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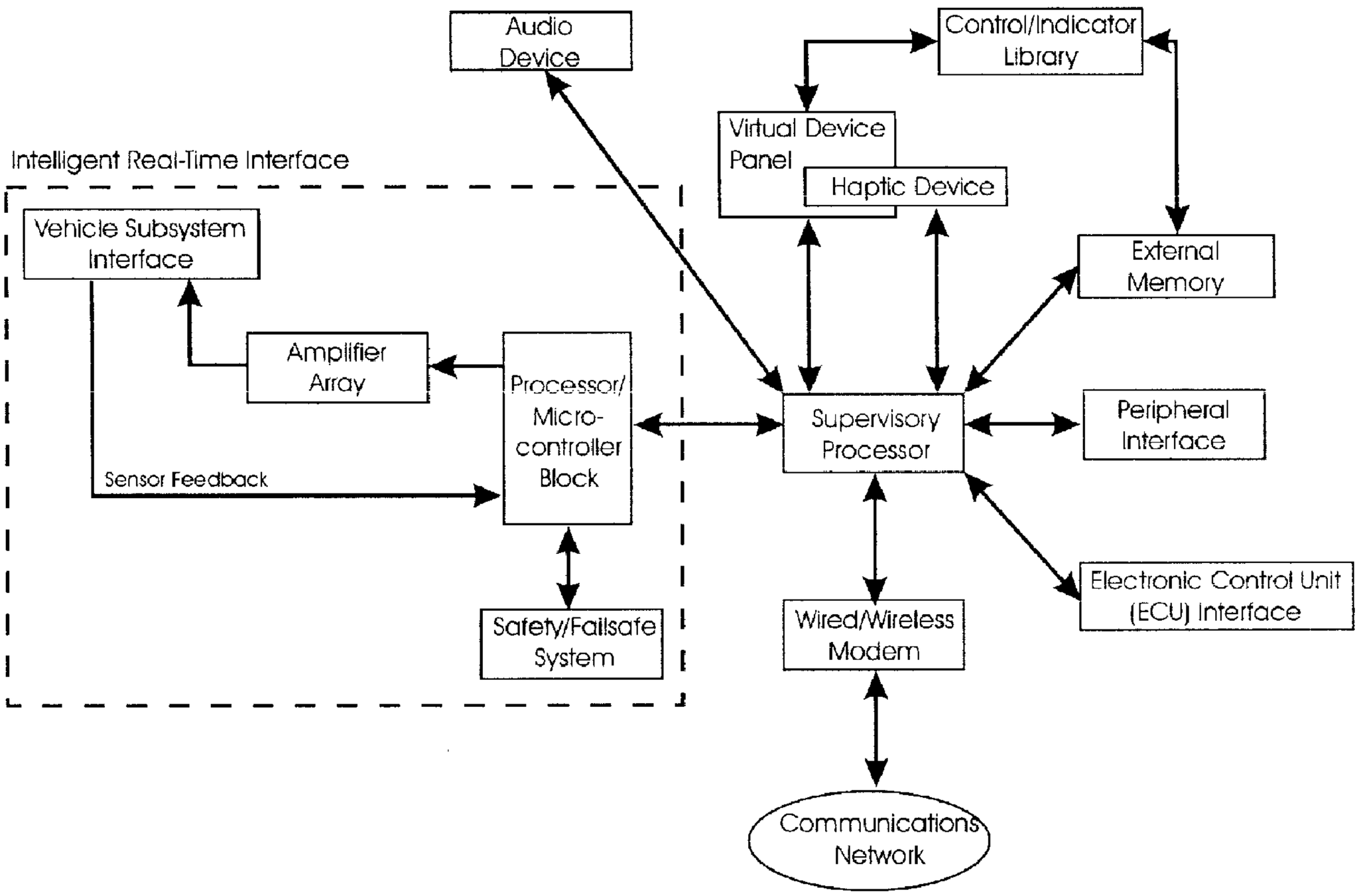
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(54) Titre : TABLEAU DE BORD RECONFIGURABLE
(54) Title: RECONFIGURABLE DASHBOARD SYSTEM



(57) Abrégé/Abstract:
A reconfigurable dashboard system for use in a vehicle is disclosed. The dashboard system, which controls and monitors various hardware and equipment in a vehicle, comprises a supervisory processor for controlling the entire dashboard system, a virtual device panel for displaying a plurality of virtual devices and/or instruments, a haptic device for interfacing with the virtual devices on the virtual device panel, an audio device for identifying the active virtual control, a control/indicator library to allow the user to layout their own custom dashboard, external memory for layout and library storage, and an intelligent real-time interface

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(57) Abrégé(suite)/Abstract(continued):
for interfacing to the sensors and actuators which are dedicated to the plurality of automobile hardware and equipment. The intelligent real time interface is comprised of a processor/microcontroller block, an amplifier array for amplifying the control signal issued by the processor/microcontroller block, a vehicle subsystem interface to connect the dashboard system to the vehicle subsystem, and a safety/failsafe system to monitor the health of the dashboard system and to override controls when necessary. The dashboard system further includes a wired/wireless modem and a communication network to link the dashboard system to the outside world, an electronic control unit (ECU) interface to interface to a vehicle's ECU, and a peripheral interface to accommodate a plurality of peripheral devices.

Abstract of the Disclosure

A reconfigurable dashboard system for use in a vehicle is disclosed. The dashboard system, which controls and monitors various hardware and equipment in a vehicle, comprises a supervisory processor for controlling the entire dashboard system, a virtual device panel for displaying a plurality of virtual devices and/or instruments, a haptic device for interfacing with the virtual devices on the virtual device panel, an audio device for identifying the active virtual control, a control/indicator library to allow the user to layout their own custom dashboard, external memory for layout and library storage, and an intelligent real-time interface for interfacing to the sensors and actuators which are dedicated to the plurality of automobile hardware and equipment. The intelligent real time interface is comprised of a processor/microcontroller block, an amplifier array for amplifying the control signal issued by the processor/microcontroller block, a vehicle subsystem interface to connect the dashboard system to the vehicle subsystem, and a safety/failsafe system to monitor the health of the dashboard system and to override controls when necessary. The dashboard system further includes a wired/wireless modem and a communication network to link the dashboard system to the outside world, an electronic control unit (ECU) interface to interface to a vehicle's ECU, and a peripheral interface to accommodate a plurality of peripheral devices.

RECONFIGURABLE DASHBOARD SYSTEM

Field of the Invention

The present invention relates to a reconfigurable dashboard system for use in a vehicle.

