DEPARTMENT OF THE NAVY

OFFICE OF COUNSEL
NAVAL UNDERSEA WARFARE CENTER DIVISION
1176 HOWELL STREET
NEWPORT RI 02841-1708

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PATENT COUNSEL
NAVAL UNDERSEA WARFARE CENTER
1176 HOWELL ST.
CODE 00OC, BLDG. 112T
NEWPORT, RI 02841

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Inventor Rosemary F. Woodside

If you have any questions please contact Mark Homer, Patent Counsel, at 401-832-6679.

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VOICE ACTIVATED CONTROLS FOR TACTICAL SONAR DISPLAYS

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to control and display systems and more particularly suited for sonar applications that utilize voice commands to simplify the operators' task and to reduce the operators' fatigue from handling scenarios involved in the underwater environment.

2. Description of the Prior Art

Sonar systems commonly employ monitors to display parameters involved in the detection, classification, and localization of targets. The determination commonly involves an operator that manipulates keyboard entries, control switches, and views associated monitors displaying the problem as it is being solved by a sonar system. Because the problem being

solved involves many variables, most of which need to be determined by the operator, the operator's task at times can be overwhelming.

The operator has been given assistance in reducing his/her tasks by employing a computer in a graphic-based operating environment comprising rectangular, scrollable viewing areas, scrollable lists or re-sizable areas that confine and display a portion of the problem being solved. Although the graphic-based system assists the operator, the use of those graphical based controls presents new problems that further burden the operator in performing the desired task. For example, the usage of graphical controls does not completely negate the need of keyboard entries while at the same time increases the usage of mouse clicks in the performance of scenarios related to underwater detection, classification and localization. Further, the usage of graphic controls creates new problems of pop-up display dialogs and menus visually covering tactical data needed to be examined by the operator in order to perform the desired scenarios. Further still, utilizing display controls and command buttons occupies room on the display monitor that could be better utilized by displaying tactical data to assist the operator. Accordingly, there is a need to provide for a control and display system particularly suited for sonar applications that utilize simple voice commands to replace the normally

needed multiple operator entries and do not suffer the hindrances of pop-up menus and hidden display contents.

OBJECT OF THE INVENTION

It is an object of the present invention to utilize simple voice commands to replace the normally needed multiple operator entries commonly involved in the scenario of handling and solving underwater detection, classification, and localization problems.

It is another object of the present invention to eliminate the need for keyboard entries or mouse clicks in performing scenarios related to underwater detection, classification, and localization. More particularly, it is an object of the present invention to provide simple voice commands for performing scenarios related to underwater detection, classification, and localization and freeing the operator from making keyboard entries and mouse clicks.

It is a further object of the present invention to avoid using a pop-up menu or dialog viewing area of a display which would hide other needed display information. More particularly, it is an object of the present invention to use voice commands in performing scenarios so as to avoid pop-up display dialog or menus from visually covering tactical data needed in the performance of the scenarios.

It is still a further object of the present invention to increase the viewing area made available for displaying scenario information. More particularly, it is an object of the present invention to use voice commands, in lieu of using display controls and command button activation, thereby leaving more room for more tactical data to be displayed.

Moreover, it is an object of the present invention to streamline the manner in which the operator handles tactical scenarios.

In addition, it is an object of the present invention to reduce operator fatigue involved in handling tactical scenarios.

Furthermore, it is an object of the present invention to simplify the training that prepares the operator to handle tactical scenarios involving underwater detection, classification, and localization.

SUMMARY OF THE INVENTION

The present invention is directed to a control and display system that utilizes simple voice commands to replace multiple operator entries so as to reduce the complexity of the tactical scenarios of underwater detection, classification, and localization required to be handled by a sonar operator.

