig. 3

REIGNITING FLAME IN VOLATILE ORGANIC COMPOUND DEVICE

BACKGROUND

1. Field of the Invention

Implementations of various technologies described herein are directed to volatile organic compound (VOC) detection and to various methods and/or systems for igniting a flame in a volatile organic compound (VOC) detector, e.g., reigniting a flame that has been extinguished in a volatile organic compound (VOC) detector.

2. Description of the Related Art

The following descriptions and examples do not constitute an admission as prior art by virtue of their inclusion within this section.

Industrial plants that handle volatile organic compounds (VOCs) sometimes experience unwanted emissions of those compounds into the atmosphere from point sources, such as smokestacks, and non-point sources, such as valves, pumps, and/or vessels containing the VOCs. Emissions from non-point sources typically occur due to leakage of the VOCs from joints and/or seals and may be referred to herein as "fugitive emissions". Fugitive emissions from control valves typically occur as leakage through the packing set around the valve stem. Control valves used in demanding service conditions involving large temperature fluctuations and frequent movements of the valve stem commonly suffer accelerated deterioration of the valve stem packing set.

The United States Environmental Protection Agency (EPA) has promulgated regulations specifying maximum permitted leakage of certain hazardous air pollutants, such as benzene, toluene, 1,1.1-trichloroethane, from certain hardware or fixtures, e.g., control valves. The regulations require facility operators to perform periodic surveys of the emissions from all control valves and pump seals. The survey interval frequency may be monthly, quarterly, semiannual, or annual. If the facility operator can document that a certain percentage of valves and pumps with excessive leakage are below a prescribed minimum, the required surveys become less frequent. Thus, achieving a low percentage of leaking valves reduces the number of surveys required per year, which may result in large cost savings.

Fugitive emissions are typically monitored using a VOC detector. which may also be referred to as a vapor analyzer. Due to the location of the control valves and a tendency to jar the VOC detector during operation, the flame inside the VOC detector may often go out during detection. When this happens, the technician operating the VOC detector may need to reignite the flame, e.g., by manually reigniting the flame. Manual reignition has a number of disadvantages, including having to unstrap the VOC detector from the back of the technician. If the flame extinguishes while the technician is in the process of climbing up a ladder on a structure, e.g., en route to a location where detection will take place, then the entire detection process is disrupted and often, for safety reasons, the technician not only has to stop climbing the ladder, but changes direction and goes back down the ladder, so that the VOC detector can be safely unstrapped and the flame manually reignited. Accordingly, there is an ongoing need for the methods and systems disclosed below.

SUMMARY

Described herein are implementations of various technologies for a method for igniting a flame in a volatile organic compound (VOC) detector. In one implementation, the method includes transmitting a first signal to the VOC detector through a wireless device. The signal is configured to ignite a flame in the VOC detector.

In another implementation, the method may include receiving a signal at a handheld personal computer indicating that a flame in the VOC detector is extinguished and reigniting the flame in the VOC detector using a wireless device configured to facilitate communication between the handheld personal computer and the VOC detector.

Also described herein are implementations of various technologies for a volatile chemical (VOC) detection system, which may include a VOC detector and a handheld personal computer in communication with the VOC detector. The handheld personal computer may be configured to control an operation of the VOC detector. The VOC detection system may further include a wireless device in communication with the VOC detector and the handheld personal computer. The wireless device may be configured to facilitate communication between the VOC detector and the handheld personal computer.

Still further, described herein are implementations of various technologies for a volatile chemical (VOC) detector, which may include a processor and a memory comprising program instructions executable by the processor to receive a first signal indicating that a flame in the VOC detector is extinguished; send a first command to a signal inverter to ground port B of the VOC detector for a first predetermined amount of time and apply a first positive voltage to port B once the first predetermined amount of time has lapsed; receive a second signal indicating an option to reignite the flame in the VOC detector; and send a second command to the signal inverter to ground port C of the VOC detector for a second predetermined amount of time and apply a second positive voltage to port C once the second predetermined amount of time has lapsed.

The above referenced summary section is provided to introduce a selection of concepts in a simplified form that are further described below in the detailed description section. The summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter. Furthermore, the claimed subject matter is not limited to implementations that solve any or all disadvantages noted in any part of this disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

Implementations of various technologies will hereafter be described with reference to the accompanying drawings. It should be understood, however, that the accompanying drawings illustrate only the various implementations described herein and are not meant to limit the scope of various technologies described herein.

FIG. 1 illustrates a schematic diagram of a VOC detection system in accordance with one or more implementations of various technologies described herein

FIG. 2 illustrates a schematic diagram of a handheld personal computer in accordance with one or more implementations of various technologies described herein.

FIG. 3 illustrates a signal diagram for reigniting a flame in the VOC detector in accordance with one or more implementations of various technologies described herein.

DETAILED DESCRIPTION

The discussion below is directed to certain specific implementations. It is to be understood that the discussion below is only for the purpose of enabling a person with ordinary skill in the art to make and use any subject matter defined now or later by the patent "claims" found in any issued patent herein.

The following paragraphs generally describe implementations of various techniques directed to various methods and systems for igniting a flame in a volatile organic compound (VOC) detector or reigniting a flame that has been extinguished. In one implementation, the VOC detection system includes a VOC detector in communication with a handheld personal computer (PC), a signal inverter coupled to the VOC detector and a Bluetooth enabled device for facilitating communication between the VOC detector and the handheld PC. The Bluetooth enabled device communicates with the handheld PC wirelessly.

In operation, when a flame inside the VOC detector extinguishes, the VOC detector sends an error message to the handheld PC via the Bluetooth enabled device. In response, the technician may send a first command through the handheld PC to the signal inverter. Upon receipt of the first command, the signal inverter grounds port B of the VOC detector for a predetermined amount of time and applies a positive voltage after the predetermined amount of time has lapsed. Upon detection that its port B was grounded for the predetermined amount of time and the positive voltage is applied to the port, the VOC detector clears the error message and sends an option to reignite the flame to the handheld PC via the Bluetooth enabled device. Upon receipt of this option, the technician may then send a second command through the handheld PC to the signal inverter. Upon receipt of the second command, the signal inverter grounds port C of the VOC detector for a predetermined amount of time and applies a positive voltage after the predetermined amount of time has lapsed. Upon detecting that port C has been grounded for the predetermined amount of time and the positive voltage is applied to port C, the VOC detector reignites the flame. One or more techniques for reigniting a flame in the VOC detector in accordance with various implementations are described in more detail with reference to FIGS. **1-3** in the following paragraphs.

FIG. **1** illustrates a VOC detection system **100** in accordance with one or more implementations of various technologies described herein. The VOC detection system **100** may also be referred to as a toxic vapor analyzer (TVA). The VOC detection system **100** may include a VOC detector or analyzer **10** configured to detect volatile organic chemicals, emissions gases, nitroaromatics, chemical warfare agents and the like. In one implementation, the VOC detector **10** is TVA-1000 available from The Foxboro Company out of Massachusetts, USA. However, it should be understood that some implementations may use other types of VOC detectors. The VOC detector **10** may include an organic or inorganic vapor monitor using a flame ionization detector (FID) or both an FID and a photoionization detector (PID). The VOC detector **10** may be coupled to a signal inverter **20**, which may be configured to invert a positive voltage signal to ground. Although the signal inverter **20** is described herein as being configured to invert a positive signal to ground, it should be understood that in some implementations depending on the configuration of the VOC detector **10**, the signal inverter **20** may be configured to invert a positive voltage to a negative voltage or invert a negative voltage signal to a positive voltage signal. Likewise, although the VOC detector **10** is described as operating with a signal inverter **20**, it should be understood that in some implementations the VOC detector **10** may operate with other devices having the same or similar functionalities as the signal inverter **20**, such as an electro-mechanical relay, a solid state relay, or an integrated circuit that would operate to pull a positive voltage signal to ground.

The signal inverter **20** may be coupled to the VOC detector **10** via cable **17** at port B and via cable **18** at port C. Various cables described herein may be made of copper. However, it should be understood that the various cables may be made from other types of material, such as fiber optic, aluminum and the like. Port D of the VOC detector **10** may be connected to ground.

The VOC detector **10** may further be coupled to a Bluetooth enabled device **110**. As such, port A of the VOC detector **10** may be coupled to a transceiver **120** portion of the Bluetooth enabled device **110** via cable **13**. The Bluetooth enabled device **110** is described in more detail in the paragraphs below.

The signal inverter **20** may also be coupled to the Bluetooth enabled device **110** via cable **15** and cable **16**. In one implementation, the signal inverter **20** may be a Quadruple Line Receiver™ available from Texas Instruments headquartered in Dallas, Tex. However, it should be understood that other implementations may use a signal inverter that may have a different configuration or design and manufactured by companies other than Texas Instruments.

The term "Bluetooth enabled device" as used herein means any device that is enabled with Bluetooth technology. Bluetooth is a wireless technology that operates in the unlicensed Industrial, Scientific, and Medical (ISM) radio band of 2.4 GHz. Bluetooth technology includes a number of protocols that allow Bluetooth enabled devices to operate in a peer-to-peer environment forming piconets. The Bluetooth protocol and specification may be found in: *Bluetooth system; Specification* Volumes 1 and 2, Core and Profiles: Version 1.1, 22 Feb. 2001. The Bluetooth enabled device **110** may be configured to facilitate communication between the VOC detector **10**, the signal inverter **20** and a handheld personal computer (PC) **50**, which will be described in more detail in the paragraphs below. The Bluetooth enabled device **110** may include a transceiver **120** and a processor **130**. The processor **130** may be coupled to the transceiver **120** by cable **14**.

