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(54) **HAND-HELD COMPUTER INTERACTIVE DEVICE**

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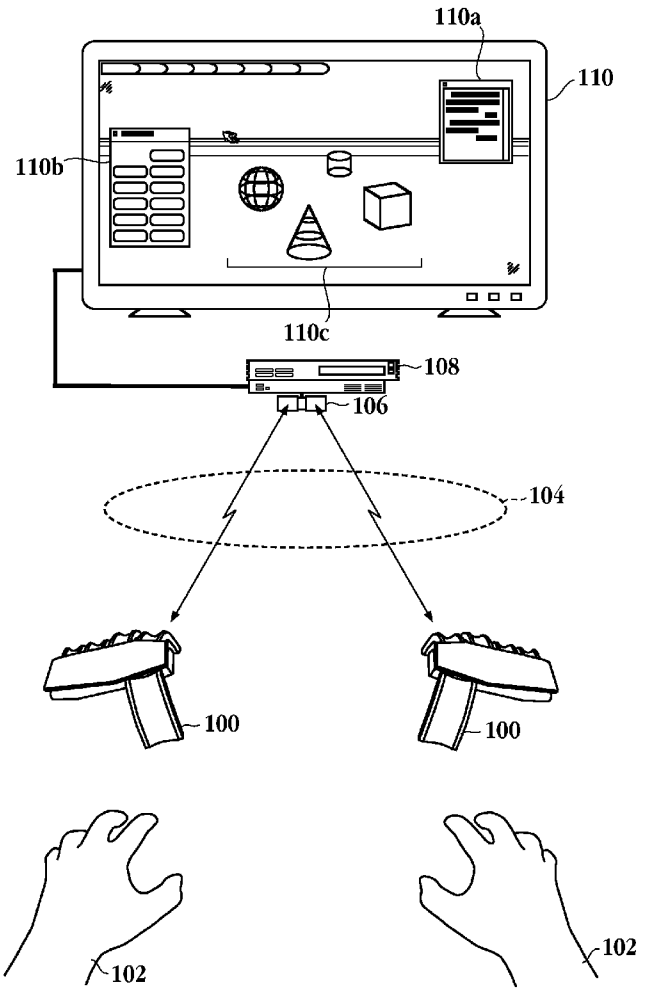
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(57) **ABSTRACT**

A computer game input device for interfacing with a computing device is provided. The input device includes a central body, and a circuit configured for detecting interaction from the input device and for communicating with a computing device. The input device also includes a plurality of protrusions extending from the central body. The plurality of protrusions are configured for movement relative to the central body, and the input device is to be held by a user's hand as opposed to being worn on the user's hand like a glove. The circuit is configured for transmitting signals to the computing device to cause interfacing with one or more features of a program executed on the computing device, based on the detected movements of the protrusions.