The control and display system comprises a first and second display system respectively responsive to first and second

control elements, and a first computer system having a first processor with first, second and third computer programs running therein. The first computer system is responsive to the first display system. The control and display system further comprises a second computer system having a second processor having fourth, fifth, and sixth computer programs running therein. The second computer system is responsive to the second display system whose displays are utilized as output devices of the sixth computer program. The control and display system further comprises a network interface mechanism interconnecting the first and second computer system and being respectively responsive to the second and fifth computer programs, and a microphone. The first computer program manages the execution of all programs running in the first processor and services the first display system. The fourth computer program manages the second processor and services the second display system. The third computer program acquires voice commands from an operator, via the microphone. The microphone is connected to the first computer system and provides electrical signals representative of spoken words to the third computer program. The third computer program determines if the command is a valid, and if the command is valid, a command string initiated by the third computer program is sent to the second computer system, via the network interface mechanism. The sixth computer program

comprises a program that translates voice command strings from the third computer program into display directives needed by the sixth computer program.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is the sole diagram of the present invention and illustrates a block diagram of the control and display system of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the drawings, wherein the same reference number indicates the same element throughout, there is shown in FIG. 1 a block diagram of the control and display system 10 of the present invention. The control and display system 10 is particularly suited for sonar applications for detection, classification, and localization by means of acoustic signals. The control and display system 10 allows the operator to select and enter parameters involved with solving the sonar problem and provides a visual observable presentation of the information, such as the data entered into a computer, as well as the data provided by the computer in solving the sonar problems. The control and display system 10 comprises a first computer system 12, a second computer system 14, and a network interface 16.

The first computer system 12 includes a microphone 18 and a display 20 responsive to control elements as known in the art.

The first computer system 12 includes a first processor 22, acting as a server processor and having running therein comprising first, second, and third computer programs 23, 25, 27, with the third computer program 27 shown as comprising Application Program Interfaces (APIs) 24 and 26. The APIs 24 and 26 comprise a Voice Acquisition System (VAS) that utilizes the microphone 18. The third computer program 27(VAS) acquires commands from an operator via the microphone 18 by utilizing API 24 and sends the resulting commands to a sixth computer program 39 (AEP), to be further described, via API 26. The third computer program 27 (VAS) is of particular importance to the present invention. The APIs 24 and 26 may be respectively *Dragon Naturally Speaking*™ ACTIVEX Module (API) and Standard Network TCP/IP API both known in the art.

The first and second computer programs 23, 25 running in the server processor 22 are standard commercially available operating system components. The first computer program 23 is a standard operating system, which manages the execution of all programs running on computer system 12 and services display 20. The second computer program 25 is a standard operating system component, which manages the transfer of standard protocol messages to/from computer system 12 across a network, such as

network interface 16, to other computer systems, such as the second computer system 14.

The second computer system 14 includes displays 30 and 32, each responsive to control elements as known in the art, which are utilized as output devices of a sixth computer program 39. The second computer system 14 includes a second processor 34 acting as a client processor and having running therein fourth, fifth, and sixth computer programs 35, 37, 39, with the sixth program 39 shown as comprising Application Program Interfaces (APIs) 36 and 38.

The sixth computer program 39 is known as the Augmentation Enhancement Package (AEP), which is comprised of the Command Interpreter Module (CIM) API 36 and Standard Network TCP/IP API 38. The Command Interpreter Module (CIM) API 36 translates voice command strings from the third computer program, running in the first computer system 12, into display directives required by the sixth computer program (AEP). The Standard Network TCP/IP API 38 is a standard operating system component. The Command Interpreter Module (CIM) API 36 is of particular importance to the present invention.

The fourth and fifth computer programs 35, 37 are standard commercially available operating system components. The fourth computer program 35 is a standard operating system, which manages the execution of all programs running on the second

computer system 14. The fifth computer program 37 is a standard operating system component, which manages the transfer of standard protocol messages to/from the second computer system 14 across a network interface 16 to other computer systems, such as the first computer system 12, and may utilize a Standard Network Interface Process, the fifth computer program 37 known in the art and utilizes the network interface 16 in operative cooperation with the Standard Network Interface Process, the second computer program 25 of the first computer system 12.

