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United States Department of the Interior
Report of Invention Form

(Prepare in triplicate)

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Date: August 10, 1999

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II. IDENTIFICATION OF THE INVENTION.

Title of the invention

Device and process for automated outreach at environmental data collection stations.

III. PROBABLE UTILIZATION OF THE INVENTION

A. Give your opinion of the extent to which the invention may be used by any agency of the Department, other Government agencies, and the public.

The device and process for automated outreach at environmental data collection stations has many potential benefits to the U.S. Geological Survey (USGS), and to Federal, State, and Local Agencies with responsibilities for collecting and disseminating information from remote environmental monitoring stations. This invention could be used to a great extent by these agencies to provide the public with pertinent and timely information from

monitoring stations at locations where the public and(or) station operators would benefit from increased public interaction with an environmental monitoring station. For example, the invention could be used in conjunction with a water quality monitoring station to indicate times when fishing or swimming would not be advisable because of measured changes in water quality. This invention could be used in conjunction with stream gages, water-quality monitoring stations, weather-monitoring stations, and geophysical-monitoring stations to provide education and outreach opportunities, and other pertinent information that would help meet the mission of the operating agency.

The USGS consistently maintains a network of about 7000 stream-gaging stations nationwide. Over the last 10 years there has been a great demand for equipment upgrades at many of these stations so that they can provide the real-time data needed by decision makers (U.S. Geological Survey, 1998). The USGS and other Federal, State, and local agencies also maintain many other stations for measuring the quality as well as the quantity of the nation's water resources. Each of these stations represents a potential need for the device and process for automated outreach at environmental data collection stations.

If used by automated weather monitoring stations at recreational areas, this device could provide on-demand health and safety advisories based on measurements from weather sensors. This device could also provide data and advisories (based on preprogrammed algorithms for data interpretation) at many sites including small unstaffed airports, helipads, boat launches, and swimming areas.

The device and process for automated outreach at environmental data-collection stations could also be used in many health and safety applications. For example, this system, if connected to an automated monitoring system designed to detect poisonous or explosive gasses in enclosed spaces could be used to lower risks for personnel required to enter such spaces for periodic inspection or maintenance. Currently, personnel must open such spaces and enter with gas detectors. This procedure can be dangerous because opening the confined spaces can introduce oxygen to a potentially explosive environment, and can expose personnel to poisonous or noxious gasses.

B. Discuss briefly the Governments interest, if any, in further developing the invention.

Outreach to the public is considered to be part of the primary mission of the USGS (U.S. Geological Survey, 1995). The USGS could use the invention as part of outreach programs at environmental monitoring stations and at sites such as museums, national- and state-park visitor centers, and other installations where remote-monitoring stations could be accessed through a simple public interface. Additionally, the U.S. Government has many sites where weather, water flow, water-quality, and other automated monitoring data would be helpful in addressing environmental and health-and safety issues, if information was available through a simple public interface at the site where information is needed.

Licensing of this invention by the USGS to private industry may be lucrative as it meets an unfulfilled need, is suitable for mass production, and can be used in the environmental monitoring industry, the health and safety industry, the outdoor recreation industry, and in other applications where real-time data can be useful when made available in natural language at the press of a button by an automated monitoring station.

IV. DETAILED TECHNICAL DESCRIPTION OF THE INVENTION

A. The principal utility and the general field of application of the invention.

The principal utility of the invention is to provide a simple push-button interface for government workers and the public to access automated monitoring data. Quick and easy access to these data is useful for the purposes of decision making as well as for general outreach and educational purposes.

The general field of application is intended to be USGS water-quality monitoring stations. This invention, however, would also be useful for USGS stream-gaging stations, and many other potential applications where public access to real-time environmental monitoring data would be helpful.

B. Briefly, what prompted the making of the invention, or how was the idea therefore obtained?

The Campbell Scientific Corporation manufactures a computer-voice modem that when programmed properly and loaded with the necessary key words will report (over the telephone) the station ID and measured environmental parameters in English language. Both inventors encountered a substantial positive response when the abilities of this device were demonstrated for other scientists, technicians, managers, customers, and the general public. Also, the ability to provide real-time data has proven to be a useful tool in outreach activities as well as efforts to provide scientists, managers, and the public with timely information about the hydrologic systems being monitored. These attributes sparked discussions about possible uses for these devices for outreach and information dissemination.

The idea for the device and process for automated outreach at environmental data collection stations was galvanized on July 15, 1998, the day we constructed an equipment shelter for the Automated Monitoring well at Walden Pond (Granato & Smith, 1998). The high level of interest among park visitors passing by the monitoring site emphasized the outreach opportunity for an automated outreach system that would provide station information, and the most current values of measured parameters in an interactive manner. Therefore, we conceived of the idea for use of the voice modem through an on-site interface system that would be used in parallel with the traditional phone-line or cellular phone connections.

C. Previously known or used methods, materials, or devices performing the task or function of the invention, and the disadvantages of such prior art. In this connection discuss the particular problems encountered with the prior art. List all pertinent literature references and patents of which the inventor has knowledge.