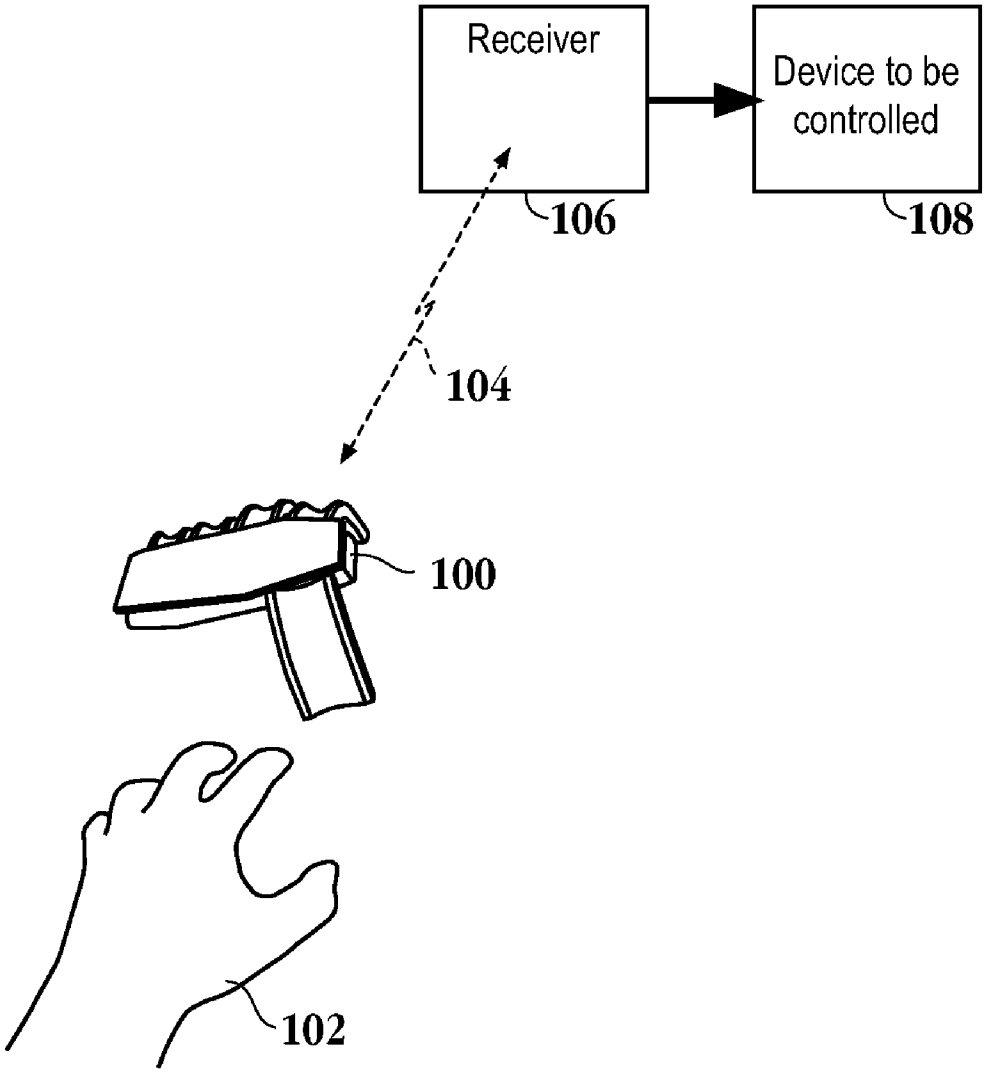


Fig. 1

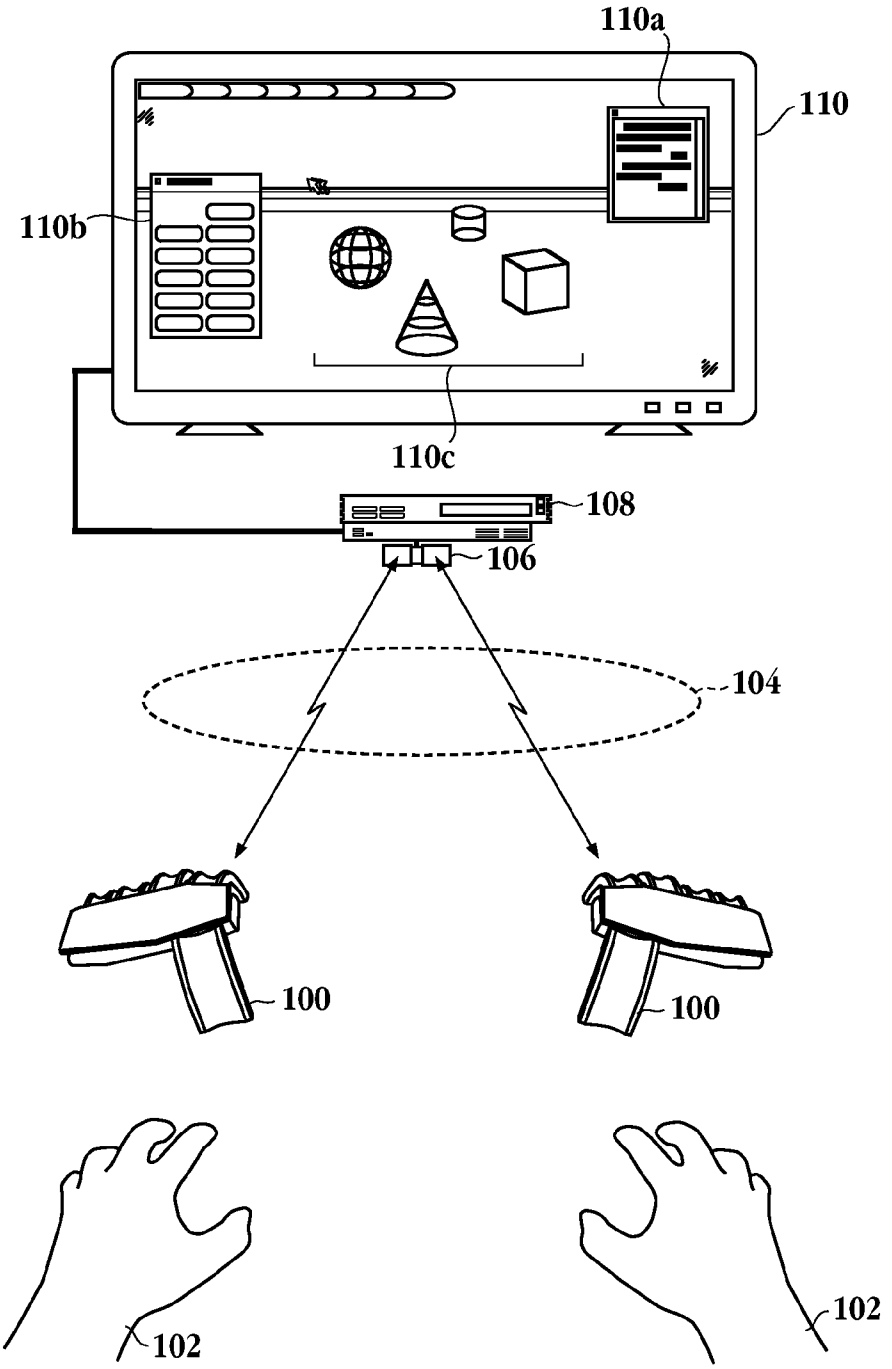


Fig. 2

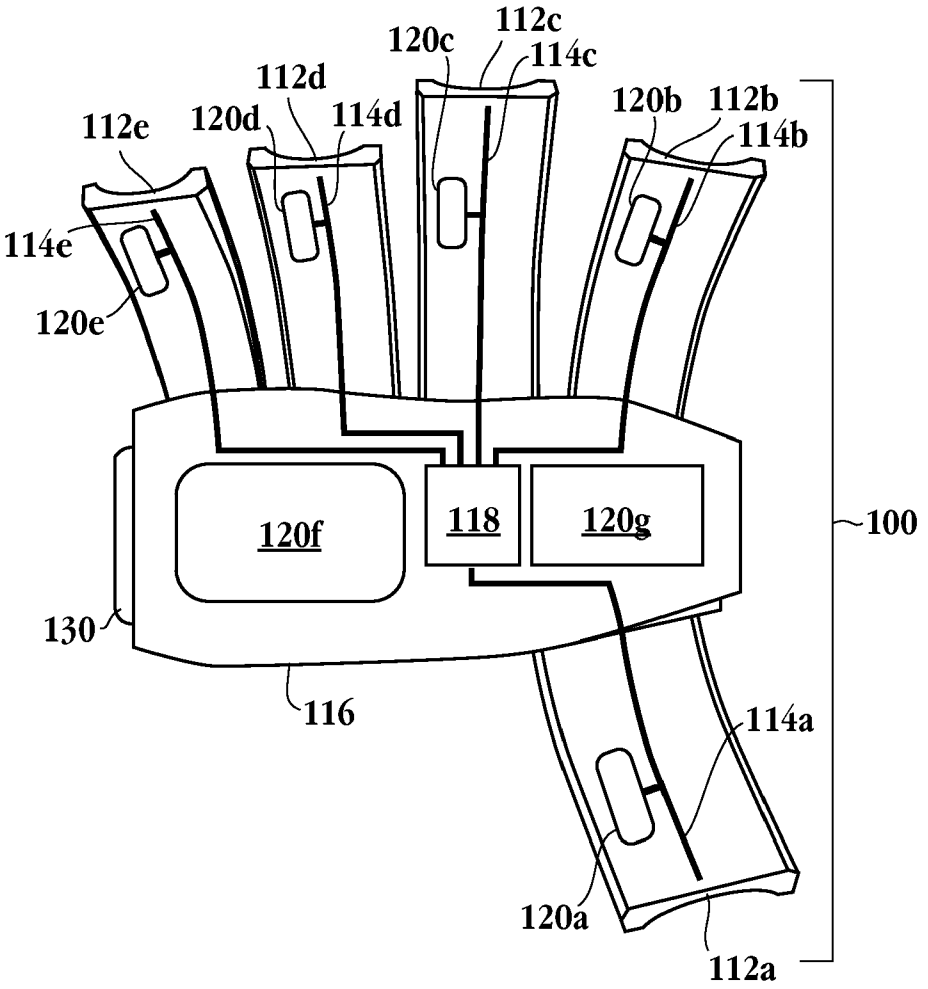

112c
120c
114c
112d
120b
112b
112e
120d
114d
114b
114e
120e
120f
118
120g
100
130
116
114a
120a
112a