The server processor 22 may be any computer that is capable of running the first, second and third computer programs 23, 25, 27. The first computer program 23 may be a standard commercially available operating system that includes a Standard Network Interface Process as a standard operating system component operating system. For one embodiment of the invention, the server processor 22 may be a Personal Computer (PC) running the *Windows NT* operating system as the first computer program 23.

The second computer program 25 running in the server processor 22 may be a standard operating system component, which manages the transfer of standard protocol messages to/from the first computer system 12 across the network interface 16 to the second computer system 14 having client processor 34 and may be the Standard Network Interface Process, the second computer

program 25 that operatively cooperates with the Standard Network Interface Process, the fifth computer program 37 of the client processor 34.

The third computer program 27, comprised of Application Program Interfaces (APIs) 24 and 26 accepts a verbal command from the operator via the microphone 18, determines if the command is valid (i.e., from the specified command set) and if the command is valid, sends a command string, via the network interface 16 mechanism using the second computer program 25, to the sixth computer program 39 running in the client processor 34.

For one embodiment of the invention, the third computer program 27 may be written in *Visual Basic* and incorporates the *Dragon NaturallySpeaking*™ ACTIVEX Module API 24 for controls including *DgnVoiceCmd* to accept a verbal command from the operator, by way of microphone 18, and to validate that command, and *DgnMicBtn* for microphone 18 operations. *Dragon Naturally Speaking*™ is a voice recognition system, which converts spoken words into computer text. The *Visual Basic* program uses the Standard Network TCP/IP API 26 to communicate with the client processor 34 and to send the validated command strings to the client processor 34. The first, second and third computer programs 23, 25, 27 are all known in the art.

The client processor 34 may be any computer, which may run the fourth, fifth, and sixth computer programs 35, 37, 39. The fourth computer program 35 may be a Unix Operating System for running and managing numerous processes, in a manner known in the art. The fifth computer program 37 may be a standard operating system component, which manages the transfer of standard protocol messages to/from the second computer system 14 across the network 16 to the first computer system 12 and may be the Standard Network Interface Process, the fifth computer program 37 that operatively cooperates with the Standard Network Interface Process, the second computer program 25 of the server processor 22.

The sixth computer program 39 is known as the Augmentation Enhancement Package (AEP), which is comprised of the Command Interpreter Module (CIM) API 36 and the Standard Network TCP/IP API 38. The Command Interpreter Module (CIM) API 36 translates voice command strings from the third computer program 27 running in the first computer system 12 into display directives required by the sixth computer program 39 (AEP) running in the second computer system 14.

The sixth computer program 39 running in the client processor 34 may also be designed as the Man-Machine Interface (MMI) between a sonar acoustical processor and the sonar operator. Utilizing a Graphical User Interface (GUI), the sonar

operator is presented with acoustical information, tactical information and numerous graphical controls with which the information can be accessed and manipulated to perform the detection, classification and localization functions. During the course of accessing and manipulating the information, the sonar operator is required to display multiple control menus and/or activate multiple controls.

The server and client processors 22 and 34, respectively, are connected by the network interface 16, which may comprise an Ethernet interface known in the art. The data communication between the server and client processors 22 and 34 is respectively handled by Standard Network Interface Processes, the second and fifth computer programs. The second and fifth computer programs 25, 37 utilize standard protocols of a Standard Network Interface Process (such as available in *Windows NT* Operating System and *Unix* Operating System).

In general, the control and display system 10 uses a client/server architecture. This client/server architecture is used primarily so that the client processor 34, acting as the receiving machine, can receive from the server processor 22, acting as the supplying machine, the voice commands information entered by the operator by way of the microphone 18. Both the client and the server processors 22 and 34, respectively, go

through different procedures to ready themselves for networking by using standard network TCP/IP protocol mechanisms.

The client processor 34 application program, that is, the sixth computer program, is preferably written in C, and uses the X *Window System*, which is a portable, network transparent window system, which provides all display functions including window layouts, graphics output, and keyboard and mouse interfaces. Some of the primary files of this application program, that is, the sixth computer program, include; (1) *comm.c* which contains the communication routines that utilize sockets; (2) *MessageHandler.c* which processes the incoming and completed messages; (3) *WidgetHandler.c* which handles all events, callbacks and widgets; and (4) *MapVoiceCommand.c* which interprets the command and performs the specified actions via widgets included in the *WidgetHandler.c*. All of the routines making up the sixth computer program operatively cooperate with each other in a manner known in the art.