The processor **130** may include a central processing unit (CPU), a system memory and a system bus that couples various system components including the system memory to the CPU. The system memory may include a read only memory (ROM) and a random access memory (RAM). A basic input/output system (BIOS), containing the basic routines that help transfer information between elements within the processor **130**, such as during start-up, may be stored in the ROM.

The Bluetooth enabled device **110** may be in communication with the handheld PC **50** wirelessly. Although implementations of various technologies are described herein with reference to the Bluetooth enabled device **110**, it should be understood that some implementations may use other type of wireless data communication or protocol, such as Spread Spectrum, Broadband, Wi-Fi and the like.

FIG. **2** illustrates a schematic diagram of a handheld PC **200** in accordance with one or more implementations of various technologies described herein. The handheld PC **200** may include a central processing unit (CPU) **221**, a system memory **222** and a system bus **223** that couples various system components including the system memory **222** to the CPU **221**. Although only one CPU is illustrated in FIG. **2**, it should be understood that in some implementations the handheld PC **200** may include more than one CPU. The system bus **223** may be any of several types of bus structures, including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. By way of example, and not limitation, such architectures may include Industry Standard Architecture (ISA) bus, Micro Channel Architecture (MCA) bus, Enhanced ISA (EISA) bus, Video Electronics Standards Association (VESA) local bus, and Peripheral Component Interconnect (PCI) bus also known as Mezzanine bus. The system memory **222** may include a read only memory (ROM) **224** and a random access memory (RAM) **225**. A basic input/output system (BIOS) **226**, containing the basic routines that help transfer information between elements within the handheld PC **200**, such as during start-up, may be stored in the ROM **224**.

The handheld PC **200** may further include a hard disk drive **227** for reading from and writing to a hard disk. The hard disk drive **227** may be connected to the system bus **223** by a hard disk drive interface **232**. The drives and their associated computer-readable media may provide nonvolatile storage of computer-readable instructions, data structures, program modules and other data for the handheld PC **200**.

The handheld PC **200** may further include computer-readable media that may be accessed by the CPU **221**. For example, such computer-readable media may include computer storage media and communication media. Computer storage media may include volatile and non-volatile, and removable and non-removable media implemented in any method or technology for storage of information, such as computer-readable instructions, data structures, program modules or other data. Computer storage media may further include RAM, ROM, erasable programmable read-only memory (EPROM), electrically erasable programmable read-only memory (EEPROM), flash memory or other solid state memory technology, CD-ROM, digital versatile disks (DVD), or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store the desired information and which can be accessed by the CPU **221**. Communication media may embody computer readable instructions, data structures, program modules or other data in a modulated data signal, such as a carrier wave or other transport mechanism and may include any information delivery media. The term "modulated data signal" may mean a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media may include wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, RF, infrared and other wireless media. Combinations of any of the above may also be included within the scope of computer readable media.

A number of program modules may be stored on ROM **224** or RAM **225**, including an operating system **235**, one or more application programs **236** and a flame reignition program **240**. The operating system **235** may be any suitable operating system that may control the operation of a networked personal or server computer, such as Windows® XP, Mac OS® X, Unix-variants (e.g., Linux® and BSD®), and the like. The flame reignition program **240** will be described in more detail with reference to FIG. **3** in the paragraphs below.

It should be understood that the various technologies described herein may be implemented in connection with hardware, software or a combination of both. Thus, various technologies, or certain aspects or portions thereof, may take the form of program code (i.e., instructions) embodied in tangible media, such as floppy diskettes, CD-ROMs, hard drives, or any other machine-readable storage medium wherein, when the program code is loaded into and executed by a machine, such as a computer, the machine becomes an apparatus for practicing the various technologies. In the case of program code execution on programmable computers, the computing device may include a processor, a storage medium readable by the processor (including volatile and non-volatile memory and/or storage elements), at least one input device, and at least one output device. One or more programs that may implement or utilize the various technologies described herein may use an application programming interface (API), reusable controls, and the like. Such programs may be implemented in a high level procedural or object oriented programming language to communicate with a computer system. However, the program(s) may be implemented in assembly or machine language, if desired. In any case, the language may be a compiled or interpreted language, and combined with hardware implementations.

FIG. **3** illustrates a signal diagram **300** for reigniting a flame in the VOC detector **10** in accordance with one or more implementations of various technologies described herein. At time T**1**, when the flame extinguishes in the VOC detector **10**, the VOC detector **10** may send an error signal through port A via cable **13** to the transceiver **120**, which may then forward the error signal to the handheld PC **50** wirelessly.

In response to receiving the error signal, the handheld PC **50** may display the error message to the user/operator. For example, the handheld PC **50** may display WARNING: FLAME OUT. In one implementation, the same message may be displayed on the screen of the VOC detector **10**.

At time T**2**, upon seeing the display, the user may send a first command from the handheld PC **50** to the processor **130** through the transceiver **120** wirelessly. The first command may include a first portion and a second portion. In one implementation, the first portion and the second portion may be separated by a predetermined time delay, e.g., about 1 second to about 3 seconds. Upon receipt of the first portion, the processor **130** may send a positive 5 volts signal along cable **15** to the signal inverter **20**, which may then apply a zero voltage signal to cable **17**, thereby grounding port B of the VOC **10**. A positive voltage is typically applied to port B during operation. In one implementation, the signal inverter **20** may ground cable **17** using port D, which is connected to ground.

At time T**3**, after the predetermined time delay has lapsed, upon receipt of the second portion, the processor **130** may apply a normal state signal along cable **15** to the signal inverter **20**, which may then remove the zero voltage previously applied to cable **17** and apply a positive voltage typically applied to port B during operation.

In this manner, the first command may operate as a toggling signal. The first portion may be configured to ground cable **17**, while the second portion may be configured to stop the grounding cable **17** and apply an operating voltage to cable **17**. In one implementation, the first portion may be ST, 0808 and the second portion may be ST, 0800.

At time T**4**, upon detecting that port B, to which cable **17** is connected, has been switched to ground for a predetermined amount of time (e.g., about 1 second to about 3 seconds) and returned to its operating voltage, the VOC detector **10** may clear the error message on its screen and display a set of options for addressing the flame out situation on its screen.

One option for addressing the flame out situation is to reignite the flame. As such, the VOC detector **10** may send the set of options to the transceiver **120** through cable **13**. The transceiver **120** may then forward the set of options to the handheld PC **50** wirelessly. Alternatively, the VOC detector **10** may send only the option to reignite the flame to the transceiver **120**.

At time T**5**, upon receipt of an option to reignite the flame, the user may wirelessly send a second command from the handheld PC **50** to the processor **130** through the transceiver **120**. The second command may include a first portion and a second portion. The first portion and the second portion may be separated by a predetermined time delay, e.g., about 1 second to 3 seconds. Upon receipt of the first portion of the second command, the processor **130** may apply a positive 5 volts signal along cable **16** to the signal inverter **20**, which may then switch cable **18** to ground. As mentioned above, the signal inverter **20** may use port D, which is connected to ground, to ground cable **18**.

At time T**6**, after the predetermined time delay has lapsed, upon receipt of the second portion of the second command, the processor **130** may apply a normal state signal along cable **16** to the signal inverter **20**, which may then remove the zero voltage previously applied to cable **18** and apply a positive voltage typically applied to cable **18** during operation.

In this manner, the second command may operate as a toggling signal. The first portion may be configured to ground cable **18**, while the second portion may be configured to stop the grounding cable **18** and apply an operating voltage to cable **18**. In one implementation, the first portion may be ST, 0404 and the second portion may be ST, 0400.

Upon detecting that port C, to which cable **18** is connected, has been switched to ground for the predetermined amount of time (e.g., about 1 second to about 3 seconds) and returned to its operating voltage, the VOC detector **10** may reignite the flame.

Although the commands that control the operation of the VOC detector **10**, e.g., for reigniting the flame, have been described with reference to the handheld PC **50**, it should be understood that in some implementations the commands may be sent from the Bluetooth enabled device **110**. For instance, the commands to clear the error message displayed due to the flame having been extinguished may be sent via a switch on the Bluetooth enabled device **110**. The commands to reignite the flame may be sent using the same switch or in combination with another switch on the Bluetooth enabled device **110**.

Although implementations of various technologies described herein are described with reference to a handheld PC, it should be understood that some implementations may be operational with other types of computing systems, such as laptop devices, multiprocessor systems, microprocessor-based systems, programmable consumer electronics, network PCs, minicomputers, personal computers and the like.

The various technologies described herein may be implemented in the general context of computer-executable instructions, such as program modules, being executed by a computer. Generally, program modules include routines, programs, objects, components, data structures, etc. that perform particular tasks or implement particular abstract data types. The various technologies described herein may also be implemented in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network, e.g., by hardwired links, wireless links, or combinations thereof. In a distributed computing environment, program modules may be located in both local and remote computer storage media including memory storage devices.

While the foregoing is directed to implementations of various technologies described herein, other and further implementations may be devised without departing from the basic scope thereof, which may be determined by the claims that follow. Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

What is claimed is:

1. A method for igniting a flame in a volatile organic compound (VOC) detector, comprising:

transmitting a first signal to the VOC detector through a wireless device, wherein the first signal is configured to clear an error message in the VOC detector by (i) grounding a first port on the VOC detector and (ii) applying a positive voltage on the first port; and

transmitting a second signal to the VOC detector through the wireless device, wherein the second signal is configured to ignite a flame in the VOC detector by (i) grounding a second port on the VOC detector and (ii) applying a positive voltage on the second port, thereby igniting the flame.