Fig. 3

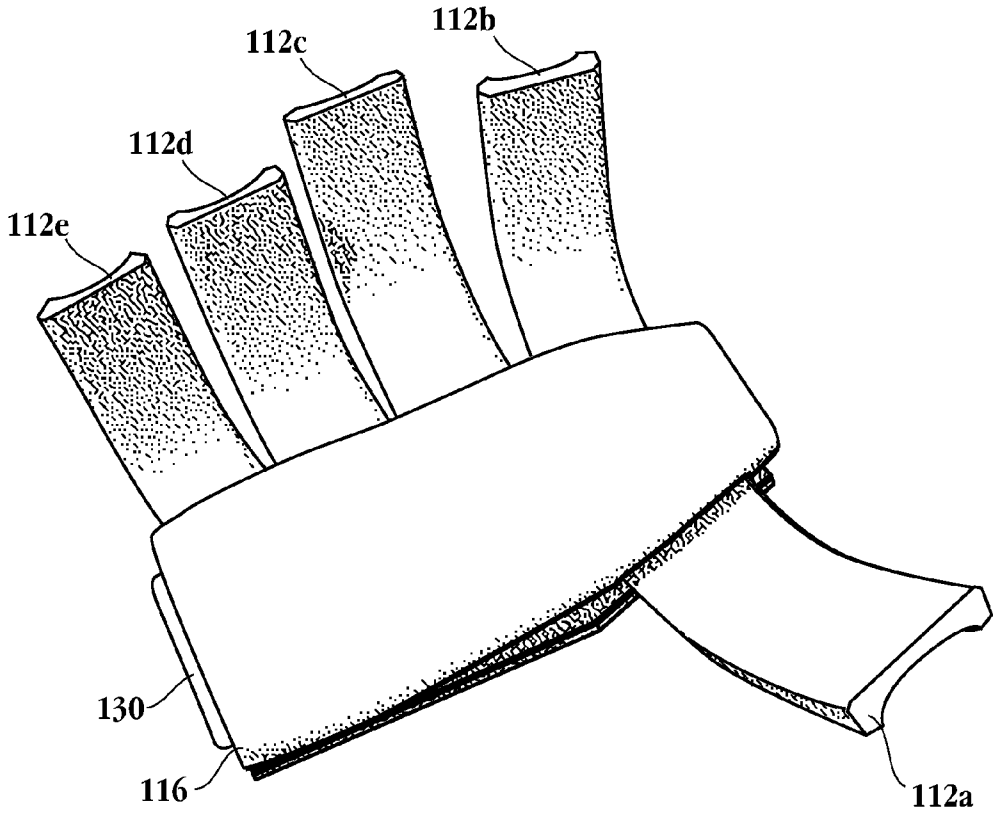


Fig. 4

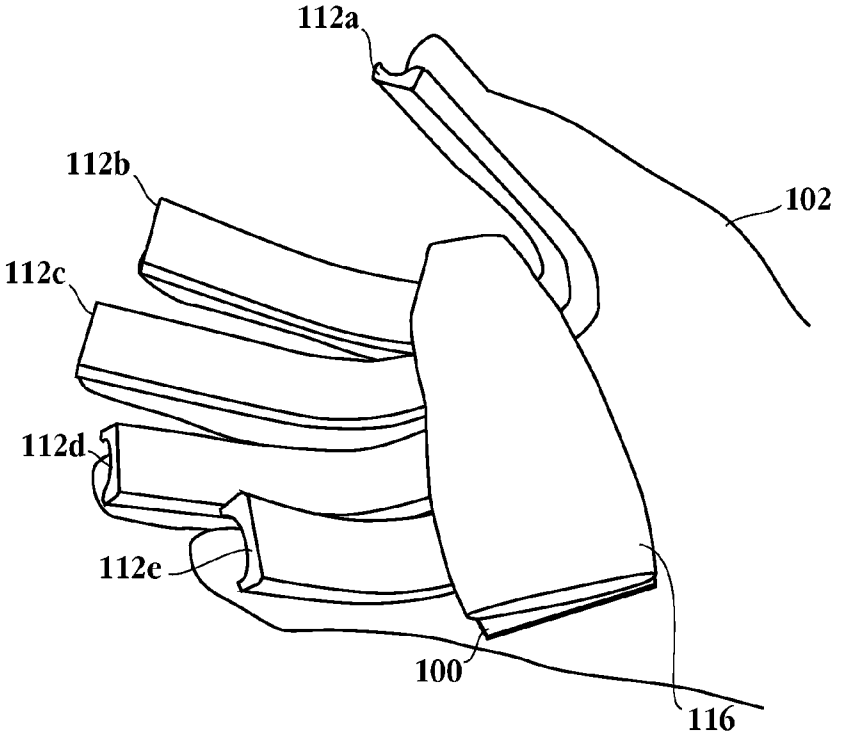

112a
112b
102
112c
112d
112e
100
116

Fig. 5A

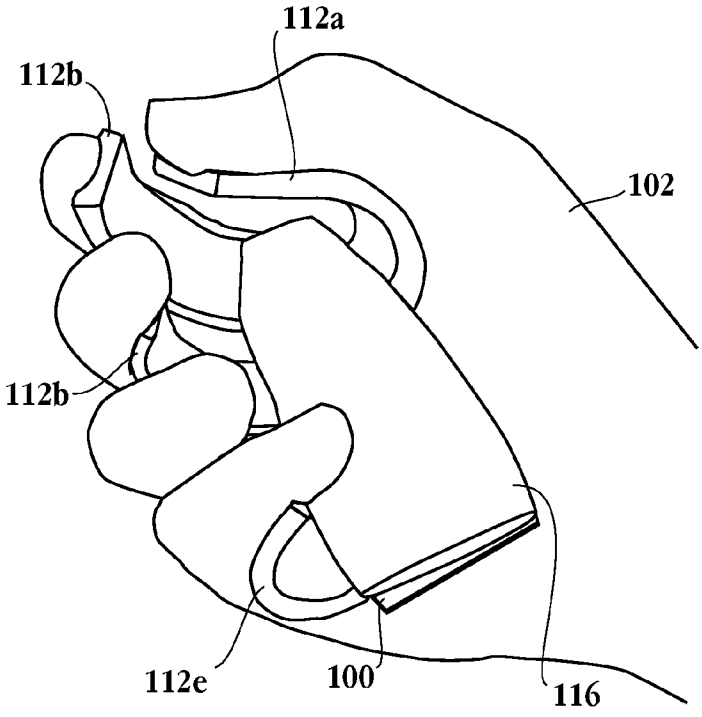

112a
112b
102
112b
112e
100
116

Fig. 5B

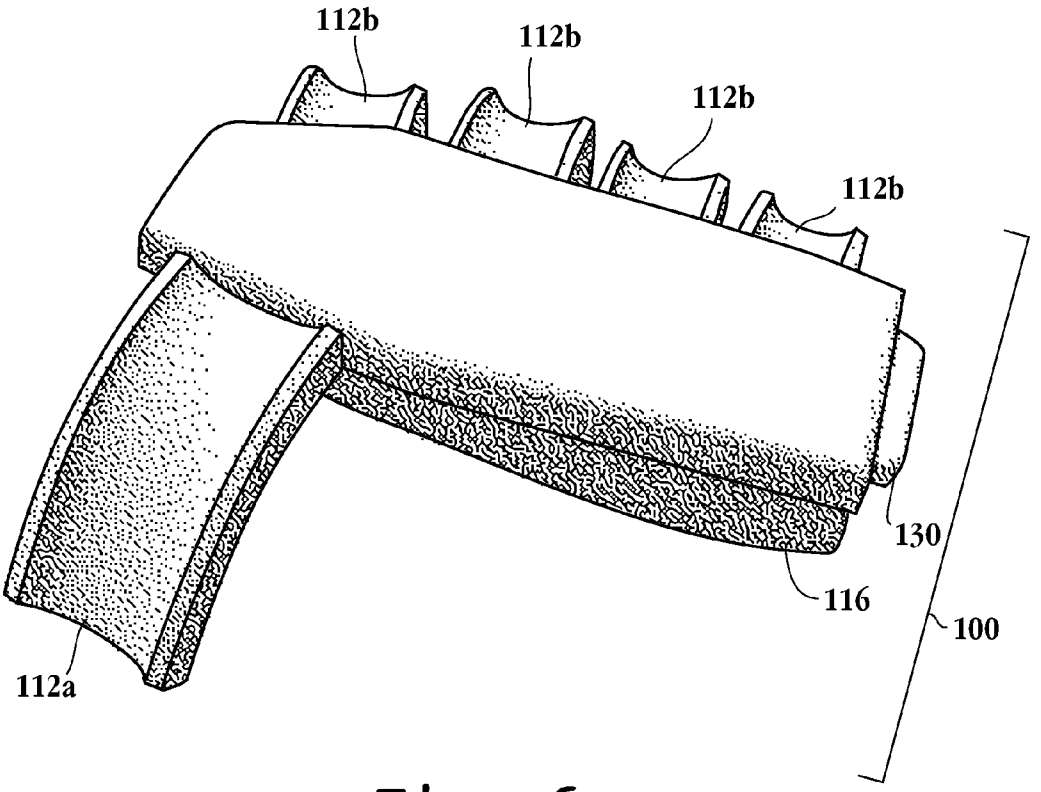


Fig. 6

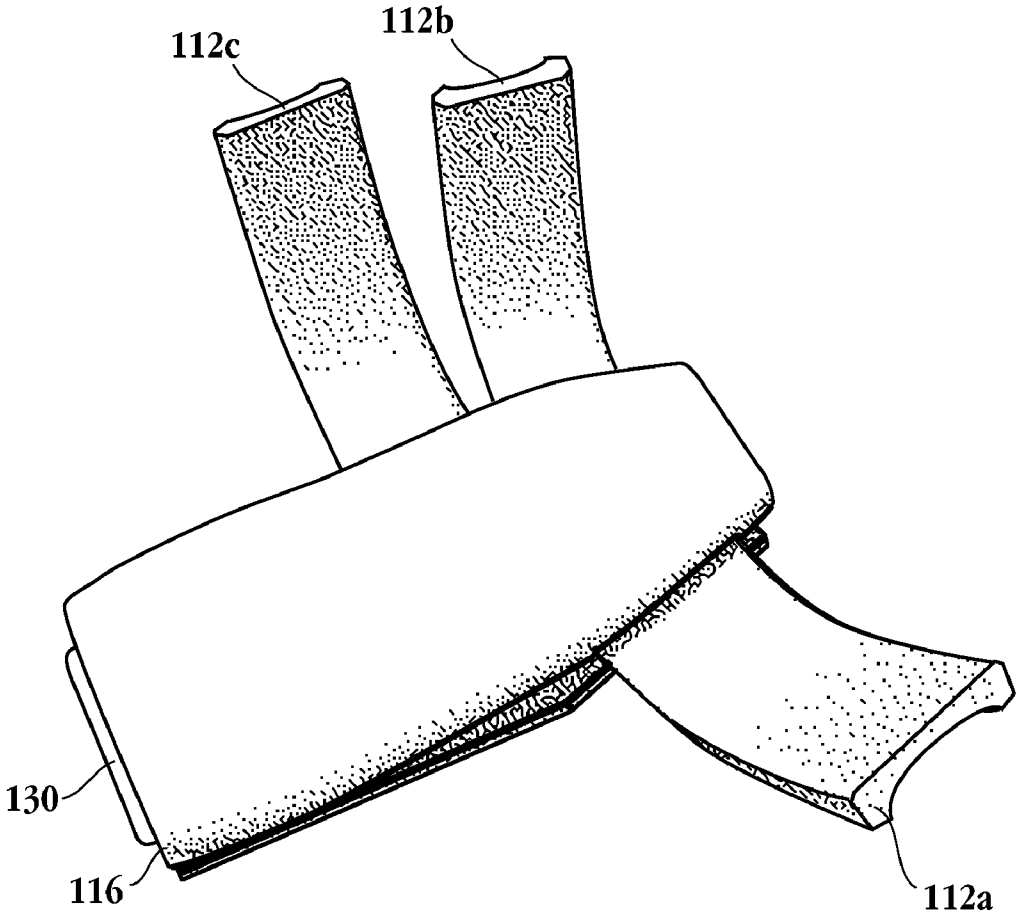


Fig. 7

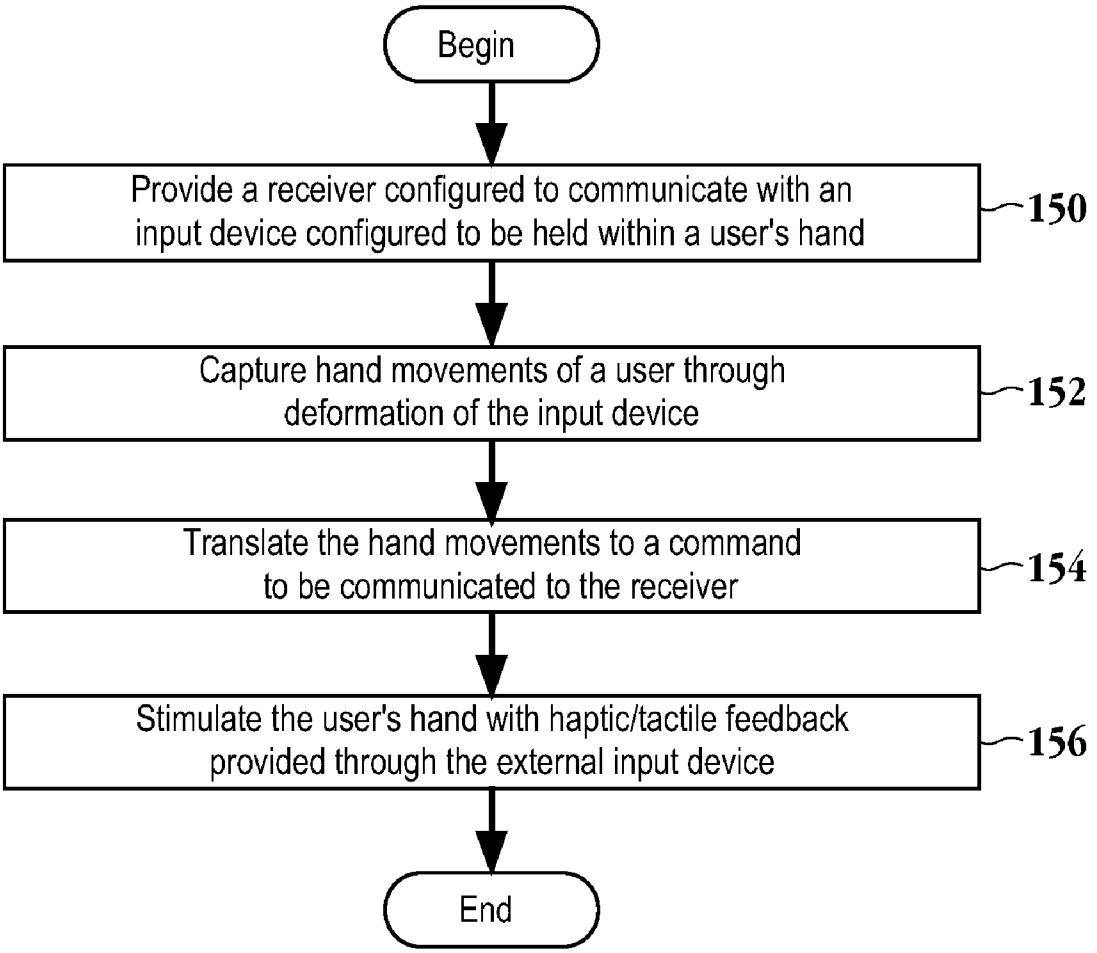

Begin
Provide a receiver configured to communicate with an input device configured to be held within a user's hand
150
Capture hand movements of a user through deformation of the input device
152
Translate the hand movements to a command to be communicated to the receiver
154
Stimulate the user's hand with haptic/tactile feedback provided through the external input device
156
End

Fig. 8

HAND-HELD COMPUTER INTERACTIVE DEVICE

CLAIM OF PRIORITY

[0001] This application is a continuation of co-pending U.S. patent application Ser. No. 11/607,209, filed on Nov. 30, 2006, which was a continuation of U.S. patent application Ser. No. 10/290,789, filed Nov. 7, 2002, now U.S. Pat. No. 7,161,579, and claims priority from U.S. Provisional Patent Application No. 60/397,092 filed Jul. 18, 2002. The disclosure of each of these applications is incorporated herein by reference for all purposes.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] This invention relates generally to input devices for computer systems, and more particularly to an input device that is held by a user.

[0004] 2. Description of the Related Art

[0005] There has been a trend to transition the personal computer from a work environment to an entertainment environment. As part of the trend, alternative input devices are being evaluated. The alternative input devices are geared toward a "living room interface" focusing more on entertainment rather than a work environment. For example, gloves that capture hand motions have been evaluated for virtual reality, telerobotics, medicine, video games, music generation, etc. applications.