The sixth computer program 39 referred to herein as the Augmentation Enhancement Package (AEP) program is of particular importance to the present invention. The AEP program generates AEP command sequences representative of Voice Commands Strings created by the Voice Acquisition System, the third computer program 27. Both the AEP Control program and the Command Interpreter Module (CIM) 36 are implemented to respond, in a

predetermined manner, to the Voice Commands corresponding to the words of the operator spoken into the microphone 18. In some cases the response is to provide dialog boxes, which are on-screen menus that are displayed and make available options to the viewing operator. The interrelationship between typical AEP Command Sequences, Voice Commands and the Actions created by the Command Interpreter Module API 36 is shown in Table 1 related to tactical sonar scenarios with the terms therein being known in the art.

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TABLE 1

AEP Objects:	Voice Commands:	Actions:
Broadband Tracker Menu	"Open Broadband Tracker" "Close Broadband Tracker"	Opens Broadband Tracker Dialog Box Closes Broadband Tracker Dialog Box
Narrowband Display Frequency Band Radio Buttons	"Select Frequency Nband One" "Select Frequency Nband Two" . . . "Select Frequency Nband N"	Selects Frequency Band One Selects Frequency Band Two . . . Selects Frequency Band N
All Grams	"Color Green" "Color Gray" . . . "Multi-Color"	Sets All Grams to Green Intensity Colors Sets All Grams to Gray Intensity Colors . . . Sets All Grams to Multi Intensity Colors
BTH Menu	"Open BTH" "Close BTH"	Opens BTH Dialog Box Closes BTH Dialog Box
BTH Color Scale Radio Buttons	"Select BTH Color Scale MONO" "Select BTH Color Scale SNR"	Sets All BTH Displays to MONO Sets All BTH Displays to SNR
Bearing Time History (BTH) Scenarios	"Configure BTH to Akula" "BTH Oscar"	Configures BTH to Akula Configures BTH to Oscar
Search Scenarios	"TB16 Search "TB23 Search	Configures AEP to TB16 Towed Array Search Configures AEP to TB23 Towed Array Search
Broadband Display Menu	"Open Broadband Display" "Close Broadband Display"	Opens Broadband Display Dialog Box Closes Broadband Display Dialog Box
Narrowband Display Menu	"Open Narrowband Display" "Close Narrowband Display"	Opens Narrowband Display Dialog Box Closes Narrowband Display Dialog Box

Recording Menu	"Open Recording" "Close Recording"	Opens Recording Dialog Box Closes Recording Dialog Box
Broadband LLG Menu	"Open Broadband LLG" "Close Broadband LLG" "LLG Band 1" "LLG Band 2"	Opens Broadband LLG Dialog Box Closes Broadband LLG Dialog Box Selects Frequency Band 1 Selects Frequency Band 2
Broadband Spectragrams	"Broadband Color Green" "Broadband Color Gray"	Sets Broadband Spectragrams to Green Intensity Sets Broadband Spectragrams to Gray Intensity
Narrowband Spectragrams	"Narrowband Color Green" "Narrowband Green Color" "Nband Color Green "Narrowband Color Gray"	Sets Narrowband Spectragrams to Green Intensity Sets Narrowband Spectragrams to Gray Intensity
Narrowband Tracker Menu	"Open Narrowband Tracker" "Close Narrowband Tracker"	Opens Narrowband Tracker Dialog Box Closes Narrowband Tracker Dialog Box
Right Tickmark CF Checkbox	"Right Tickmark Contact Followers On" "Right Tickmark Contact Followers "Off"	Enables Tickmark Contact Followers (CF) Disables Tickmark Contact Followers (CF)
Right Overlay CF Checkbox	"Right Overlay Contact Followers On" "Right Overlay Contact Followers Off"	Enables Overlay Contact Followers (CF) Disables Overlay Contact Followers (CF)
Right Fast Checkbox	"Right Fast On" "Right Fast Off"	Enables Fast Updates Disables Fast Updates
Right Medium Checkbox	"Right Medium On" "Right Medium Off"	Enables Medium Updates Disables Medium Updates
Scan Pop-down List	"Scan Bearing Only" "Scan Frequency Only" "Scan Auto 5 Seconds" "Scan Auto 7 Seconds"	Sets Scan Pop-down list
Stop Button	"Scan Stop"	Halts the current scan operation