2. The method of claim **1**, further comprising receiving a third signal through the wireless device, wherein the third signal indicates that the flame in the VOC is extinguished.

3. The method of claim **2**, wherein the first signal is transmitted to the VOC detector in response to receiving the third signal.

4. The method of claim **1**, wherein the wireless device is an IEEE standard 802.15.1 enabled device.

5. A method for igniting a flame in a volatile organic compound (VOC) detector, comprising:

receiving a signal at a handheld personal computer indicating that a flame in the VOC detector is extinguished; and

reigniting the flame in the VOC detector using a wireless device that facilitates communication between the handheld personal computer and the VOC detector, wherein the reigniting step comprises:

sending a first command to the VOC detector through the wireless device, wherein the first command comprises:

a first portion configured to cause a signal inverter coupled between the wireless device and the VOC detector to ground a first port of the VOC detector; and

a second portion configured to cause the signal inverter to stop the grounding of the first port, thereby clearing an error message in the VOC detector; and

sending a second command to the VOC detector through the wireless device, wherein the second command comprises:

a first portion configured to cause the signal inverter to ground a second port of the VOC detector; and

a second portion configured to cause the signal inverter to stop the grounding of the second port, thereby reigniting the flame.

6. The method of claim **5**, wherein the wireless device is an IEEE standard 802.15.1 enabled device.

7. The method of claim **5**, wherein reigniting the flame in the VOC detector comprises sending the first command and the second command from the handheld personal computer to the VOC detector through the wireless device.

8. The method of claim **5**, wherein reigniting the flame in the VOC detector is accomplished by transmitting a reignition signal from the wireless device to the VOC detector.

9. The method of claim **8**, wherein the reignition signal is transmitted by activating a switch on the wireless device.

10. The method of claim **5**, wherein the reigniting step comprises receiving an option to reignite the flame in the VOC detector after the first port of the VOC detector has been grounded for a predetermined amount of time.

11. The method of claim 10, wherein the second command is sent to the VOC detector in response to receiving the option to reignite the flame in the VOC detector.

12. The method of claim 5, wherein the flame in the VOC detector is reignited upon detecting that the second port has been grounded for a predetermined amount of time and the grounding of the second port is stopped after the redetermined amount of time has lapsed.

13. The method of claim 5, wherein the first port of the VOC detector is grounded for a first predetermined amount of time.

14. The method of claim 13, wherein the first predetermined amount of time ranges from about one second to about three seconds.

15. The method of claim 13, wherein the grounding of the first port is stopped after the first predetermined amount of time has lapsed.

16. The method of claim 5, wherein the second port of the VOC detector is grounded for a second predetermined amount of time.

17. The method of claim 16, wherein the grounding of the second port is stopped after the second predetermined amount of time has lapsed.

18. A volatile chemical (VOC) detection system, comprising:

a VOC detector;

a handheld personal computer in communication with the VOC detector, the handheld personal computer being configured to control an operation of the VOC detector;

a wireless device in communication with the VOC detector and the handheld personal computer, the wireless device being configured to facilitate communication between the VOC detector and the handheld personal computer; and

a signal inverter coupled to the VOC detector and to ground, wherein the handheld personal computer is configured to send a first command to the signal inverter to ground a first port of the VOC detector for a first predetermined amount of time and stop the grounding of the first port after the first predetermined amount of time has lapsed, thereby clearing an error signal in the VOC detector.

19. The VOC detection system of claim 18, wherein the wireless device is an IEEE standard 802.15.1 enabled device.

20. The VOC detection system of claim 18, wherein the VOC detector is configured to send the error signal to the handheld personal computer upon detecting that a flame in the VOC detector has gone out.

21. The VOC detection system of claim 18, wherein the signal inverter is coupled between the VOC detector and the wireless device.

22. The VOC detection system of claim 18, wherein the VOC detector is configured to clear the error signal upon detecting that the first port has been grounded for the first predetermined amount of time and the grounding of the first port is stopped after the first predetermined amount of time has lapsed.

23. The VOC detection system of claim 22, wherein the handheld personal computer is configured to send a second command to the signal inverter to cause the signal inverter to ground a second port of the VOC detector for a second predetermined amount of time and stop, the grounding of the second port after the second predetermined amount of time has lapsed.

24. The VOC detection system of claim 23, wherein the VOC detector is configured to reignite the flame upon detecting that the second port has been grounded for the second predetermined amount of time and the grounding of the second port is stopped after the second predetermined amount of time has lapsed.

25. The VOC detection system of claim 18, wherein the VOC detector is configured to send a reignition option to the handheld personal computer upon detecting that the first port has been grounded for the first predetermined amount of time.

26. A handheld personal computer for operating a volatile chemical (VOC) detector, comprising:

a processor; and

a memory comprising program instructions executable by the processor to:

receive a first signal indicating that a flame in the VOC detector is extinguished;

send a first command to a signal inverter to ground a first port of the VOC detector for a first predetermined amount of time and stop the grounding of the first port once the first predetermined amount of time has lapsed, thereby clearing an error message in the VOC detector;

receive a second signal indicating an option to reignite the flame in the VOC detector; and

send a second command to the signal inverter to ground a second port of the VOC detector for a second predetermined amount of time and stop the grounding of the second port once the second predetermined amount of time has lapsed, thereby reigniting the flame.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 8,034,290 B1
APPLICATION NO. : 11/668367
DATED : October 11, 2011
INVENTOR(S) : Leo Skiba et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Column 9, lines 7 to 8, claim 12:

grounding of the second port is stopped after the redetermined amount of time has lapsed.

is corrected to:

grounding of the second port is stopped after the predetermined amount of time has lapsed.

Column 9, lines 24 to 25, claim 18:

A volatile chemical (VOC) detection system, comprising:

is corrected to:

A volatile organic chemical (VOC) detection system, comprising:

Column 10, line 14, claim 23:

determined amount of time and stop, the grounding of the

is corrected to:

determined amount of time and stop the grounding of the

Signed and Sealed this
Twenty-eighth Day of May, 2013

Teresa Stanek Rea
Acting Director of the United States Patent and Trademark Office

US008386164B1

(12) United States Patent
Moses

(10) **Patent No.: US 8,386,164 B1**

(45) **Date of Patent: Feb. 26, 2013**

(54) **LOCATING LDAR COMPONENTS USING POSITION COORDINATES**

(75) Inventor: **Rex Moses**, Nassau Bay, TX (US)

(73) Assignee: **LDARtools, Inc.**, League City, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1299 days.

(21) Appl. No.: **12/121,705**

(22) Filed: **May 15, 2008**

(51) **Int. Cl.**

G01S 1/00	(2006.01)
G06F 17/00	(2006.01)
G06F 7/00	(2006.01)

(52) **U.S. Cl.** **701/409**; 701/466; 701/468; 701/532; 701/300; 340/995.18; 340/995.19; 707/609

(58) **Field of Classification Search** 701/400, 701/408, 409, 430, 431, 433, 438, 439, 440, 701/442, 445, 450, 451, 453, 461, 462, 468, 701/469, 470, 471, 475, 486, 487, 495, 516, 701/517, 518, 522, 532, 533, 538, 540, 300, 701/466, 491; 340/995.1, 995.14, 995.18, 340/995.19, 995.24; 707/609

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,853,455 A	12/1974	Riordan et al.	
3,985,509 A	10/1976	Trone et al.	
4,346,055 A	8/1982	Murphy et al.	
H572 H	2/1989	Hansen	
5,206,818 A	4/1993	Speranza	
5,356,594 A	10/1994	Neel et al.	
6,341,287 B1	1/2002	Sziklai et al.	
6,438,535 B1	8/2002	Benjamin et al.	
6,478,849 B1	11/2002	Taylor et al.	
6,545,278 B1	4/2003	Mottier et al.	
6,549,916 B1	4/2003	Sedlar	
6,609,090 B1	8/2003	Hickman et al.	
6,672,129 B1	1/2004	Frederickson et al.	
6,680,778 B2 *	1/2004	Hinnrichs et al.	356/437
6,722,185 B2	4/2004	Lawson et al.	
6,771,744 B1	8/2004	Smith et al.	
7,017,386 B2	3/2006	Liu et al.	
7,089,530 B1	8/2006	Dardinski et al.	
7,103,610 B2	9/2006	Johnson et al.	
7,136,904 B2	11/2006	Bartek et al.	
7,330,768 B2	2/2008	Scott et al.	
7,356,703 B2	4/2008	Chebolu et al.	
7,369,945 B2	5/2008	Miller et al.	
7,437,362 B1	10/2008	Ben-Natan	

(Continued)

FOREIGN PATENT DOCUMENTS

WO 2006-022648 A1 3/2006

OTHER PUBLICATIONS

Office Action (Aug 4, 2009); U.S. Appl. No. 12/032,499 (Moses, et al).