[0006] One of the shortcomings with the gloves is that manufacturers are finding that consumers do not like to wear a glove for entertainment applications. The gloves require the user to constantly remove the gloves and put the gloves back on, especially if the user is moving between multiple applications. For example, where the user may have to perform typing or some other function requiring a sense of feeling in the hands, consumers tend to remove the gloves. In addition, the data glove hinders the movement of the hand and has substantial weight. Thus, gloves have not been embraced by users for entertainment applications.

[0007] Another solution being offered as an alternative input device is computer vision systems. However, computer vision systems are limited in their applications for the entertainment environment. Computer vision systems do not provide for tactile feedback and are limited by lighting conditions. Furthermore, computer vision systems have the problem of "address", i.e., the question of whether the gesture is intended for the computer. Also, parameters are inferred and hence are potentially inaccurate. In addition, the input device must be within view of a camera. Still another disadvantage of computer vision systems is that some gestures are self-occluding and are difficult to interpret.

[0008] Thus, there is a need to solve the problems of the prior art to provide an input device convenient for a user to use that provides tactile/haptic feedback and does not have to be worn by a user.

SUMMARY OF THE INVENTION

[0009] Broadly speaking, the present invention fills these needs by providing an input device configured to be held by a user. It should be appreciated that the present invention can be implemented in numerous ways, including as an apparatus, a method, a process, a system, program instructions or a device. Several inventive embodiments of the present invention are described below.

[0010] In one embodiment, a computer game input device for interfacing with a computing device is provided. The input device includes a central body, and a circuit configured for detecting interaction from the input device and for communicating with a computing device. The input device also includes a plurality of protrusions extending from the central body. The plurality of protrusions are configured for movement relative to the central body, and the input device is to be held by a user's hand as opposed to being worn on the user's hand like a glove. The circuit is configured for transmitting signals to the computing device to cause interfacing with one or more features of a program executed on the computing device, based on the detected movements of the protrusions.

[0011] In another embodiment, an input detection program executed at a computing device is provided. The input detection program includes program instructions for determining when to trigger input commands of a main program and tactile feedback responses to an external input device configured to be held by a user. The input detection program includes program instructions for detecting a signal from the external input device. The signal is generated by causing a physical change to the external input device. Program instructions for triggering an input command at the program run on the computing device are provided. The triggering results from the detected signal from the external input object. In one embodiment program instructions for generating a tactile feedback signal at the external input device in response to the detected signal are provided.

[0012] In yet another embodiment, a computing system enabling tactile feedback to a user is provided. The computing system includes a computing unit. The computing unit includes circuitry configured to receive and transmit commands. A display monitor in communication with the computing unit is included. An input device configured to be held in a user's hand is included. The input device is enabled to provide tactile feedback to a user in response to hand movements of the user.

[0013] In still yet another embodiment, a computing system is provided. The computing system includes a computing unit. The computing unit includes circuitry configured to receive and transmit commands. A display monitor in communication with the computing unit is included. A hand-held input device is provided. The input device is enabled to manipulate objects displayed on the display monitor.

[0014] In another embodiment, a computing system capable of providing vibrational feedback to a user is provided. The computing system includes means for capturing hand movements of a user through an external input device configured to be held by the user. Means for transmitting the captured hand movements to a computing device and means for transmitting commands to the external input device in response to the transmitted hand movements of the user are included. Means for providing tactile feedback to the user in response to the transmitted commands to the external input device are provided. Means for displaying graphic images associated with the commands received from the external input device are included.

[0015] In yet another embodiment, a method for communicating commands to a computer system from an external input device is provided. The method initiates with providing a receiver configured to communicate with an external input

device configured to be held by a user. Then, hand movements of the user are captured through the deformation of the external input device. Next, the hand movements are translated to a command to be communicated to the receiver for causing input control at the receiver.

[0016] In still yet another embodiment, a method for communicating commands to a computer system from a handheld input device is provided. The method initiates with providing a game console having a receiver configured to communicate with a handheld input device. Then, hand movements of a user are captured through the deformation of the input device by a user's hand. Next, the hand movements are translated to a command to be communicated to the receiver. Then, in response to the command being communicated to the receiver, the user's hand is stimulated with tactile feedback provided through the input device. The user's hand is stimulated by controlling a hardness and a pattern of a vibration applied to the user's hand.

[0017] In another embodiment, computer program instructions for managing computer input commands are provided. The computer program instructions are embodied in a computer readable media. The computer program instructions include program instructions for capturing hand movements applied to a wireless hand-held input device. Program instructions for receiving specific commands associated with the captured hand movements are included. Program instructions for applying the specific commands to a program being directed by the hand-held input device are provided also.

[0018] In yet another embodiment, an input device is provided. The input device includes a central body and at least one protrusion extending from the central body. The central body and the at least one protrusion are configured to capture a user's finger movements. A response and communications system is disposed within the input device.

[0019] In still yet another embodiment, an input device is provided. The input device includes a central body. At least one protrusion extending from the central body is included. The central body and the at least one protrusion are configured to capture a user's hand movements. A communications system incorporated with the central body enables communication between the input device and a computing device.

[0020] Other aspects and advantages of the invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] The invention, together with further advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawings in which:

[0022] FIG. **1** is a simplified schematic diagram of the external input device configured to be held by a user to provide input to a receiver in accordance with one embodiment of the invention.

[0023] FIG. **2** is a simplified schematic diagram of a pair of input devices configured to communicate with a computing device in communication with a display monitor in accordance with one embodiment of the invention.

[0024] FIG. **3** is a bottom view of the external input device illustrating the embedded electronics in accordance with one embodiment of the invention.

[0025] FIG. **4** is a bottom perspective view of the input device in an open position in accordance with one embodiment of the invention.

[0026] FIG. **5**A is a schematic diagram of the input device being held by a user while the input device is in an open position in accordance with one embodiment of the invention.

[0027] FIG. **5**B is a schematic diagram of the input device being held by a user while the input device is in a closed position in accordance with one embodiment of the invention.