Narrowband Beams Radio Buttons	"Beams 2" "Beams 4"	Sets number of narrowband beams
Microphone Image	"Microphone On" "Microphone Off"	Activates voice engine Deactivates voice engine

From Table 1, listing the commands commonly involved in a typical underwater detection, classification, and localization operator scenario, it is seen that the Augmentation Enhance Package (AEP), the sixth computer program 39 comprised of Command Interpreter Module API 36 and Standard Network TCP/IP API 38 is trained to respond to Simple Voice Commands. The response of the sixth computer program 39 (AEP) comprised of program packages 36 and 38 simplify the task of the operator, while at the same time give the operator more control to direct the displays involved in the scenario. Further, the operator is not burdened with making keyboard entries or mouse clicks. For example, the operator is not hindered with covered display, but rather, by saying "Scan Bearing Only" the Command Interpreter Module API and AEP program respond setting the scan pop-down list. Without the present invention, the sonar operator is required to make multiple keyboard entries and mouse clicks, as well as being hindered by pop-up and pop-down lists and hidden data parameters.

It should now be appreciated that the practice of the present invention utilizes simple voice commands to replace the

normally needed multiple operator entries commonly involved in sonar tactical scenarios.

It should be further appreciated that the practice of the present invention substantially eliminates the need of keyboard entries and mouse clicks in performing scenario related to underwater detection, classification, and localization. In addition, the practice of the present invention avoids the problem of a menu window viewing area hiding the needed display information. Moreover, the present invention by eliminating these problems increases the viewing area that is made available to display tactical scenario information.

It should be further appreciated that the practice of the present invention provides for voice commands which streamline the operators handling of tactical scenarios, while at the same time reduces the operator fatigue commonly involved in tactical scenarios. Further, the present invention results in simplifying the training necessary to be given to an operator before he/she can handle tactical scenarios.

The invention has been described with reference to the preferred embodiments and some alternates thereof. It will be understood that many additional changes in the details, materials, steps and arrangement of parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within

the principle and scope of the invention as expressed in the appended claims.

Attorney Docket No. 82668

VOICE ACTIVATED CONTROLS FOR TACTICAL SONAR DISPLAYS

ABSTRACT OF THE DISCLOSURE

A control and display system is disclosed that is particularly suited for sonar applications. The control and display system utilizes voice recognition to be responsive to simple voice commands to generate and display the results of complex combinations of commands. The utilization of voice commands avoids such hindering display and control problems as hiding tactical data, while at the same time allows for more visual display to be provided for tactical data information. The utilization of voice commands streamlines the manner in which an operator handles tactical scenarios, reduces operator fatigue when handling tactical scenarios, and simplifies training the operator to handle tactical scenarios.