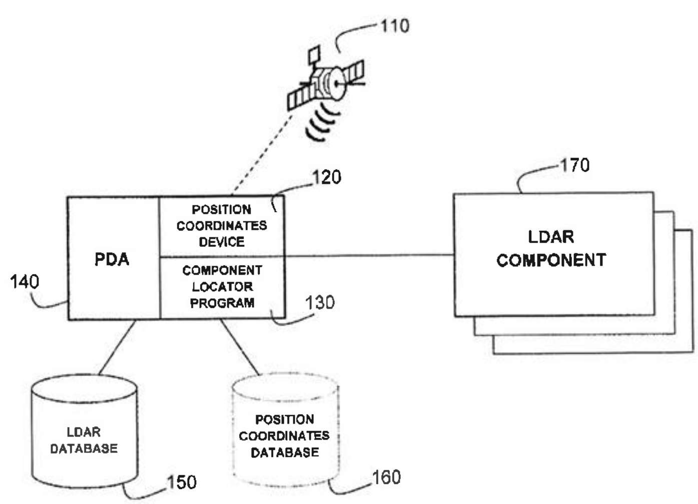
(Continued)

Primary Examiner — Thomas Tarcza
Assistant Examiner — Edward Pipala
(74) *Attorney, Agent, or Firm* — Pramudji Law Group PLLC; Ari Pramudji

(57) **ABSTRACT**

Various technologies and techniques directed to creating, encrypting, and updating a database of position coordinates of LDAR components. In one implementation, the method for creating a database of coordinates of leak detection and repair (LDAR) components includes receiving an input pertaining to an LDAR component, obtaining position coordinates of a handheld computer device and associating the position coordinates of the handheld computer device with the LDAR component.

28 Claims, 4 Drawing Sheets



U.S. PATENT DOCUMENTS

7,588,726 B1	9/2009	Mouradian et al.	
7,657,384 B1	2/2010	Moses	
7,840,366 B1	11/2010	Moses et al.	
7,851,758 B1 *	12/2010	Scanlon et al.	250/330
2002/0026339 A1	2/2002	Frankland et al.	
2002/0080032 A1	6/2002	Smith et al.	
2002/0094498 A1	7/2002	Rodriguez-Rodriguez et al.	
2003/0012696 A1	1/2003	Millancourt	
2003/0081214 A1	5/2003	Mestha et al.	
2003/0085714 A1	5/2003	Keyes et al.	
2003/0217101 A1	11/2003	Sinn	
2004/0059539 A1	3/2004	Otsuki et al.	
2004/0226345 A1	11/2004	McCoy et al.	
2004/0258213 A1	12/2004	Beamon et al.	
2005/0000981 A1	1/2005	Peng et al.	
2005/0005167 A1	1/2005	Kelly et al.	
2005/0053104 A1	3/2005	Kulp et al.	
2005/0060392 A1	3/2005	Goring et al.	
2005/0117641 A1	6/2005	Xu et al.	
2005/0234934 A1	10/2005	Mackay et al.	
2005/0246112 A1 *	11/2005	Abhulimen et al.	702/51
2005/0262995 A1	12/2005	Kilkis	
2005/0275556 A1	12/2005	Brown	
2006/0020186 A1	1/2006	Brister et al.	
2006/0220888 A1	10/2006	Germouni et al.	
2006/0235611 A1 *	10/2006	Deaton et al.	701/207
2006/0286945 A1	12/2006	Reznik et al.	
2007/0000310 A1	1/2007	Yamartino et al.	
2007/0004381 A1	1/2007	Larson et al.	
2007/0139183 A1 *	6/2007	Kates	340/521
2007/0299953 A1	12/2007	Walker et al.	
2008/0021717 A1	1/2008	Kaartinen et al.	
2008/0063298 A1	3/2008	Zhou et al.	
2008/0092625 A1 *	4/2008	Hinnrichs	73/23.2
2008/0120043 A1	5/2008	Miller et al.	
2008/0231719 A1	9/2008	Benson et al.	

OTHER PUBLICATIONS

USPTO Office Action (Jan. 24, 2012)—U.S. Appl. No. 12/814,265 (Moses).

Response to Office Action (Mar. 21, 2011), Office Action (Dec. 21, 2010), RCE (Sep. 27, 2010), Advisory Action (Sep. 10, 2010); U.S. Appl. No. 11/668,367 (Skiba. et al).

Response After Final (May 23, 2011), Final Office Action (Mar. 22, 2011), Response to Office Action (Dec. 27, 2010); U.S. Appl. No. 12/133,920 (Moses, et al).

"Bluetooth Tutorial—Specifications"; Palo Wireless: Bluetooth Resource Center [online]; Jan. 5, 2006; retrieved Dec. 23, 2009 via Internet Archive Wayback Machine.

USPTO Allowance (Jun. 8, 2011); U.S. Appl. No. 11/668,367 (Skiba, et al).

RCE Amendment (Jun. 22, 2011) and USPTO Advisory Action (Jun. 7, 2011); U.S. Appl. No. 12/133,920 (Moses, et al).

Response to Office Action (Aug. 29, 2011), USPTO Office Action (May 27, 2011); U.S. Appl. No. 12/474,504 (Bolinger, et al).

"2nd Annual Fugitive Emissions—Leak Detection and Repair Symposium"; ISA Technical Conference Brochure; Nov. 2002.

"Introducing the Allegro CX(TM) Field Computer"; Product Newswire (product announcement); Jun. 21, 2004.

"New from Accutech, Wireless Acoustic Monitor Field Units Make Fugitive Emissions Monitoring Compliance Easy"; Product Announcement/Description; Feb. 10, 2004.

"LDARManager™ Makes Fugitive Emission Monitoring a Breeze TISCOR launches its newest product for Leak Detection and Repair"; product announcement/description; Nov. 8, 2002.

Environmental Analytics, Inc. v. TMX2, Inc. and LDAR Solutions, Ltd.; Case 4:08-cv-03353; USDC, Southern District of Texas; First Amended Complaint; Dec. 10, 2008.

Response/Amendment After Final (Aug. 24, 2010); Final Office Action (Jun. 25, 2010); Response to Office Action (Apr. 26, 2010); and Office Action (Jan. 25, 2010); U.S. Appl. No. 11/668,367 (Skiba, et al).

Response to Office Action (Jul. 13, 2010); Office Action (Apr. 14, 2010); Response/Amendment After Final (Mar. 29, 2010); Final Office Action (Jan. 29, 2010); Response to Office Action (Nov. 4, 2009); and Office Action (Aug. 4, 2010); U.S. Appl. No. 12/032,499 (Moses, et al).

Office Action (Sep. 27, 2010); U.S. Appl. No. 12/133,920 (Moses, et al).

Response to Office Action (Feb. 21, 2012) and USPTO Office Action (Nov. 18, 2011); U.S. Appl. No. 12/359,196 (Moses, et al.).

USPTO Final Action (Jul. 12, 2012) and Response to Office Action (Apr. 24, 2012); U.S. Appl. No. 12/814,265 (Moses).

* cited by examiner

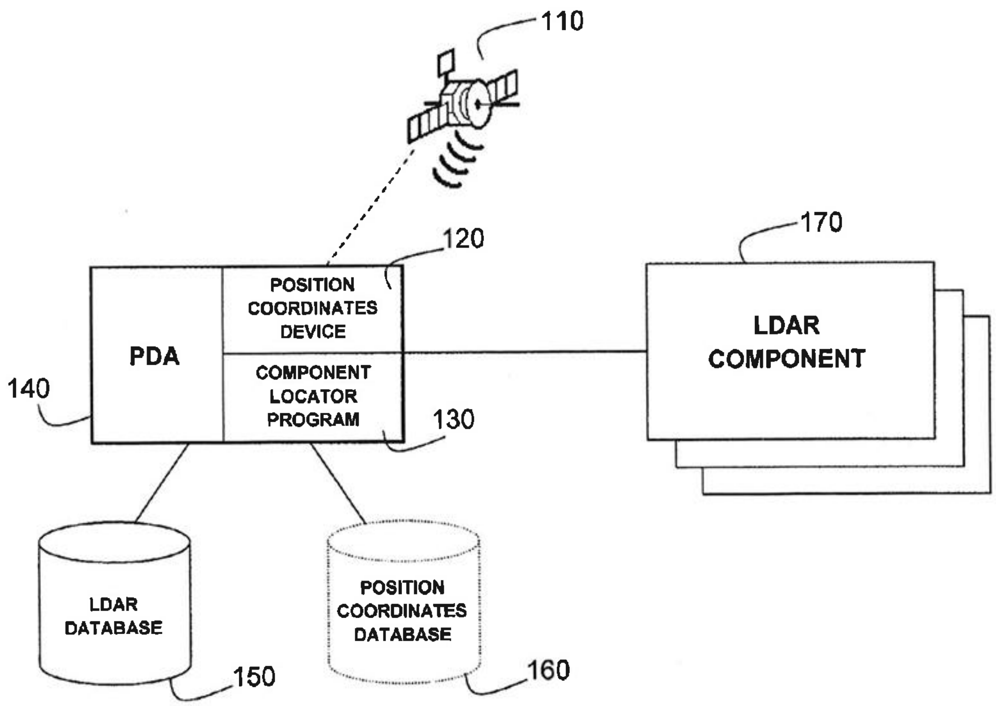

110
120
170
POSITION
COORDINATES
DEVICE
PDA
COMPONENT
LOCATOR
PROGRAM
140
130
LDAR
COMPONENT
LDAR
DATABASE
POSITION
COORDINATES
DATABASE
150
160