Background and Advantages of the Invention

The automotive industry is constantly striving to develop new innovations while maintaining or improving safety and reducing cost. One of the recent initiatives involves drive-by-wire technology, where a mechanical device for transmitting forces between two locations is replaced by a series of sensors, actuators, and control software. For example, with the traditional steering system in a vehicle, the driver is able to change the direction of the vehicle by applying force to the steering wheel. The steering wheel is attached to a shaft with a pinion mounted on the end. This pinion subsequently moves a rack that changes the angle of the wheels. Most vehicles have a power assist so that less force is required to be applied by the driver to execute a turn. The mechanical connection transfers the force of the wheel/road interaction back to the steering wheel allowing the driver to "feel" the road. In a drive-by-wire vehicle, most of these mechanical linkages are replaced with a variety of sensors, actuators, and control software. To execute a turn in a drive-by-wire system, the driver turns a wheel or moves a joystick in the direction of the desired turn. A sensor measures the amount of rotation or movement of the input device and, through the control software, commands actuators located at the wheels to turn the wheels by an amount equivalent to the desired turn angle. A disadvantage of this approach is that the driver no longer 'feels" the road. Thus, haptic devices are employed to provide force sensations that emulate the forces felt by the driver in a non drive-by-wire vehicle. The reconfigurable dashboard extends this concept to all the control buttons and knobs in the vehicle.

Summary of the Invention

According to the present invention, a reconfigurable dashboard system for vehicles is provided. The reconfigurable dashboard concept revolves around the replacement of conventional physical knobs, levers and controls with virtual knobs, levers, controls and haptic technology. In general, the reconfigurable dashboard system consists of a display, a haptic device and a supporting infrastructure. The virtual controls, the layout of which can be set by the user, are generated on a display. The user (driver) uses the haptic device to "feel" these devices to operate controls to control various subsystems within the vehicle such as the radio, environmental control and windshield wipers, which will be hereinafter referred to as "auto hardware". Since the dashboard system comprises virtual devices, the user can configure the layout of the dashboard as desired, or download and implement a pre-configured layout from the manufacturer's website. Through underlying electronic/electrical interfaces, the dashboard system can control a plurality of auto hardware within the vehicle. Since the dashboard system is controlled via a computer processor, there exists the opportunity to embed additional intelligence into the operation of each auto hardware as well.

According to one aspect of the present invention, there is provided a reconfigurable dashboard system for controlling and monitoring a plurality of automobile hardware and equipment in a vehicle. The dashboard system comprises a computer processor for controlling the entire dashboard system, a virtual device panel for displaying a plurality of virtual devices and/or instruments, a haptic device for interfacing with the virtual devices on the virtual device panel, an audio device for identifying the active virtual control, a control/indicator library to allow the user to layout their own custom dashboard, external memory for layout and library storage, and an intelligent real-time interface for interfacing to the sensors and actuators which are dedicated to the plurality of automobile hardware and equipment. The intelligent real time interface is comprised of a processor/microcontroller block, an amplifier array for amplifying the control signal issued by the processor/microcontroller block, a

vehicle subsystem interface to connect the dashboard system to the vehicle subsystem, and a safety/failsafe system to monitor the health of the dashboard system and to override controls when necessary. The intelligent real time interface is easily reprogrammed to accommodate both new and existing vehicle hardware and subsystems. The dashboard system further includes, a wired/wireless modem and a communication network to link the dashboard system to the outside world, an electronic control unit (ECU) interface to interface to a vehicle's ECU, and a peripheral interface to accommodate a plurality of peripheral devices. Every component of the dashboard system will be detailed hereafter, in conjunction with the description of the preferred embodiment of the present invention.

Brief Description of the Drawings

The embodiments of the invention will now be described with reference to the accompanying drawing, in which:

Figure 1 is a schematic representation of a reconfigurable dashboard system of the invention.

Figure 2 shows one embodiment of a haptic device integrated into the virtual device panel.

Figure 3 shows another embodiment of a haptic device that is external to the virtual device panel.

Figure 4 shows the connectivity of components of the reconfigurable dashboard system, in which the control loop is closed within the processor/microcontroller block of the intelligent real-time interface.

Detailed Description of the Preferred Embodiment(s)

In Fig. 1, there is shown a reconfigurable dashboard system according to one embodiment of the present invention, which is hereinafter referred to as a "dashboard system". With reference to FIG. 1, details of the invention will be

described below, together with various aspects of the invention and the associated advantages therewith. As shown in FIG. 1, the dashboard system comprises a supervisory processor, a virtual device panel, a haptic device, an audio device, a control/indicator library, an external memory, and an intelligent real-time interface. The intelligent real time interface comprises a processor/microcontroller block, an amplifier array, a vehicle subsystem interface and a safety/failsafe system. The dashboard system further includes a wired/wireless modem, a communications network, an electronic control unit (ECU) interface, and a peripheral interface. Each component of the dashboard system will be detailed below, referring to Figs. 1 to 4.

Supervisory Processor

The supervisory processor is the heart of the dashboard system of the present invention. It is responsible for controlling the haptic device, controlling the virtual device panel, facilitating communications with the ECU via the ECU interface, interfacing to other plug in peripherals via the peripheral interface, communicating with the external communications network via the wired/wireless modem, driving the audio device, accessing the external memory, and coordinating the functionality of the intelligent real-time interface. The supervisory processor can be a microcontroller or microprocessor, a digital signal processor, an Application Specific Integrated Circuit (ASIC) or any other device, custom designed or off-the-shelf, which is capable of performing the above tasks.

Virtual Device Panel

The virtual device panel is used to display various virtual devices and/or instruments in the vehicle. Using the haptic device, the user is able to lay out the control devices and indicators on the virtual device panel as required or download a preconfigured layout from the vehicle manufacturer's website or other server via the wired/wireless modem and communications network. The virtual device panel allows the user to access a library of controls/indicators that are available for the given make of vehicle or automobile. The user is able to

select and drag these devices from the library using the haptic device onto the virtual device panel where it can be, for example, resized, made a different colour, etc. Each control element has preconfigured ranges to facilitate the operation of the corresponding device. The virtual device panel comes from the factory with a default dashboard layout, which will likely consist of all possible controls/indicators or only those that are most commonly used. Using the virtual device panel, the user is able to save and load a variety of dashboard layouts to/from memory or restore the default layout. Using this facility, each driver can save and load his or her own dashboard layout preference with the touch of a button.