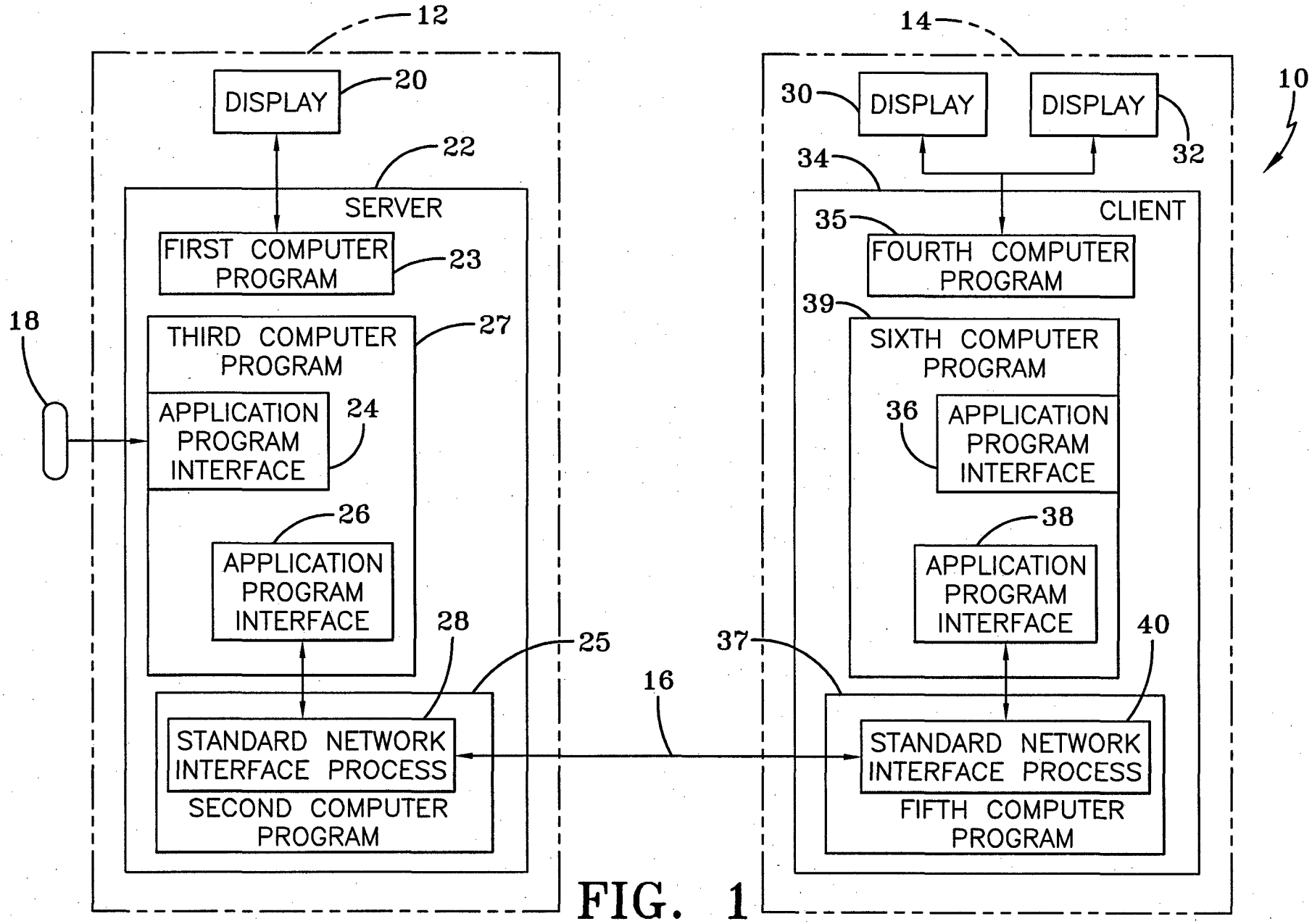
12
14
10
DISPLAY
20
DISPLAY
DISPLAY
30
32
22
34
SERVER
CLIENT
35
FIRST COMPUTER PROGRAM
23
FOURTH COMPUTER PROGRAM
18
39
THIRD COMPUTER PROGRAM
27
SIXTH COMPUTER PROGRAM
APPLICATION PROGRAM INTERFACE
24
36
APPLICATION PROGRAM INTERFACE
26
38
APPLICATION PROGRAM INTERFACE
APPLICATION PROGRAM INTERFACE
28
25
37
40
16
STANDARD NETWORK INTERFACE PROCESS
STANDARD NETWORK INTERFACE PROCESS
SECOND COMPUTER PROGRAM
FIFTH COMPUTER PROGRAM

FIG. 1