A comprehensive search of the U.S. Patent and Trademark Office's on-line bibliographic database of the patent literature did not reveal any similar technologies for outreach at environmental monitoring stations (U.S. Patent and Trademark Office, 1999). We do not know of any available systems that perform the function described for our invention. Monitoring stations sometimes feature a poster or placard, which designates the site as an environmental monitoring station and provides some basic information about the monitoring site.

The USGS has a successful real-time data distribution system on the internet (U.S. Geological Survey, 1999), but providing an internet interface at remote monitoring stations would be costly and prone to vandalism. Voice modems are in standard use for remote data access, and we are familiar with automated voice menu systems in phone systems. Museums, science centers, and aquariums use push button displays for public outreach and education efforts but these systems generally use prerecorded messages, or interact with computer programs designed solely for outreach. Our system, however, is designed to add outreach capabilities to active real-time monitoring systems using a simple interface that does not allow interference with the primary mission of the sampling system. Our system communicates basic information about the monitoring station and the most recent measurements in natural audible language through a speaker system. Also, our system is designed to provide outreach on-site at the monitoring system, or to provide outreach at a nearby location such as a visitor's center using the same voice modem interface. Therefore, we are not aware of any specific previously known or used methods, materials, or devices that are available to perform the task or function of this invention.

D. Give explanation of a specific embodiment of the invention:

- 1. Include therein the theory of the operation of the invention**
- 2. In a mechanical or electrical invention give a detailed description by reference to a sketch or drawing. All component parts of the apparatus must be labeled and the description keyed thereto.**
- 3. In a process or chemical composition, include extreme and preferred ranges of conditions (e.g., temperature, pressure, ratio of components, voltage, current, etc.) and alternate or equivalent materials which may be employed.**
- 4. Include any additional material such as photographs, reports, publications, and refer to texts or other informational material which may be helpful to an understanding of the invention.**

The theory of the invention for the device and process for automated outreach at environmental data collection stations is that:

1. Upon activation, a mechanical switch, which is available to the public, will send a signal to a control structure that will (a) set a timer to prevent repeated activation until the device completes a preprogrammed process, (b) activate an electronic data collection platform via a commercially available voice modem by using an electronic line simulator and phone-line selector, and (c) deliver station information and the most current values of measurements from the data-collection platform and(or) system status through (d) a speaker interface that is activated by an amplifier assembly to generate a message that sounds like a human voice speaking in a suitable language (such as English).
2. The control structure will also have an electronic interrupter switch to prevent the public outreach system from interfering with the primary data collection mission of the monitoring system.
3. The control structure will also have an electronic data shield consisting of an interface surge suppressor assembly to prevent electrical failure via a surcharge through the public interface system.

The invention consists of two main components a public interface, and a control structure that interface with an automated monitoring station that has an electronic data collection and control platform, a commercially available voice interface and one or more electronic operators interface (fig. 1). Figure one is a logical schematic of the invention and the relevant components of an automated environmental monitoring system. Each logical component assembly is designated by a rectangle of dashed lines, and the two assemblies within the solid-lined enclosure are the components of the device and process for automated outreach at environmental data collection stations depicted in Figure One. The public interface (fig. 1) includes a mechanical pressure switch (similar to a doorbell) and a speaker assembly. The public interface would be made of inexpensive parts and would be armored to withstand weather and a reasonable level of vandalism. The public interface is connected to the control structure (fig. 1) through the automated monitoring structure's shelter wall. The control structure includes an electronic data shield to prevent large electrical charges, such as a lightning strike, to propagate through the control structure electronics into the monitoring station electronics. The control structure includes a timer to cut off the public interface input button that prevents input signals from repeated activation of the button while the control structure is responding to a public activation event from the button. The control structure also includes an electronic interrupter switch (for surge suppression) to allow the electronic data collection and control platform to disable the invention while the station is making a measurement or responding to commands from (or a query by) the station operator. The control structure also incorporated a line simulator and an electronic phone-line selector to interface with a preprogrammed voice modem (fig.1). The voice modem is a commercially available voice interface that is part of the automated monitoring station and is interfaced directly to the electronic control platform. Such a voice modem is standard for many remote-monitoring stations and would generally be supplied separately from the assembly that contained the device and process for automated outreach at environmental data collection stations. Finally, the invention includes an amplifier to transmit the electronic voice message to the speaker in the public interface with enough volume to be clearly heard and

understood at the monitoring station (fig.1). Either the speaker assembly or the amplifier assembly could be equipped with a volume control to set an appropriate speaker-voice volume, by the public or by the operator, respectively.