The virtual device panel can be located on the dashboard as a separate display or can be implemented as a heads-up system on the windshield. In the case of the former, the haptic device can be located remotely from the display in a convenient location readily accessible by the user. The virtual device panel can use existing or new display technology.

Haptic Device

The haptic device allows the user to interface with the virtual controls/indicators on the virtual device panel, develop a new dashboard layout, or download a predefined dashboard layout. It is a device that provides the user with the sense of touching real controls when the haptic device overlays the corresponding virtual control on the virtual device panel. The preferred embodiment of the device has a minimum of 2 ½ degrees-of-freedom (DOF) in movement and actuation. As illustrated in Fig. 2, the first degree-of-freedom, defined as the "X-DOF", allows the haptic device to transverse the width of the virtual device panel and to exert force in this direction of movement. The second degree-of-freedom, defined as the "Y-DOF", allows the haptic device to transverse the height of the display and exert force in this direction of movement. The remaining ½ degree-of-freedom, defined as the "Z-DOF", operates in the direction perpendicular to the plane defined by the X-DOF and the Y-DOF. Haptic feedback in the Z-DOF can be active or passive (e.g. a mechanical

switch). Three-dimensional haptic effects can be implemented with as few as two degrees-of-freedom through the appropriate choice of and combination of effects. For example, if effects are programmed to simulate a thin wall in the X-Y plane, the user feels as if the haptic device has gone "over" the wall when passing through this thin wall. This is an effect in the Z direction, even though there are no forces applied by the Z-DOF. The haptic device can incorporate up to six independent degrees-of-freedom in movement and actuation – three in translation and three in rotation.

FIG. 2 shows an embodiment of the haptic device according to the invention, where it is integrated into the virtual device panel. In this embodiment, actuators/motors required to generate the force effects in each of the active degrees-of-freedom are contained within the virtual device panel housing. The X-DOF and Y-DOF transverse the plane of the virtual device panel. The Z-DOF acts perpendicular to this plane and may be active or passive. FIG. 2 also illustrates one possible implementation of a rotary degree-of-freedom. The actuator to drive this DOF is located either on top of the positioning rails or is contained within the virtual device panel housing, giving rise to a remotely driven DOF. FIG. 2 also shows two example virtual devices displayed on the virtual device panel - a rotary knob and a slider. Force affects to emulate the feel of a mechanical rotary knob or a slider using the X-DOF and Y-DOF become active when the Z-DOF portion of the haptic device lies within the effect region. For example, in the three DOF case, the X-DOF, Y-DOF and Rotary-DOF become active when the Z-DOF lies over top of the virtual rotary knob. A gravity well effect could be implemented on the X-DOF and Y-DOF to keep the Z-DOF located over the knob. In parallel, the Rotary-DOF can be programmed to emulate a series of detents as the knob rotates. In all cases, the strength and type of effects can be set by the user.

Figure 3 illustrates another embodiment of the haptic device according to the invention, which is located externally to the virtual device panel. In this embodiment, the haptic device is a five bar mechanism with up to three active degrees of freedom (X-DOF, Y-DOF & Rotary DOF) and one active or passive ½

DOF (Z-DOF). The inverse kinematics of the mechanism are embedded into the supervisory controller or a processor/microcontroller dedicated to the haptic device to map from joint coordinates of the haptic device to Cartesian co-ordinates of the virtual device panel. The functionality of the external haptic device and virtual device panel is then similar to that of the previous embodiment of Fig. 2.

Audio Device

The audio device, which is driven by the supervisory processor, is used in conjunction with the haptic device to provide information to the user regarding active virtual controls/indicators. That is, when a control/indicator is made active, the dashboard system enunciates the label associated with the active control/indicator.

Control/Indicator Library

The control/indicator library includes software objects representing all possible controls and indicators that are available for a given dashboard system. The user accesses the library by using the haptic device in conjunction with the virtual device panel. To configure a dashboard layout, the user selects the desired control/indicator from the library and drags/copies it to the layout screen on the virtual device panel. Each control/indicator has associated properties whereby the user can set the type of effects, size, strength of effects, etc. The library may or may not be resident in the external memory. This library can be updated using the communications network and the wired/wireless modem.

External Memory

According to the invention, an external memory is provided. The external memory can be volatile and/or non-volatile. The control/indicator library can be located in non-volatile external memory to off load supervisory processor memory. The supervisory processor is the only device that is able to store data to the external memory while both the supervisory processor and the virtual device panel are able to read data from the external memory.

Intelligent Real-time Interface

The intelligent real-time Interface includes a processor/microcontroller block, an amplifier array, a vehicle subsystem interface, and a safety/failsafe system. The intelligent real-time interface connects to vehicle subsystems via the vehicle subsystem interface, which facilitates easy access to the sensors and actuators within the vehicle subsystem. The intelligent real time interface can also access sensors/actuators of a vehicle subsystem through the supervisory processor and the ECU.

The interface is sufficiently intelligent to interpret the needs of the connected hardware. For instance, the intelligent real-time interface is able to output either analogue or digital (e.g. Pulse Width Modulated (PWM)) signals to drive the amplifiers for the subsystem. Moreover, it is able to read from a variety of sensor types (i.e. analogue, digital, etc.).

The intelligent real-time interface is configured so as to allow easy insertion or replacement of processors/microcontrollers to make it readily adaptable to the specific needs of an application. The intelligent real-time interface also facilitates the download of software/firmware updates through the wired/wireless modem and communications network.

FIG. 4 illustrates one approach to integrating a control loop for a specific subsystem into the reconfigurable dashboard system. The user positions the haptic device over the top of the slider at which point a gravity effect is enabled thereby keeping the Z-DOF of the haptic device "locked" to the slider knob. As the user moves the haptic device in the Y direction, the slider knob moves and the recorded slider position changes. The slider position is sent to the supervisory controller where it is transformed into a commanded reference signal for use by one of the processors/microcontrollers within the processor/microcontroller block. In this example, the control loop is closed within the processor/microcontroller using embedded linear or non-linear controller C(s). Sensor signals from the vehicle subsystem are read into the processor/microcontroller through the sensor decoder (e.g. quadrature decoder

for encoder signals) and the vehicle subsystem interface. The error between the commanded reference and the sensor signal is used to derive an error signal. The controller C(s) processes the error signal in accordance with the control law to generate an appropriate correction signal. The correction signal is converted into a pulse-width-modulated signal by the pulse width modulator, amplified, and sent to the appropriate actuator in the vehicle subsystem via the vehicle subsystem interface. If the control loop is closed within the vehicle subsystem itself, the commanded reference issued by the supervisory controller would be transformed by the processor/microcontroller, the amplifier, or both to meet the specific input requirements of the vehicle subsystem.