Fig. 1

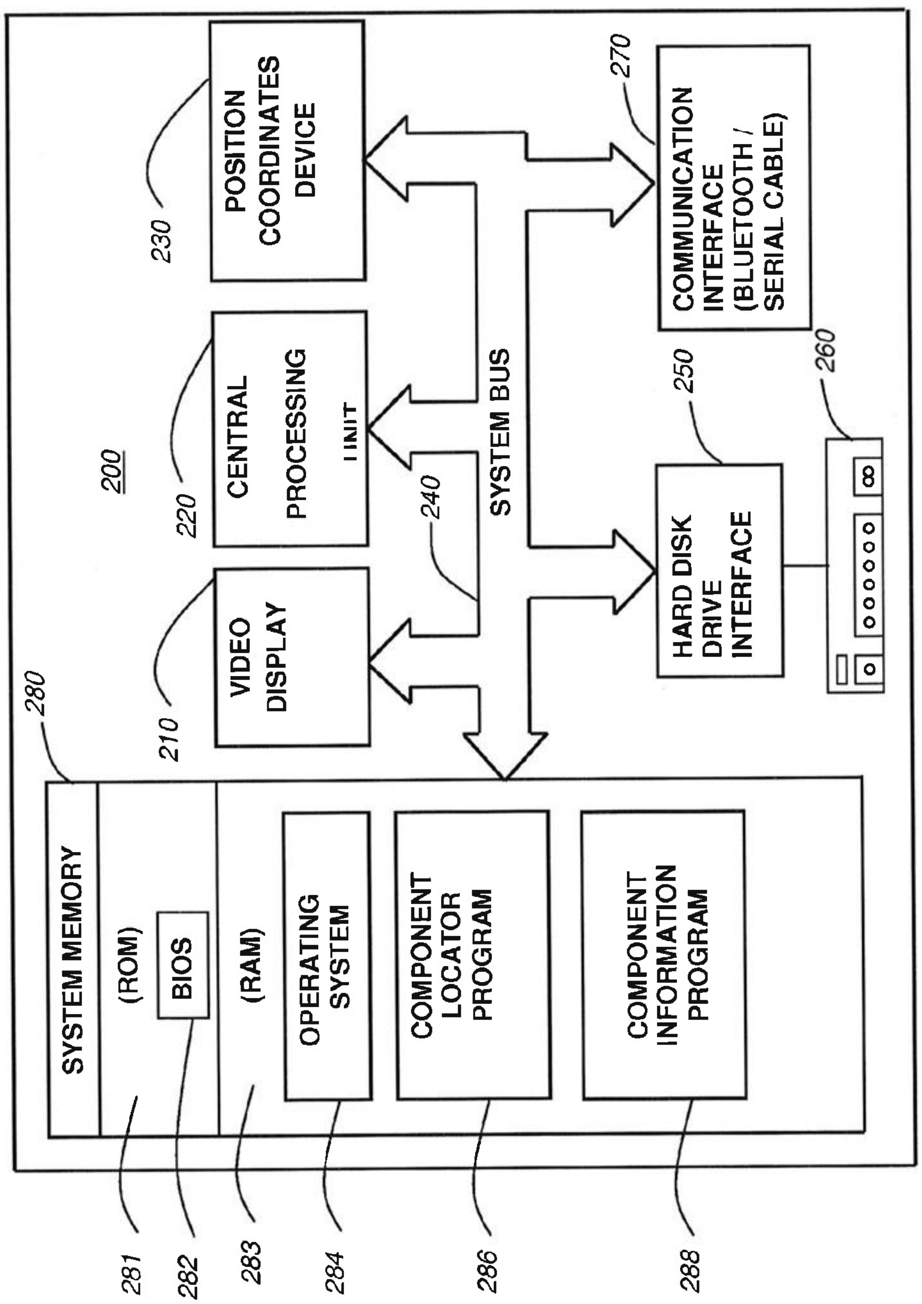

200
POSITION COORDINATES DEVICE
230
CENTRAL PROCESSING UNIT
220
VIDEO DISPLAY
210
240
SYSTEM BUS
COMMUNICATION INTERFACE (BLUETOOTH / SERIAL CABLE)
270
HARD DISK DRIVE INTERFACE
250
260
280
SYSTEM MEMORY
(ROM)
BIOS
(RAM)
OPERATING SYSTEM
COMPONENT LOCATOR PROGRAM
COMPONENT INFORMATION PROGRAM
281
282
283
284
286
288

Fig. 2

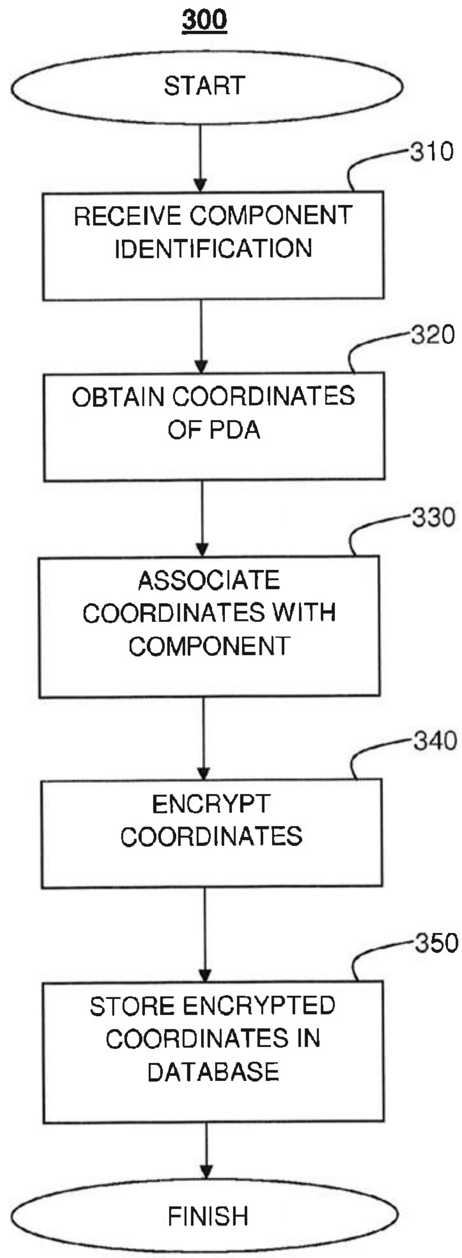

300
START
310
RECEIVE COMPONENT IDENTIFICATION
320
OBTAIN COORDINATES OF PDA
330
ASSOCIATE COORDINATES WITH COMPONENT
340
ENCRYPT COORDINATES
350
STORE ENCRYPTED COORDINATES IN DATABASE
FINISH

Fig. 3

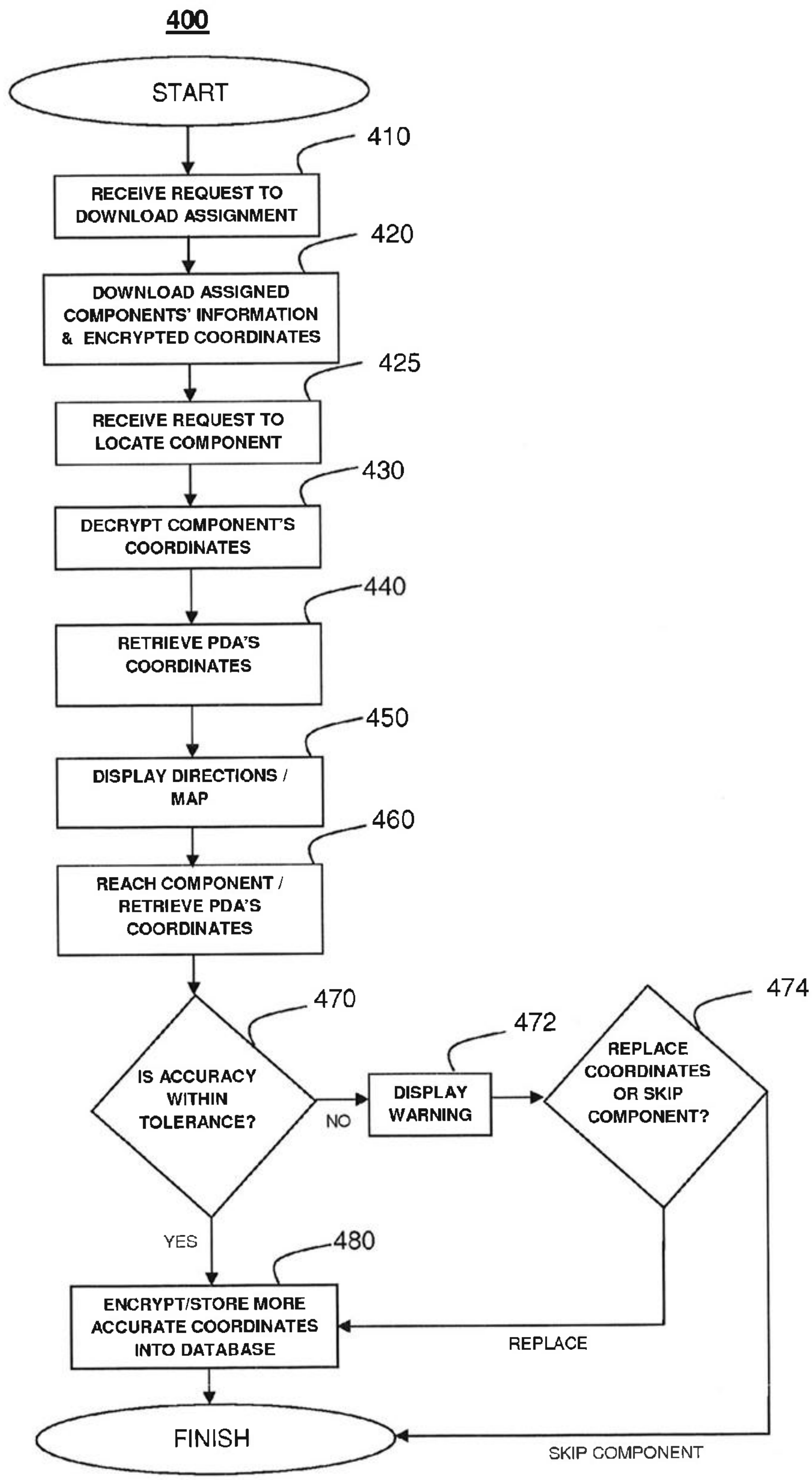

400
START
410
RECEIVE REQUEST TO DOWNLOAD ASSIGNMENT
420
DOWNLOAD ASSIGNED COMPONENTS' INFORMATION & ENCRYPTED COORDINATES
425
RECEIVE REQUEST TO LOCATE COMPONENT
430
DECRYPT COMPONENT'S COORDINATES
440
RETRIEVE PDA'S COORDINATES
450
DISPLAY DIRECTIONS / MAP
460
REACH COMPONENT / RETRIEVE PDA'S COORDINATES
470
IS ACCURACY WITHIN TOLERANCE?
NO
472
DISPLAY WARNING
474
REPLACE COORDINATES OR SKIP COMPONENT?
YES
480
ENCRYPT/STORE MORE ACCURATE COORDINATES INTO DATABASE
REPLACE
FINISH
SKIP COMPONENT

Fig. 4

LOCATING LDAR COMPONENTS USING POSITION COORDINATES

BACKGROUND

1. Field of the Invention

Implementations of various technologies described herein generally relate to various methods and/or systems for locating components in a Leak Detection And Repair (LDAR) program.