[0028] FIG. **6** is a top perspective view of an input device in accordance with one embodiment of the invention.

[0029] FIG. **7** is a bottom perspective view of an alternative embodiment of the input device of FIG. **4**.

[0030] FIG. **8** is a flowchart diagram of the method operations of method for communicating commands to a computer system from an external input device in accordance with one embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] An invention is disclosed for an input device that is held by a user and provides tactile feedback to a user to simulate a hand-based activity. In the following description, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be apparent, however, to one skilled in the art that the present invention may be practiced without some or all of these specific details. In other instances, well known process steps have not been described in detail in order not to unnecessarily obscure the present invention.

[0032] The embodiments of the present invention provide a user input device that is held by a user, as opposed to being worn like a glove. The disclosed device is designed to capture data regarding a user's hand movements. As used herein, hand movements include finger movements, e.g., bending of fingers and thumbs, flexing of fingers and thumbs, etc. Hand movements also includes the movement of the whole hand by the arm. Thus, the input device may be used to capture finger and thumb movements and at the same time a computing device can track the hand movements through space so that a click and drag operation can be accomplished with the input device as described in more detail below. The captured data is in the form of digital data, which allows the input device to be used as an interactive device with a computer program. The movement of particular fingers is thus transferred to particular protrusions of the input device. These movements are translated and then transferred to a computing system to initiate a command, respond to a query, provide a command, maneuver objects in an interactive video game, etc. In addition, the input device provides vibrational feedback to the user so that the user can experience a sense of touch associated with the commands being transferred to the computing system.

[0033] FIG. **1** is a simplified schematic diagram of the external input device configured to be held by a user to provide input to a receiver in accordance with one embodiment of the invention. External input device **100** is configured to be held within the palm of a user's hand **102**. As the user squeezes and relaxes the pressure applied on the protrusions of input device **100**, through pressure applied by the user's fingers and thumb, electronics embedded in the input device sense the change in position of the protrusions and generate commands transmitted to receiver **106**. Receiver **106** is in communication with device **108** which is controlled by the

signals transmitted to the receiver from input device **100**. In one embodiment device **108** can be a computer, or a game console which can be manufactured by any company. For purposes of example, the game console may be a PLAYSTATION™ game console. It will be apparent to one skilled in the art that the embedded electronics may generate short range radio signals. These signals can be processed in accordance with public or proprietary processing circuitry and/or software. For exemplary purposes, communication of the radio signals can be done using standards such as BLUETOOTH, or other suitable wireless technology (e.g., such as IEEE 802.11). While it is preferred to employ a technology not requiring a line of sight, the embodiments described herein can also be applied to technologies requiring a line of sight such as infrared signals.

[0034] FIG. **2** is a simplified schematic diagram of a pair of input devices configured to communicate with a computing device in communication with a display monitor in accordance with one embodiment of the invention. External input devices **100** are configured to fit within the palm of each of a user's hands **102**. As shown, each of input devices **100** is enabled to communicate with computing device **108** through receiver **106**. While receiver **106** is shown outside of the frame of computing device **108**, it should be appreciated that the receiver can be integrated into the computing device in one embodiment of the invention. Input device **100** transmits and receives signals through a response and communication system embedded within the input device in one embodiment. Computing device **108** is in communication with display monitor **110**. Computing device **108** transmits digital data to display monitor **110** so that the digital data can be viewed. Display monitor **110** may display text **110***a*, menu **110***b* and/or graphics **110***c*. In one embodiment, where computing device **108** is a game console, display monitor **110** displays graphics or a user interface associated with a game being played.

[0035] Each of input devices **100**, of FIG. **2**, is configured to generate commands **104** in response to a user's hand movements. Commands **104** are captured by computing device **108** through receiver **106**. The captured data is in the form of digital data, which enables input devices **100** to be used as an interactive device with a computer program. The movement of a particular finger or fingers is thus transferred to particular protrusions of input device **100**. As noted above, these movements are then transferred to computing device **108** to initiate a command, respond to a query, maneuver objects in an interactive video game, etc. It should be appreciated that input devices **100** are configured to fit comfortably within a user's hand. Thus, different sizes can be made available based upon a user's age, gender, etc. Additionally, input devices **100** are configured to remain in a user's hand even if the user is holding his hands in a typing position. That is the natural bend of the user's fingers will support the input device in order to prevent the input device form falling out of the user's hand. Of course, finger straps, such as VELCRO straps, may be incorporated to secure the input device to the user's hand in one embodiment of the invention. The material of the protrusions is selected such that, the material does not easily slide off of the fingers while a user is holding the input device. It should be appreciated that some of the embodiments described herein include a device that fits completely within a user's hand, without the need to be attached to the user's hand or wrapped around the user's fingers or even worn by a user such as a glove.

[0036] FIG. **3** is a bottom view of the external input device illustrating the embedded electronics in accordance with one embodiment of the invention. External input device **100** is composed of central body **116** and protrusions **112***a*-**112***e*. Protrusions **112***a*-**112***e* may also be referred to as legs. Each of protrusions **112***a*-**112***e* are available for each finger and thumb of a user's hand. Protrusions **112***a*-**112***e* are configured to bend as each respective finger or thumb bends. In essence, the configuration of external input device **100** is analogous to a spider, where protrusions **112***a*-**112***e* are the legs in one embodiment. Central body **116** is configured to rest in the palm area of a user's hand. Additionally, central body **116** includes electronics for translating finger and thumb movements and provides an anchor point for each of protrusions **112***a*-**112***e*. Of course, the electronics for translating finger and thumb movements may be disposed anywhere within input device **100** or even attached to the input device. In one embodiment, transmitter/receiver **118** contains circuitry for transmitting signals to a computing device, such as device **108** of FIG. **2**. Transmitter/receiver **118** also contains circuitry for receiving signals from an external device, such as computing device **108** of FIG. **2**.