Each component of the intelligent real time interface will be described below in greater detail.

Processor/Microcontroller Block: The processor/microcontroller block includes a series of microcontrollers or other similar processors that are capable of interfacing to and controlling a defined combination of a variety of sensors and actuators, each of which is dedicated to a subsystem within the vehicle. This implementation allows subsystems that require fast and consistent real-time sampling rates to perform at peak performance. Each processor/microcontroller within the intelligent real-time interface is responsible for reading and processing sensor information, calculating control solutions, and driving actuators so as to achieve the desired subsystem response. In addition, the processor/microcontroller allows the implementation of advanced control and operating solutions so as to improve the performance of the associated subsystem.

The processor/microcontroller block connects to the amplifier array, which has one or more amplifiers dedicated to each processor/microcontroller in the block. It also connects to the vehicle subsystem interface to read sensor data from the vehicle subsystem. One or more processors/microcontrollers in the block are dedicated to the safety/failsafe system.

Amplifier Array: In most control systems, control signals issued by the controller need to be amplified to operate the corresponding actuator. The dashboard system contains an amplifier array with one or more amplifiers being dedicated to a corresponding processor/microcontroller. The individual amplifiers provide either an analog output or a digital output (e.g. Pulse Width Modulation (PWM)) to drive the actuation device. The amplifier array is configured so as to allow easy insertion or replacement of amplifiers to maximize versatility and minimise cost.

Vehicle Subsystem Interface: In a vehicle, there exist a number of subsystems consisting of sensors and actuators to be controlled and/or monitored. Such systems include the entertainment centre, lights and wipers. Many of these subsystems are monitored and controlled by the electronic control unit (ECU). The dashboard system has access to a vehicle subsystem either through a direct connection to the subsystem or through an indirect connection via the ECU. In the case of the latter, the subsystem components are reached through the vehicle subsystem interface. Given these options, a vehicle subsystem can be controlled by closing the control loop within the subsystem, by closing the control loop through the ECU or by closing the control loop through the reconfigurable dashboard (Fig. 4). In all cases, the reconfigurable dashboard will be able to control the operation of the subsystem.

Safety/Failsafe System: In the event of a failure of one or more of the vehicle subsystems or the dashboard system itself, the safety/failsafe system contained within the intelligent real-time interface is activated. One or more processors/microcontrollers within the processor/microcontroller block is dedicated to safety/failsafe functions. The safety system continuously monitors sensor/actuator/system health in an effort to retain a safe level of operation. Should an unsafe condition be predicted or detected, the safety processor/microcontroller overrides the dashboard system, sets controls to maximise operational safety, and displays a warning message to alert the driver. The safety system is augmented with a failsafe system that ensures actuators fail in the safest manner possible.

Wired/Wireless Modem

The dashboard system has communication access to the outside world through the wired/wireless modem, which can access the communications network in real time or non real time. The wired/wireless modem can facilitate connection to the Internet, a cellular network or any other reachable wired or wireless network. For example, this connection allows the driver to download mp3's from his home computer to listen to in his car, or to access a library of mp3's on-line, eliminating the need for the driver to carry his music in the form of either compact disks or cassettes.

Communications network

The communications network provides the means for the user to connect to a remote location from the vehicle. This link allows users to download dashboard templates from a vehicle or automobile manufacturer's website, download software and firmware upgrades, download additional control intelligence, or download/upload any other information. The manufacturer can subsequently use download statistics to collect market information regarding user preferences relating to dashboard layouts, colour schemes, etc.

Electronic Control Unit (ECU) Interface

The electronic control unit (ECU) is the brain of the vehicle or automobile. The dashboard system has the means to communicate to the ECU via the ECU Interface to assess the status of auto hardware as well as control the operation of auto hardware, if desired.

Peripheral Interface

The peripheral interface allows the dashboard system to connect to peripheral devices such as laptops, personal data assistants (PDA's), mechanical controls to override virtual controls, system analysers, etc.

A sample application will be described below, using the embodiment of the invention noted above.

Let it be assumed that an automobile manufacturer has just released a new model of a car with a reconfigurable dashboard system. This dashboard system is essentially an LCD panel (virtual device panel) with a haptic device attached so that the driver can feel virtual buttons and knobs. This haptic device is mounted close to the steering column, well within the driver's vision. The haptic device includes a small "mouse", which the driver can grab on to, thereby allowing him or her to "feel" the virtual controls on the virtual device panel. Thus, neither the automobile manufacturer nor the end user are confined to a single dashboard layout with sundry real buttons and knobs for the lighting, environmental, stereo and wiper controls (which are spread out all over the front panel of the vehicle). Instead, different dashboard layouts can be either custom-designed by the end user or a pre-configured layout can be downloaded via the wired/wireless communication means.

Once the new owner is familiar with the reconfigurable dashboard system, then he/she can virtually change the functionality of the entire automobile dashboard. For example, perhaps, when one purchases a vehicle, a factory "skin" or look/functionality of the dashboard is preinstalled. When the car starts, the owner sees four large virtual buttons: "Environmental", "Entertainment", "Wipers", "Lights", "Reprogram". The owner grabs the mouse and moves it to one of the virtual buttons. The owner can actually feel the button even though it appears to be simply a picture of a button on a display. What's more, the owner finds that he or she can turn virtual knobs and push virtual slider controls as if they are real. Optionally, the owner can enable an audio device so that in addition to feeling the active control, the reconfigurable dashboard system can also tell him or her which control is active. Now suppose that the owner presses the "Entertainment" button. A new panel layout geared towards the control of his or her vehicle's entertainment center appears. Virtual sliders, pushbuttons and rotary dials are now available in the blink of an eye that allows the owner to control volume, the tuner, the balance, the equalizer, etc. Once again, these controls appear to be mere images on the virtual device panel but a quick scan over the panel with the haptic device makes the owner realize that each and

every control feels like its mechanical counterpart (the more traditional knob or button).

Now, suppose that a user doesn't like the "look" of the panel. He hits the "Reprogram" button on the main menu and creates his own design from scratch or downloads another design from the car manufacturer's website's on-line library since the reconfigurable dashboard system has a wireless connection to the Internet. On the other hand, his wife complains there are too many controls. She finds that she only ever uses a few of the buttons on each menu item. Thus, she configures the dashboard so that there are only 6 buttons (Heat on full, Lights on, Wipers on full, Volume Control, Radio and CD player) on her virtual device panel. She saves her layout in on-board memory so that she can easily load it the next time she drives the car. Also, being the user with the highest access priority to the reconfigurable dashboard system, she limits the volume of the radio to 95 dB so that her teenage son doesn't damage his hearing when he uses the stereo in the car.