2. Description of the Related Art

The following descriptions and examples do not constitute an admission as prior art by virtue of their inclusion within this section.

Industrial plants that handle volatile organic compounds (VOCs) sometimes experience unwanted emissions of those compounds into the atmosphere from point sources, such as smokestacks, and non-point sources, such as valves, pumps, and/or vessels containing the VOCs. Emissions from non-point sources typically occur due to leakage of the VOCs from joints and/or seals and may be referred to herein as "fugitive emissions". Fugitive emissions from valves typically occur as leakage through the packing set around the valve stem.

Most industrial plants have established an LDAR program to detect if any fugitive emissions are being released into the atmosphere. Given the obscure locations of many of these potential emission sources, technicians usually experience major difficulties in locating all of the LDAR components.

Further, there are security risks involved with storing the locations of hazardous gas/chemical equipment where LDAR components are positioned on an unsecured database.

SUMMARY

Described herein are one or more implementations of various technologies and techniques directed to creating, encrypting, and updating a database of position coordinates of LDAR components. In one implementation, the method for creating a database of coordinates of leak detection and repair (LDAR) components includes receiving an input pertaining to an LDAR component, obtaining position coordinates of a handheld computer device in response to receiving the input and associating the position coordinates of the handheld computer device with the LDAR component.

Described herein are also one or more implementations of various techniques for using the position coordinates to assist a user (technician) to locate an LDAR component in the field. In one implementation, the method for providing assistance to a user for locating a leak detection and repair (LDAR) component includes receiving a request to locate an LDAR component in a field, retrieving position coordinates of the LDAR component, obtaining position coordinates of a handheld computer device and providing directions from the position coordinates of the handheld computer device to the position coordinates of the LDAR component.

In one implementation, the method may further include obtaining current position coordinates of the handheld computer device when the user has reached the LDAR component, determining whether the current position coordinates are within a predetermined range of the retrieved position coordinates of the LDAR component and whether the dilution of precision of the current position coordinates are higher than the dilution of precision of the retrieved position coordinates, and if it is determined that the current position coordinates are within the predetermined range and that the dilution of precision of the current position coordinates are higher than the dilution of precision of the retrieved position coordinates, then replacing the retrieved position coordinates of the LDAR component with the current position coordinates.

Described herein are also one or more implementations of various techniques for a system for locating leak detection and repair (LDAR) components. In one implementation, the system includes one or more position coordinates satellites and a handheld computer device in communication with the position coordinates satellite. The handheld computer device includes a processor and a memory comprising program instructions executable by the processor to: receive an input pertaining to an LDAR component, obtain position coordinates of the handheld computer device using the position coordinates satellites and associate the position coordinates of the handheld computer device with the LDAR component.

In another implementation, the system includes a position coordinates satellite and a handheld computer device in communication with the position coordinates satellite. The handheld computer device includes a processor and a memory comprising program instructions executable by the processor to: receive a request to locate an LDAR component in a field, retrieve position coordinates of the LDAR component in response to receiving the request, obtain position coordinates of the handheld computer device using one or more position coordinates satellites and provide directions from the position coordinates of the handheld computer device to the position coordinates of the LDAR component.

The above referenced summary section is provided to introduce a selection of concepts in a simplified form that are further described below in the detailed description section. The summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter. Furthermore, the claimed subject matter is not limited to implementations that solve any or all disadvantages noted in any part of this disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

Implementations of various technologies will hereafter be described with reference to the accompanying drawings. It should be understood, however, that the accompanying drawings illustrate only the various implementations described herein and are not meant to limit the scope of various technologies described herein.

FIG. **1** illustrates a schematic diagram of an LDAR component locator system in accordance with one or more implementations of various technologies and techniques described herein.

FIG. **2** illustrates a schematic diagram of a personal digital assistant (PDA) in accordance with one or more implementations of various technologies and techniques described herein.

FIG. **3** illustrates a flow diagram of a method for creating a database of position coordinates for LDAR components in accordance with one or more implementations of various techniques described herein.

FIG. **4** illustrates a flow diagram of a method for assisting a user to locate an LDAR component in accordance with various techniques described herein.

DETAILED DESCRIPTION

The discussion below is directed to certain specific implementations. It is to be understood that the discussion below is only for the purpose of enabling a person with ordinary skill in the art to make and use any subject matter defined now or later by the patent "claims" found in any issued patent herein.

The following paragraphs generally describe one or more implementations of various techniques directed to acquiring position coordinates of LDAR components and providing a user with a method in which to locate the immediate vicinity or the precise location of an LDAR component. In one implementation, the LDAR component locator system may include an LDAR component, a global positioning system device, one or more position coordinates satellites in communication with a PDA, a database of LDAR component information, and a database of position coordinates.

In operation, a user may perform monitoring, documenting, or maintenance work at each LDAR component. After the user has completed his maintenance work at one LDAR component, he may input an account of the work that he completed into his PDA. Upon receiving this information about a specific LDAR component, the PDA may retrieve its own position coordinates, encrypt it, and store it as the position coordinates for the specified LDAR component on a database for position coordinates. In order to keep the location of the LDAR components safe from sabotage, the component locator program may encrypt the position coordinates prior to storing them to the database. Further, the encrypted position coordinates may be stored in a database separate from the database that stores other information pertaining to LDAR components.

After an LDAR component's position coordinates have been stored, a user may request to locate the LDAR component on his PDA. Upon receiving a request to locate a specific LDAR component, the PDA may download the LDAR component's position coordinates, decrypt it, and compare it to its own current position coordinates. Using the two coordinates, the PDA may provide the user with a map or step-by-step directions on how to reach the vicinity of the specified LDAR component.

The accuracy of an LDAR component's location may be determined each time an LDAR component has been located by a user. If an LDAR component's newly acquired location coordinates are within a predetermined accuracy tolerance, the newly acquired coordinates may be stored in the database of the position coordinates in place of the previous coordinates for the LDAR component. Otherwise, if an LDAR component's newly acquired location coordinates exceed a predetermined accuracy tolerance, the PDA may display a warning notice to its user. The user may have the option to either replace the previously stored position coordinates with the newly acquired coordinates, or he may disregard the warning and keep the previously stored position coordinates on the database.

In one implementation, the component locator program may also determine the accuracy of a location by comparing the dilution of precision values between the position coordinates stored on the database and the PDA's newly acquired position coordinates. The dilution of precision may be calculated by determining the number of GPS satellites used in locating the PDA's position coordinates. If the newly acquired coordinates have a higher degree of precision than the previously stored coordinates, the component locator program may replace the previously stored coordinates with the newly acquired coordinates.

One or more implementations of various techniques for an LDAR component locator system will now be described in more detail with reference to FIGS. **1-4** in the following paragraphs.

FIG. **1** illustrates a block diagram of a system or network **100** that may be used to locate LDAR components in accordance with one or more implementations of various technologies and techniques described herein.

The system **100** may include a computer device, such as a personal digital assistant (PDA) **140**, in communication with a position coordinates satellite **110**, LDAR components **170**, a database **150** for storing LDAR information and a database **160** for storing position coordinates of the LDAR components **170**. LDAR components **170** may include devices such as valves, pumps, compressors, connectors, flanges, and other devices that can be found at industrial plants.

The PDA **140** may be configured for storing the hardware and software elements required to locate specific components. For instance, the PDA **140** may include hardware components, such as a position coordinates device **120**, and software components, such as a component locator program **130**.

The position coordinates device **120** may be used to assist position satellite **110** in obtaining the position coordinates of PDA **140**. The position coordinates device **120** may be any device that communicates with a position coordinates satellite **110** to determine its position coordinates. The satellite **110** may be configured to provide the position coordinates device **120** its position coordinates. Although only one position coordinates satellite is shown in FIG. **1**, it should be understood that in some implementations the satellite **110** may include one or more medium Earth orbit satellites. In one implementation, the position coordinates device **120** may use Global Positioning System (GPS) satellites to determine the PDA **140**'s GPS coordinates. It should also be noted that satellite **110** may be replaced with other communications devices such as cellular phone towers or any other device that may be capable to provide position coordinates of the PDA **140**.