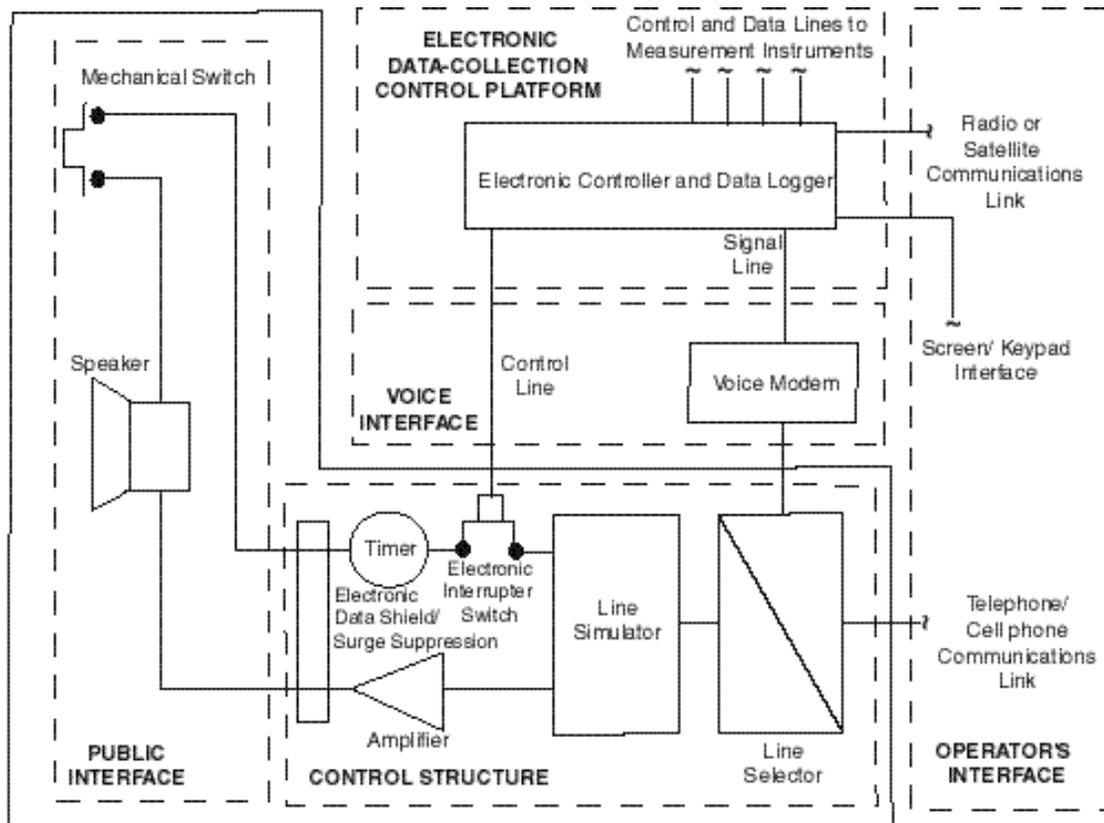


Figure 1.-Logical schematic of the device and process for automated outreach at an environmental-data collection station including the public interface and the control structure (component modules within the solid-lined enclosure), and the data collection-station components including the electronic data-collection platform, the voice interface, and the operator's interface.

E. Alternate embodiments of the invention including specific examples. To the extent found to be appropriate, follow the instructions given in regard to D above.

This invention may have several embodiments. The public interface and control structure would normally be located at the monitoring site, but also could be located at a remote site such as a National Park Visitors Center, or a public nature-center or science museum. It could also be coupled with a more sophisticated interface, which would provide a menu of options. The voice feature may be coupled with a fixed visual display such as an explanatory poster. The device could be coupled with a dynamic visual display such as a LED readout, a continuous strip chart, or a video display terminal. The device may also be coupled with a combination of these alternatives and(or) designed with a Braille interface to maximize the utility of the voice interface for the visually impaired.

This device could also be programmed to activate without visitor input. The device could use a proximity sensor, motion or light sensor to detect and address a visitor. This device could be programmed to activate and announce system conditions based upon the time of day, or on a preset time interval during hours of operation. A combination of automatic and manual activation can also be programmed. The device could also be coupled to one of the remote web cameras that are now available to record visitors and to deter and record vandalism, which has always been a problem at remote monitoring stations.

F. The advantages of the invention over the prior art noted in connection with Item C.

The device and process for automated outreach at environmental data collection stations provides advantages over the prior art which is to provide no information or to provide only a static poster or placard because the automated outreach device makes real-time data available to visitors at remote sites such as USGS stream gaging stations, sewer entries, industrial facilities, and beaches or other recreational sites where other sources of information may not be available.

G. Features of the invention believed to be new.

1. A public interface to a complex electronic monitoring station that interfaces with commercially available voice modems to provide station information and the most current values of measurements from the data-collection platform that is simple to use, inexpensive to build or replace, and is resistant to vandalism and adverse weather conditions.
2. A data shield assembly consisting of a surge suppressor assembly to prevent electrical surges (such as a lightning strike) from the public interface to damage the controller or the electronic monitoring station.
3. An interface with a built in timer to prevent repeated activation of the system feedback loop while the station and the interface are communicating to the public.
4. An electronic interrupter switch to prevent the public interface from interfering with the primary mission of the data collection station.

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