All the while, the manufacturer notes which on-line dashboard configuration is the most popular by analyzing download statistics so that they can target new dashboard layouts. Moreover, the communication network allows them to provide software and firmware updates for the reconfigurable dashboard system. For example, suppose that the manufacturer finds that the wiper settings were not optimal and that the majority of users were adopting other settings. Through the communication network, the manufacturer automatically downloads firmware/software updates to the car, which subsequently automatically updates the processor/microcontroller in the intelligent real-time interface. From the manufacturer's standpoint, they have realized substantial savings due to the removal of failure-prone mechanical devices. Meanwhile the user has greater freedom to change the layout of the dashboard and the feel of the controls to suit his/her preference.

The advantages and benefits of the present invention include the following:

1. The reconfigurable dashboard system of the invention readily integrates into the drive-by-wire concept;

2. The layout of the dashboard system can be selected by the user according to his or her preference. As well, a user is able to download their dashboard preference prior to driving an unfamiliar vehicle, whether it be a new car or a rental;

3. The user can eliminate controls that are often not used to reduce clutter. Reduction of dashboard clutter will also result in safer operation of the vehicle;

4. The user can set the size and feel of each control independently;

5. A number of mechanical systems, which are prone to failure, can be removed thereby reducing cost, increasing reliability and increasing safety;

6. The user can receive updates from the manufacturer through the communication network;

7. The manufacturer can readily add functionality to the dashboard system through firmware and software upgrades;

8. By analysing download statistics, the manufacturer can define the most popular user options thereby increasing customer satisfaction;

9. Each driver can save their dashboard preference and load it when they use the automobile;

10. The reconfigurable dashboard system can be augmented with audio feedback to help the user locate controls;

11. Since the reconfigurable dashboard system is processor-based, intelligent control and operating solutions can easily be embedded;

12. A master user can restrict or control other users' access to subsystem functionality; and

13. Given embedded engine/subsystem health monitoring functionality, verbose descriptions of potential problems associated with automotive subsystems can be displayed to the user. This effectively replaces the "Service Engine Soon" indicator on the instrument panel.

Other Applications

Even though the descriptions contained herein relate to a reconfigurable dashboard, there are a number of other uses of this technology, in whole or in part, including but not limited to personal data assistants (PDA's), home appliances, industrial automation, or any other man-machine interface.

While the present invention has been described with reference to specific embodiments, the description is illustrative of the invention and is not to be construed as limiting the invention. Various modifications may occur to those skilled in the art without departing from the true spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A reconfigurable dashboard system for controlling and monitoring a plurality of automobile hardware and equipment in a vehicle, the dashboard system comprising:

(a) a computer processor for controlling and coordinating the entire reconfigurable dashboard system;

(b) a virtual device panel for displaying a plurality of virtual controls and/or instruments in the vehicle;

(c) a haptic device for interfacing with the virtual devices on the virtual device panel using haptic feedback;

(d) an intelligent real-time interface having a series of microcontrollers and processors for interfacing to and controlling a defined combination of sensors and actuators, which are dedicated to the plurality of automobile hardware and equipment in the vehicle; and

(e) a plurality of sensors, allocated to the plurality of automobile hardware and equipment, for being interfaced to the intelligent real-time interface.

2. A reconfigurable dashboard system according to claim 1, further comprising an amplifier array, each amplifier being dedicated to a corresponding processor, for amplifying the signal from the processor/microcontroller output signals to actuate subsystem components.

3. A reconfigurable dashboard system according to claim 2, wherein the amplifier array is configured so as to allow easy insertion or replacement of the amplifiers.

4. A reconfigurable dashboard system according to claim 1, further comprising a wired or wireless modem for communicating through a communication network.

5. A reconfigurable dashboard system according to claim 1, further comprising a peripheral interface to facilitate the connection of peripheral devices such as laptops, personal data assistants (PDA's), mechanical controls to override virtual controls, system analysers, etc.

6. A reconfigurable dashboard system according to claim 1, further comprising a safety and failsafe system connected to the intelligent real-time interface.

7. A reconfigurable dashboard system according to claim 1, wherein the computer processor includes a microcontroller, a microprocessor, a digital signal processor, or an application specific integrated circuit (ASIC).

8. A reconfigurable dashboard system according to claim 1, wherein the virtual device panel is configured to change the layout and operation of devices and/or instruments.

9. A reconfigurable dashboard system according to claim 1, wherein the intelligent real-time interface is configured to allow insertion or replacement of processors.

10. A reconfigurable dashboard system according to claim 1, wherein the haptic device is integrated into the virtual device panel or is located external to the virtual device panel.

11. A reconfigurable dashboard system according to claim 1, wherein the haptic device possesses one or more degrees of freedom.

12. A reconfigurable dashboard system according to claim 1, wherein an audio device is provided to indicate to the user which virtual device is active.