The component locator program **130** may be used to store the position coordinates of the LDAR components **170** into a database and to assist the user in locating LDAR components **170**. In one implementation, the component locator program **130** may link or associate an LDAR component **170** with its corresponding position coordinates obtained by the position coordinate device **120**. After making this association, the component locator program **130** may encrypt the position coordinates and store them in the position coordinates database **160**. The component locator program **130** may be described in more detail with reference to FIGS. **3** and **4** in the following paragraphs.

The position coordinates database **160** may be configured to store position coordinates of each LDAR component **170**. The position coordinates database **160** may be located on a server, personal computer, or other similar computer medium.

The database **150** may be configured to store LDAR component information, such as tag number, size, component type and process stream information. Like the position coordinates database **160**, database **150** may also be located on a server, personal computer, or other similar computer medium.

Although various implementations described herein are with reference to a PDA, it should be understood that in some implementations the PDA **140** may be substituted with any other computer device that can utilize software programs, communicate wirelessly with other computer media, and interface with a position coordinates device **120**, such as a laptop, Pocket PC, and the like.

FIG. **2** illustrates a schematic diagram of a PDA **200** in accordance with one or more implementations of various technologies described herein. The PDA **200** may include a central processing unit (CPU) **220**, a system memory **280**, and a system bus **240** that couples various system components including the system memory **280** to the CPU **220**. Although only one CPU **220** is illustrated in FIG. **2**, it should be understood that in some implementations the PDA **200** may include more than one CPU. The system bus **240** may be any of several types of bus structures, including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. By way of example, and not limitation, such architectures may include Industry Standard Architecture (ISA) bus, Micro Channel Architecture (MCA) bus, Enhanced ISA (EISA) bus, Video Electronics Standards Association (VESA) local bus, and Peripheral Component Interconnect (PCI) bus also known as Mezzanine bus. The system memory **280** may include a read only memory (ROM) **281** and a random access memory (RAM) **283**. A basic input/output system (BIOS) **282**, containing the basic routines that help transfer information between elements within the PDA **200**, such as during start-up, may be stored in the ROM **281**. A video display **210** or other type of display device may also be connected to system bus **210** via an interface, such as a video adapter.

The PDA **200** may further include a hard disk drive **260** for reading from and writing to a hard disk. The hard disk drive **260** may be connected to the system bus **240** by a hard disk drive interface **250**. The drives and their associated computer-readable media may provide nonvolatile storage of computer-readable instructions, data structures, program modules and other data for the PDA **200**.

The PDA **200** may further include computer-readable media that may be accessed by the CPU **220**. For example, such computer-readable media may include computer storage media and communication media. Computer storage media may include volatile and non-volatile, and removable and non-removable media implemented in any method or technology for storage of information, such as computer-readable instructions, data structures, program modules or other data. Computer storage media may further include RAM, ROM, erasable programmable read-only memory (EPROM), electrically erasable programmable read-only memory (EEPROM), flash memory or other solid state memory technology, CD-ROM, digital versatile disks (DVD), or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store the desired information and which can be accessed by the CPU **220**.

The PDA **200** may contain a communication interface **270** that may connect with other types of computer media such as servers, computers, the Internet, databases, and the like. In one implementation, the communication interface **270** may be a Bluetooth communications interface. However, it should be understood that some implementations may use other types of wired or wireless communications.

Communication media may embody computer readable instructions, data structures, program modules or other data in a modulated data signal, such as a carrier wave or other transport mechanism and may include any information delivery media. The term "modulated data signal" may mean a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media may include wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, RF, infrared and other wireless media. Combinations of any of the above may also be included within the scope of computer readable media.

A number of program modules may be stored on ROM **281** or RAM **283**, including an operating system **284**, a component locator program **286** and a component information program **288**. The operating system **284** may be any suitable operating system that may control the operation of a networked personal or server computer, such as Windows® XP, Mac OS® X, Unix-variants (e.g., Linux® and BSD®), and the like. In one implementation, the component information program **288** may be stored on RAM **225** or hard disk drive **227**. The component information program **240** may be used to outline and store information about certain components such as its identification number, size, location, pressure, etc. The component information program **240** may also be configured to initiate the component locator program **286** to store or locate specific LDAR components.

The PDA **200** may further include a position coordinate device **230**, which may provide the component locator program **286** the current position coordinates of the PDA **200**. The position coordinates device **230** may include an antenna, tuned to the frequency of the position satellites, receiver processors, a clock, and other components that may be used to interface with the PDA **200** and the position coordinates satellite **110**. In one implementation, the component locator program **286** may use the position coordinates provided by the position device **230** to create a database of position coordinates for each LDAR component. The component locator program **286** will be described in more detail with reference to FIG. **3** and FIG. **4** in the paragraphs below. Although FIG. **2** indicates that the position coordinate device **230** may be integrated into the PDA **140**, it should be noted that in other implementations the position coordinate device **230** may be a separate component that communicates with the PDA **140** over the PDA's communication interface **270**.

FIG. **3** illustrates a flow diagram of a method **300** for creating a database of position coordinates of LDAR components **170** in accordance with one or more implementations of various techniques described herein. At step **310**, a user may input an LDAR component's identification information into the PDA **140**. The component's identification information may reflect its attached tag number, serial number, or any other unique identification name that may or may not be physically attached to the actual LDAR component.

Upon receipt of the component's identification information, the component locator program **286** may obtain the current position coordinates of the PDA **140** (step **320**). In doing so, the component locator program **286** may send a command to the position coordinates device **230** to retrieve the current position coordinates of PDA **140**. Here, the position coordinates device **230** may interface with the position coordinates satellite **110** to locate and store the exact position coordinates of the PDA **140**. The obtained coordinates may be stored in memory **280**, hard drive **260**, or any other memory storage device.

Although the component locator program **286** is described as obtaining position coordinates of the PDA **140** upon receipt of the LDAR component identification information, it should be understood that in some implementations, the component locator program **286** may obtain position coordinates of the PDA **140** at times other than receiving a component's identification. For instance, the component locator program **286** may obtain position coordinates of the PDA **140** when the user performs normal maintenance operations, such as monitoring, servicing, collecting data on a specific component, and the like. The component locator program **286** may also be programmed to automatically store the position coordinates of an LDAR component when a monitoring event is recorded or when a tag is documented into the PDA. Furthermore, it should be noted that the component locator program **286** may also be configured to store the position coordinates of a specific landmark, such as a control room, intersection, or major piece of equipment.

At step **330**, the component locator program **286** associates the position coordinates of PDA **140** with the component identification information received at step **310**. In this manner, the position coordinates of the LDAR component for which the identification information is received at step **310** may be obtained.

At step **340**, the component locator program **286** may encrypt the position coordinates. In one implementation, the component locator program **286** may also encrypt the link or association between the specific component identification number and its position coordinates. Various encryption methods may be used by the component locator program **286** to keep the position coordinates of the LDAR components invisible to the public.

At step **350**, the component locator program **286** may store the encrypted position coordinates into the position coordinates database **160**. Notably, the position coordinates database **160** is separate from the database **150** that stores other information about LDAR components. The component locator program **286** may use the communication interface **270** to send the encrypted data to the position coordinate database **160**.

FIG. **4** illustrates a flow diagram of a method **400** for assisting a user to locate an LDAR component in accordance with various techniques described herein. At step **410**, the component locator program **286** may receive a request from a user to download the user's assignment.

At step **420**, the component locator program **286** may retrieve the user's assignment, the information pertaining to the LDAR components listed in his assignment from the LDAR information database **150** and the corresponding encrypted position coordinates from the position coordinates database **160**.

At step **425**, the component locator program **286** may receive a request from a user to locate a specific LDAR component from his assignment list.

At step **430**, the component locator program **286** may decrypt the retrieved encrypted position coordinates. The component locator program **286** may decrypt the encrypted coordinates using a decryption algorithm or another similar decryption method.

At step **440**, the component locator program **286** may send a command to the position coordinates device **230** to retrieve the current position coordinates of the PDA **140**. As mentioned above, the position coordinates device **230** may interface with one or more position coordinates satellites to determine the current position of PDA **140**. In one implementation, the position coordinates device **230** may store the position coordinates of the PDA **140** on some memory device that may be accessed by the component locator program **286**.

At step **450**, the component locator program **286** may use the current position coordinates of PDA **140** and the decrypted position coordinates of the specified LDAR component to provide directions from the PDA **140**'s current location to the location of the specified LDAR component. The directions provided by the component locator program **286** may include a heading and distance, a general area map, a map of the area or facility in which the specified LDAR component is identified with a pointer, a snapshot view map that indicates the general direction and distance to the specified component, travelogues, vocal directions, written directions, video presentation and the like. Although it may be understood that the video display **210** may update automatically to indicate the PDA **140**'s progress in reaching the specified component, it should also be noted that directions displayed on the video display **210** may not update automatically as the PDA **140** moves closer to the specified LDAR component. Instead, the user may need to enter another request to the component locator program **286** to locate the specified LDAR component, in order for the video display **210** to update. In one implementation, the actual position coordinates of the LDAR component are never displayed to the user.

Once the user has physically reached the specified vicinity of the LDAR component's location, the user may perform various tasks, such as monitor, document, collect data, and the like. Upon completion of his tasks, the user may request to update or confirm the position coordinates of the LDAR component. In one implementation, such request may take place when the user presses the ENTER key on the PDA **140**. As such, at step **460**, upon receipt of the request to update the position coordinates of the LDAR component, the component locator program **286** may once again obtain the position coordinates of the PDA **140**. In another implementation, at step **460**, upon completion of his tasks, the user may record the task that he completed into the component information program **288**. Once an LDAR component is updated on the component information program **288**, the component information program **288** may automatically send a command to the component locator program **286** to retrieve the PDA **140**'s current position coordinates.