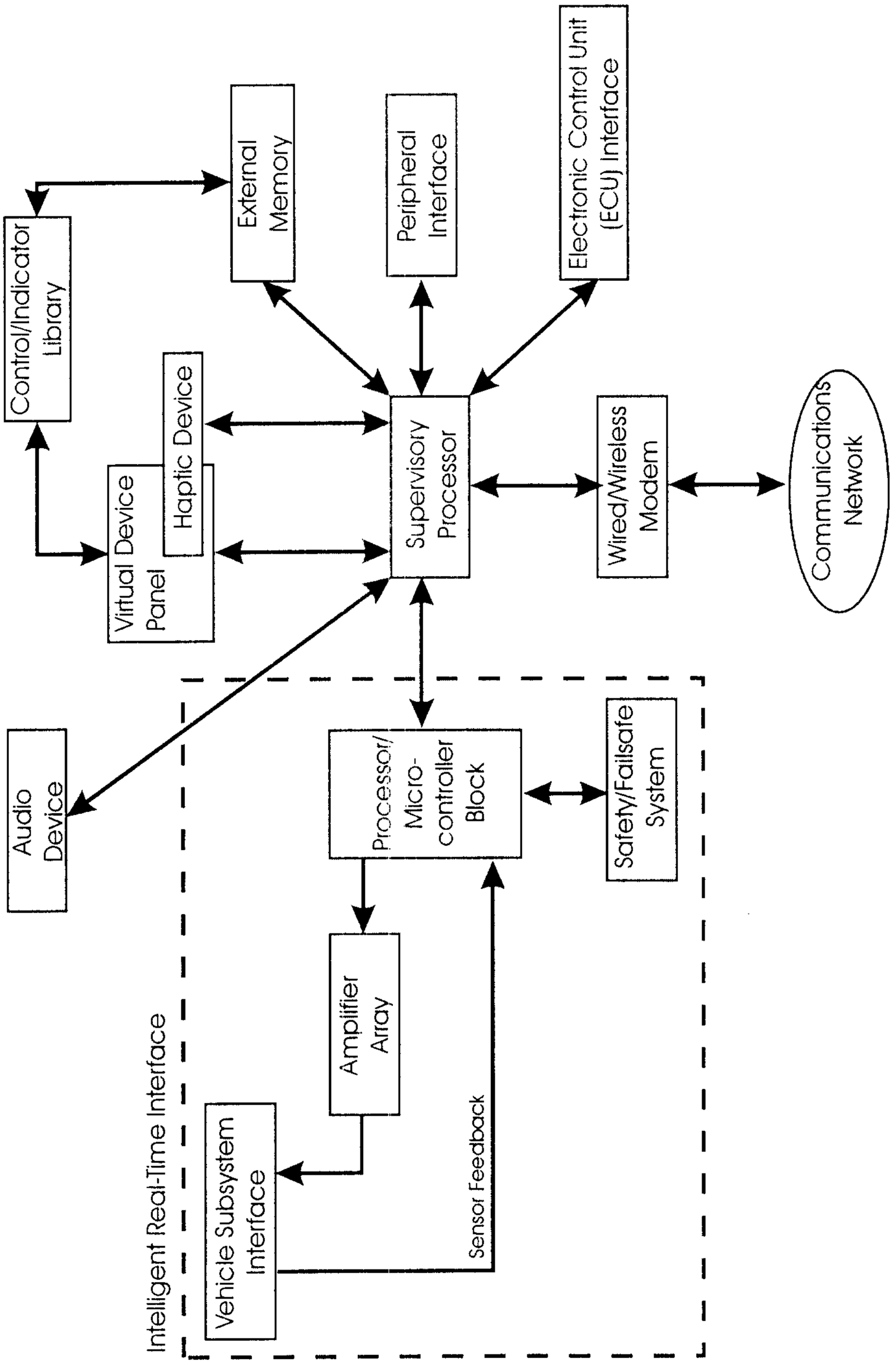

Control/Indicator Library
External Memory
Peripheral Interface
Electronic Control Unit (ECU) Interface
Haptic Device
Virtual Device Panel
Supervisory Processor
Wired/Wireless Modem
Communications Network
Audio Device
Processor/ Micro-controller Block
Safety/Failsafe System
Amplifier Array
Vehicle Subsystem Interface
Sensor Feedback
Intelligent Real-Time Interface

Fig. 1

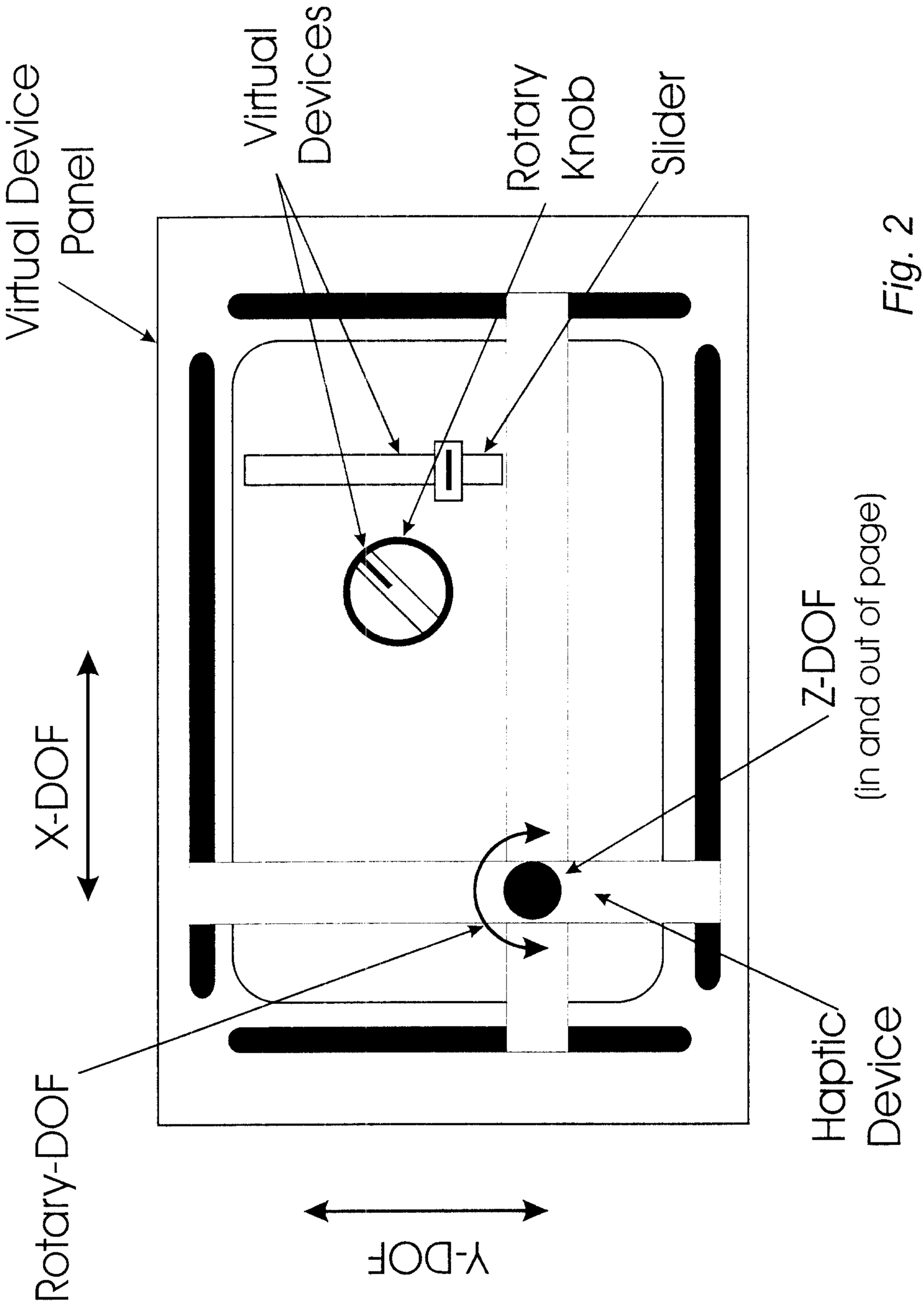

Virtual Device Panel
Virtual Devices
Rotary Knob
Slider
Z-DOF
(in and out of page)
Haptic Device
X-DOF
Rotary-DOF
Y-DOF