At step **470**, the component locator program **286** may compare the PDA **140**'s current position coordinates recently obtained at step **460** with the previously decrypted position coordinates. Using the two position coordinates, the component locator program **286** may determine if the two sets of coordinates are within a predetermined accuracy tolerance. For example, the accuracy of the sets of coordinates may be determined by calculating the distance between the two coordinates. The predetermined accuracy tolerance may be a distance defined by the client, the user's supervisor, or the like.

At step **472**, the component locator program **286** may display a warning notice to the user if the difference between the two position coordinates exceeds the predetermined tolerance. The warning notice may be displayed on the video display **210**.

At step **474**, the component locator program **286** may prompt the user to either replace the previous position coordinates associated with the LDAR component or disregard the warning. If the user selects the option to disregard the warning, then the component locator program **286** may await for its next request to locate another LDAR component.

On the other hand, if the user selects the option to replace the previous position coordinates with the current position coordinates, then at step **480**, the component locator program **286** may encrypt and store the newly acquired position coordinates on the position coordinates database **160**. As mentioned above, the component locator program **286** may also encrypt the link between the LDAR component identification information and its newly acquired position coordinates.

Referring back to step **470**, if the difference between the two position coordinates falls within the predetermined tolerance, then at step **480**, the component locator program **286** may encrypt and store the newly acquired position coordinates on the position coordinates database **160**. In one implementation, if the newly acquired position coordinates have a higher degree of precision based on the dilution of precision value, the component locator program **286** may replace the previous coordinates with the newly acquired coordinates in the position coordinates database **160**.

Referring back to step **474**, if the user selects the option to replace the previous position coordinates with the newly acquired position coordinates, then the component locator program **286** may encrypt and store the newly acquired position coordinates on the position coordinates database **160**. After the component locator program **286** encrypts and stores the newly acquired position coordinates, it may await for its next request to locate another LDAR component.

In one implementation, the component locator program **286** may not display a warning notice at step **472** if the difference between the two position coordinates exceeds the predetermined tolerance. Instead, the component locator program **286** may report the discrepancy on a separate database for quality assurance purposes. The quality assurance information may verify whether the user was in fact in the vicinity of the LDAR component that he was monitoring, documenting, or updating.

In another implementation, the component locator program **286** may create a separate file that keeps record of the user's completed tasks. For instance, the component locator program **286** may list the LDAR component that was monitored, the time and date it was monitored, and the LDAR components dilution of precision value. Using this information, the component locator program **286** may generate information outlining the user's route/path, his pace, his activities, his periods of inactivity, and the like.

While the foregoing is directed to implementations of various technologies described herein, other and further implementations may be devised without departing from the basic scope thereof, which may be determined by the claims that follow. Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

What is claimed is:

1. A method for creating a database of coordinates of leak detection and repair (LDAR) components, comprising:
- receiving an input pertaining to an LDAR component;
- obtaining position coordinates of a handheld computer device in response to receiving the input;
- associating the position coordinates of the handheld computer device with the LDAR component; and
- storing the position coordinates in association with the LDAR component into a database.

2. The method of claim **1**, wherein associating the position coordinates comprises associating the position coordinates of the handheld computer device with a unique identifier of the LDAR component.

3. The method of claim **1**, wherein the position coordinates are Global Positioning System coordinates.

4. The method of claim **1**, wherein obtaining the position coordinates comprises determining the position coordinates from one or more position coordinates satellites.

5. The method of claim **1**, further comprising encrypting the position coordinates.

6. The method of claim **1**, further comprising encrypting the association between the position coordinates of the handheld computer device and the LDAR component.

7. The method of claim **1**, wherein the database that stores the position coordinates is separate from a database that stores other information about the LDAR component.

8. A method for providing assistance to a user for locating a leak detection and repair (LDAR) component, comprising:
- receiving a request to locate an LDAR component in a field;
- retrieving position coordinates of the LDAR component;
- obtaining position coordinates of a handheld computer device; and
- displaying directions on the handheld computer device, wherein the directions are from the position coordinates of the handheld computer device to the position coordinates of the LDAR component.

9. The method of claim **8**, wherein the position coordinates of the LDAR component are encrypted and further comprising decrypting the encrypted position coordinates.

10. The method of claim **8**, wherein the directions comprise a heading and distance, a map, a video presentation, a travelogue map, vocal instructions, text or combinations thereof.

11. The method of claim **8**, wherein the directions are provided displayed without displaying the position coordinates of the LDAR component.

12. The method of claim **8**, wherein displaying the directions comprises providing directions to the vicinity of the LDAR component.

13. The method of claim **8**, wherein the position coordinates of the handheld device or the LDAR component are Global Positioning System (GPS) coordinates obtained from one or more GPS satellites or cellular phone towers.

14. The method of claim **8**, further comprising:
- obtaining current position coordinates of the handheld computer device when the user has reached the LDAR component;
- comparing the current position coordinates of the handheld computer device with the retrieved position coordinates of the LDAR component; and
- displaying a warning message on the handheld computer device to the user if the difference between the current position coordinates of the handheld computer device and the retrieved position coordinates of the LDAR component exceeds a predetermined range.

15. The method of claim **14**, further comprising providing the user with an option to either replace the position coordinates of the LDAR component with the current position coordinates of the handheld computer device if the difference between the current position coordinates of the handheld computer device and the retrieved position coordinates of the LDAR component exceeds a predetermined range.

16. The method of claim **8**, further comprising:
- obtaining current position coordinates of the handheld computer device when the user has reached the LDAR component;
- determining whether the current position coordinates are within a predetermined range of the retrieved position coordinates of the LDAR component; and
- if it is determined that the current position coordinates are within the predetermined range, then replacing the retrieved position coordinates of the LDAR component with the current position coordinates.

17. The method of claim **8**, further comprising:
- obtaining current position coordinates of the handheld computer device when the user has reached the LDAR component;
- determining whether the current position coordinates are within a predetermined range of the retrieved position coordinates of the LDAR component and whether the dilution of precision of the current position coordinates is higher than the dilution of precision of the retrieved position coordinates; and
- if it is determined that the current position coordinates are within the predetermined range and that the dilution of precision of the current position coordinates are higher than the dilution of precision of the retrieved position coordinates, then replacing the retrieved position coordinates of the LDAR component with the current position coordinates.

18. The method of claim 8, further comprising:

obtaining current position coordinates of the handheld computer device when the user has reached the LDAR component;

comparing the current position coordinates of the handheld computer device with the retrieved position coordinates of the LDAR component; and

if the difference between the current position coordinates of the handheld computer device and the retrieved position coordinates of the LDAR component exceeds a predetermined range, then sending a message regarding the difference to a database for quality assurances purposes.

19. A system for locating leak detection and repair (LDAR) components, comprising:

one or more position coordinates satellites; and

a handheld computer device in communication with the position coordinates satellite, wherein the handheld computer device comprises:

a processor; and

a memory comprising program instructions executable by the processor to:

receive an input pertaining to an LDAR component;

obtain position coordinates of the handheld computer device using the position coordinates satellites;

associate the position coordinates of the handheld computer device with the LDAR component;

store the position coordinates in association with the LDAR component into a database.

20. The system of claim 19, wherein the handheld computer device further comprises a position coordinates device configured to determine the position coordinates of the handheld computer device from the position coordinates satellites.

21. The system of claim 19, wherein the memory further comprises program instructions executable by the processor to encrypt the position coordinates.

22. A system for locating leak detection and repair (LDAR) components, comprising:

one or more position coordinates satellites; and

a handheld computer device in communication with the position coordinates satellite, wherein the handheld computer device comprises:

a processor; and

a memory comprising program instructions executable by the processor to:

receive a request to locate an LDAR component in a field;

retrieve position coordinates of the LDAR component in response to receiving the request;

obtain position coordinates of the handheld computer device using the one or more position coordinates satellites; and

display directions on the handheld computer device, wherein the directions are from the position coordinates of the handheld computer device to the position coordinates of the LDAR component.

23. The system of claim 22, wherein the handheld computer device further comprises a position coordinates device configured to determine the position coordinates of the handheld computer device from the one or more position coordinates satellites.

24. The system of claim 19, further comprising a position coordinates device configured to determine from the one or more position coordinates satellites the position coordinates of the handheld computer device, wherein the position coordinates device is in communication with the handheld computer device.

25. A method for tracking a technician in an industrial plant, comprising:

receiving one or more sets of position coordinates of a handheld computer device while the technician is performing a task for a leak detection and repair (LDAR) component disposed inside the industrial plant, wherein the handheld computer device is used by the technician to perform the task;

associating the one or more sets of position coordinates with the technician; and

storing the one or more sets of position coordinates automatically by the handheld computer device into a database while performing the task.

26. The method of claim 25, further comprising displaying a representation of the one or more sets of position coordinates on a computer screen.

27. The method of claim 25, wherein the one or more sets of position coordinates comprise a first set of position coordinates and a second set of position coordinates, wherein the second set of position coordinates is received after the first set of position coordinates is received, and further comprising displaying a first representation of the first set of position coordinates and a second representation of the second set of position coordinates, wherein the second set of position coordinates is different from the first set of position coordinates.

28. The method of claim 25, wherein the task comprises monitoring the LDAR component, servicing the LDAR component, collecting data from the LDAR component, documenting the LDAR component or combinations thereof.

* * * * *