Fig. 2

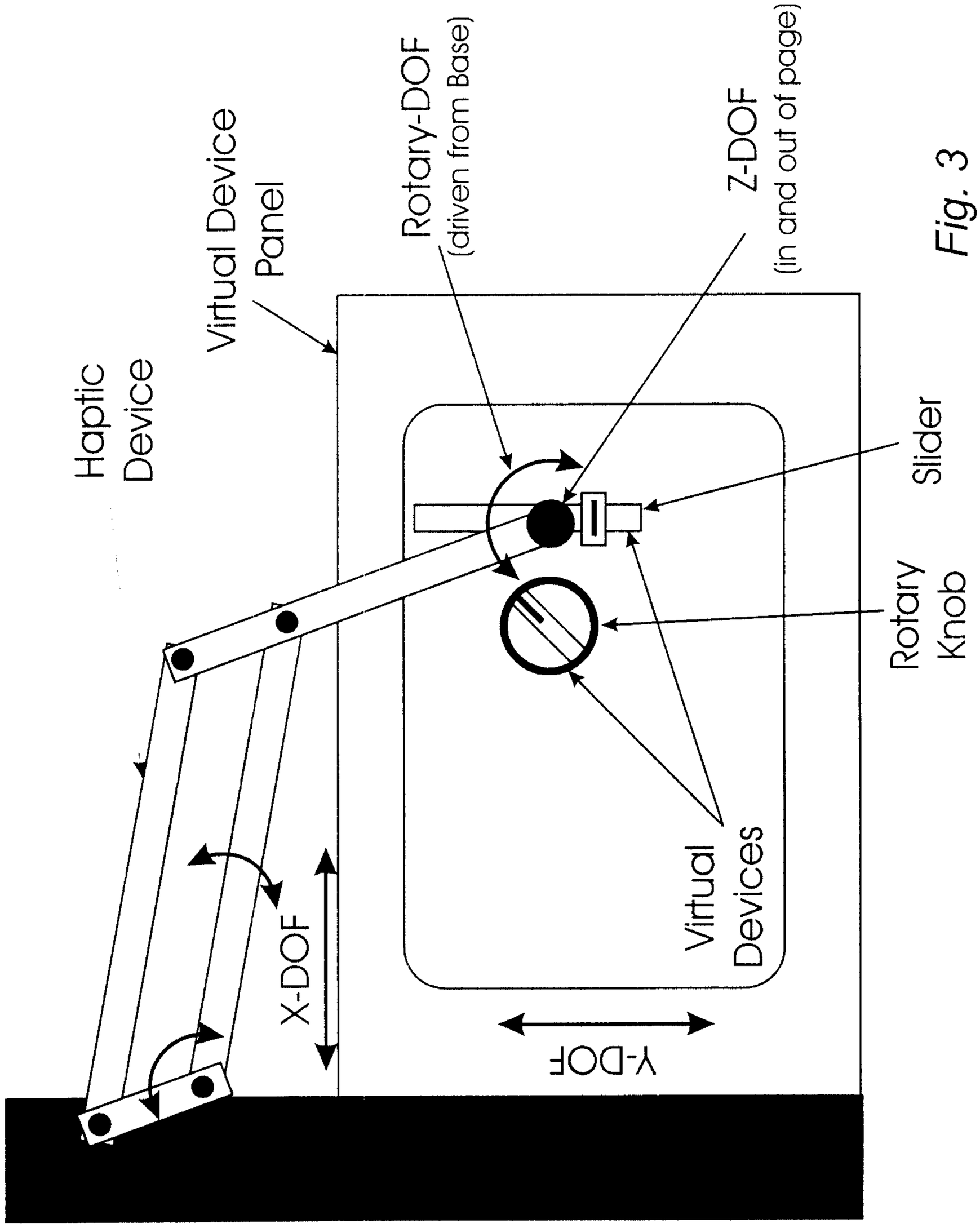

Haptic Device
Virtual Device Panel
Rotary-DOF (driven from Base)
Z-DOF (in and out of page)
Slider
Rotary Knob
Virtual Devices
X-DOF
Y-DOF

Fig. 3

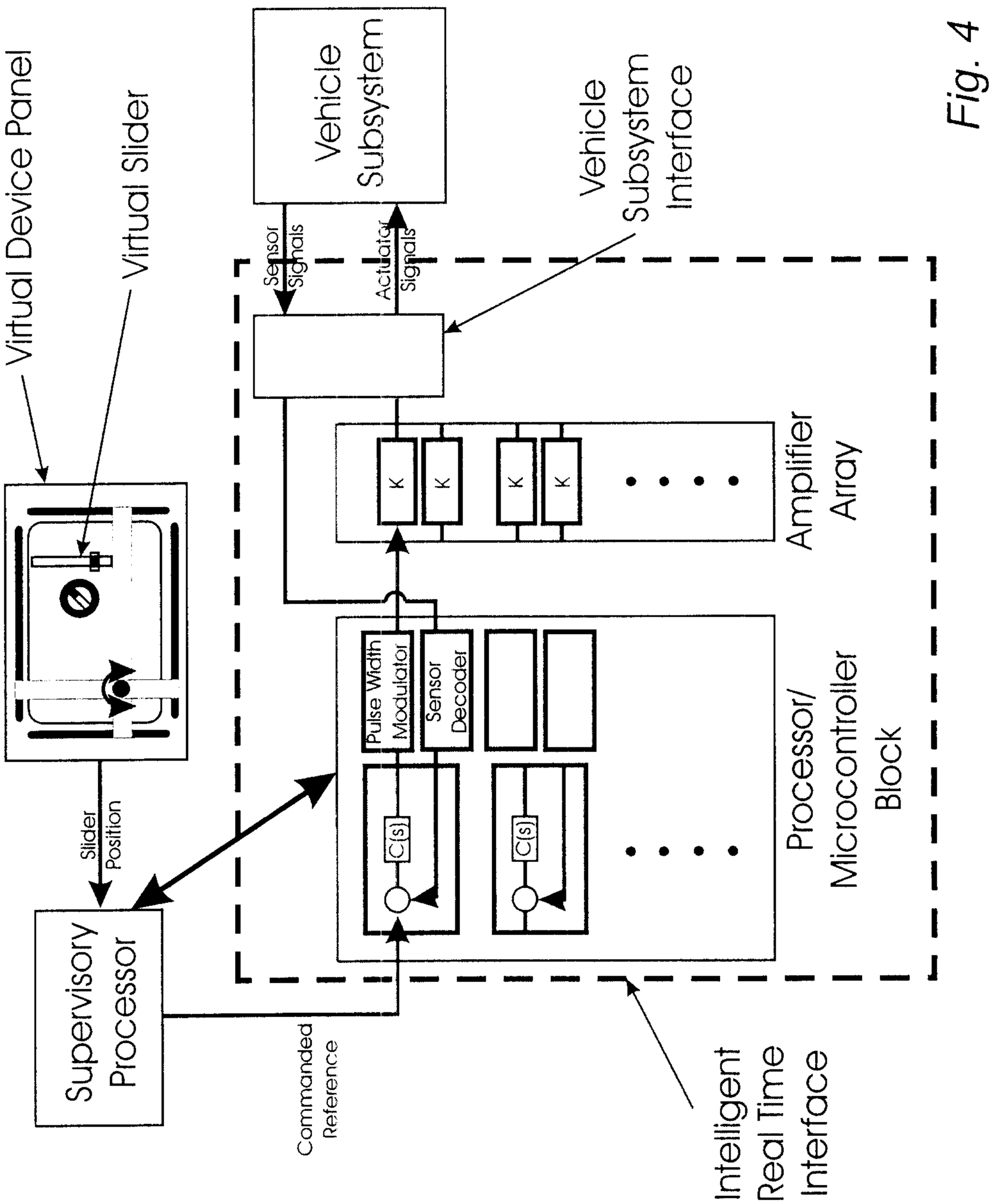
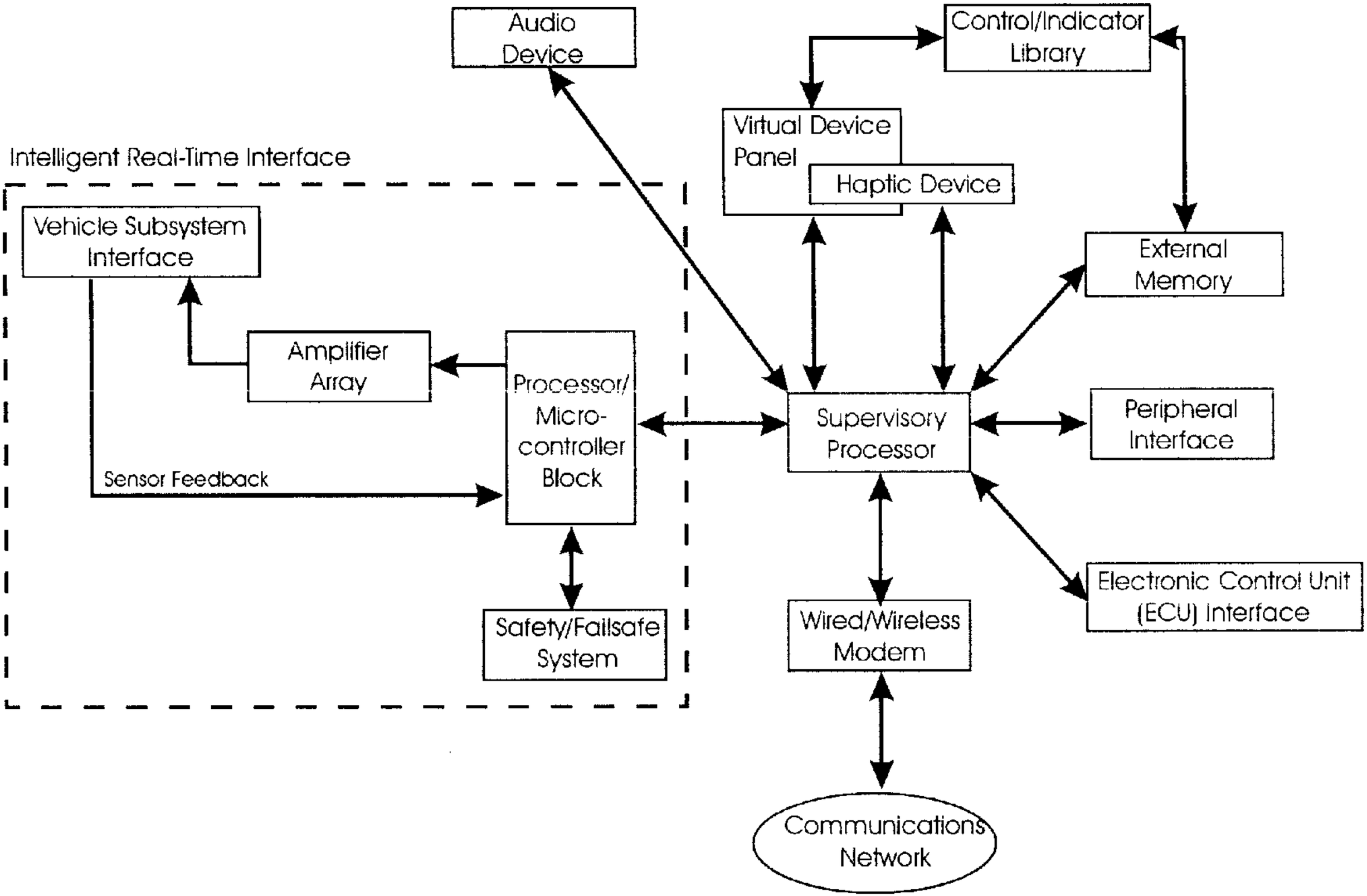

Virtual Device Panel
Virtual Slider
Vehicle Subsystem
Sensor Signals
Actuator Signals
Vehicle Subsystem Interface
K
K
K
K
Amplifier Array
Pulse Width Modulator
Sensor Decoder
C(s)
C(s)
Processor/ Microcontroller Block
Slider Position
Supervisory Processor
Commanded Reference
Intelligent Real Time Interface

Fig. 4


Audio Device
Control/Indicator Library
Virtual Device Panel
Haptic Device
Intelligent Real-Time Interface
Vehicle Subsystem Interface
External Memory
Amplifier Array
Processor/ Micro-controller Block
Supervisory Processor
Peripheral Interface
Sensor Feedback
Safety/Failsafe System
Wired/Wireless Modem
Electronic Control Unit (ECU) Interface
Communications Network