[0037] External input device **100** of FIG. **3** is enabled to provide low latency tactile/haptic feedback to the fingers, thumb and palm of a user's hand through vibrators **120***a*-**120***g* positioned within the external input device. In one embodiment, the haptic/tactile feedback is provided through a TOUCHENGINE™ tactile/haptic interface component consisting of an actuator and controlling unit. Of course, any tactile/haptic interface component, either manufactured especially for the present embodiment, or one that can be engineered from outside supplier hardware and/or software may be used. In another embodiment, each protrusion **112***a*-**112***e* and central body **116** include at least one vibrator for providing low latency haptic/tactile feedback. Each protrusion is enabled to measure pressure at: (a) the fingertip, (b) calculate the flex of the finger, and (c) stimulate the finger with patterned vibrations. The surface of the protrusion that contacts the user's hand is, in one embodiment, rubberized to give the user a secure and comfortable grip. In yet another embodiment, the number of protrusions can be varied so that, for example, only the thumb and first two fingers are sensed and the user could grip the bottom part of the input device with the remaining two fingers. It should be appreciated that since the hand makes up a large part of expressive ability, it is well suited to communicate information to a computing device. It should be appreciated that the protrusions may be composed of any suitable material that can be deformed and subsequently returned to a natural position once the force causing the deformation is released. As used herein, the terms tactile and haptic are interchangeable as both terms refer to a sense of touch.

[0038] Line extensions **114***a*-**114***e* are configured to sense the flex or degree of bend of a finger or thumb. The flex or degree of bend is communicated to transmitter/receiver **118** where the signal is translated into a command that is subsequently transmitted to a computing device in one embodiment. Of course, the signal can be communicated directly to transmitter/receiver **118** without being translated. Input device **100** is constructed of lightweight material in one embodiment. For example, central body **116** is composed polystyrene, rubber foam, plastic or some other suitable lightweight material capable of holding the above mentioned electronics and acting as an anchor for protrusions **112***a*-**112***e*.

Protrusions **112***a*-**112***e* are composed of a material that can be gripped by a user's hand. In one embodiment, the material for protrusions **112***a*-**112***e* offers enough resistance so that input device **100** can be held comfortably and without much effort while a user's hand. As mentioned above, the material allows protrusions **112***a*-**112***e* to be squeezed into a closed position, as illustrated with reference to FIG. **5**B, and then returned to an open position, once the force causing input device **100** to close is removed. Electronics, such as receiver/transmitter **118**, line extensions **114***a*-**114***e*, and vibrators **120***a*-**120***g* are embedded within central body **116** and protrusions **112***a*-**112***e*. In one embodiment, pressure sensors are included at the fingertip positions of protrusions **112***a*-**112***e* to monitor fingertip pressure. The above described electronics are included in the response and communications system, also referred to as the communications system, of input device **100**. In another embodiment, power is supplied for the embedded electronics of the response and communications system through a battery located within central body **116**.

[0039] FIG. **4** is a bottom perspective view of the input device in an open position in accordance with one embodiment of the invention. Central body **116** is configured to fit inside a user's palm, while protrusions **112***a*-**112***e* conform to a user's fingers and thumb. The input device is of a lightweight construction that allows a user as much freedom of movement as possible. In one embodiment, the electronics embedded in central body **116** allow for unrestricted placement of the input device during operation as there is no line-of-sight requirement. That is, a short range radio technology, rather than an infrared signal, is used to communicate through the input device and the computing device. In another embodiment, each of protrusions **112***a*-**112***e* include a sensor configured to detect the pressure exerted by the fingertips of a user.

[0040] FIG. **5**A is a schematic diagram of the input device being held by a user while the input device is in an open position in accordance with one embodiment of the invention. Central body **116** of input device **100** fits within the palm of a user's hand **102**. Each of protrusions **112***a*-**112***e* are configured to accommodate a finger or thumb of the user's hand **102**. FIG. **5**B is a schematic diagram of the input device being held by a user while the input device is in a closed position in accordance with one embodiment of the invention. Here, input device **100** is brought to a closed position as the user squeezes protrusions **112***a*-**112***e* while holding the input device in the user's hand **102**. Central body **116** remains against the user's palm while input device **100** is closed. In one embodiment, a latching mechanism allows a user to latch input device **100** in a closed position. In the latched position, protrusions **112***a*-**112***e* essentially wrap around central body **116** to define a cylinder. Thus, input device **100** can easily fit inside a pocket or can conveniently be stored by the user as the area for storage is minimized in the latched position. A button can be depressed or moved to release the latching mechanism so that the input device opens, i.e., the protrusions are released from the latched position and "open up".

[0041] Input device **100** may be utilized for numerous input functions. Some exemplary functions are described below. The input device can act as a virtual keyboard in one embodiment. Here, low latency vibrators, such as TOUCHENGINE™ vibrators, mounted on each finger to give a tactile "click" when moving from one virtual key to another. A different click can be used to indicate when a key is pressed (via pressure sensors on fingertips), and a continuous vibration can be used whenever the finger is out of the "home" row. Positional left/right tracking of the hand could be used to switch between different zones of the virtual keyboard if, for example, only a single hand is being used. Such a virtual keyboard has the advantage that any surface can be typed on, in any orientation. For instance, a user might be standing and can type on the sides of their legs.

[0042] In another embodiment, the input device can act as a virtual piano with feedback similar to the keyboard embodiment described above. For example, a camera pointed at the user could show live video of the user combined with a three dimensional computer graphic piano responding to the users hands.

[0043] The input device can act as a control for a game in one embodiment. For instance, for a game where the user is a pilot, a folded sheet of plastic can be used to simulate the cockpit controls (e.g., the instrument panel can be printed on the plastic or other material), and the user can be wearing the input devices on each hand to enable piloting of the airplane or other vehicle or device. A display monitor connected to a computer, or game unit, allows the user to view the interactions. To begin, the user can touch the four corners of the sheet, which calibrates the positional tracking. For example, the four corners of the sheet can be marked with red crosses to indicate the areas to be touched. A combination of fingertip pressure, positional tracking, and tactile feedback can be used to interact with the game. The game may also include a plastic yoke or joystick that contains no electronics and only serves to constrain or steady the users hands. The game detects the user gripping the controls by a combination of fingertip pressure and finger flex information and then tracks the motion and/or orientation of the hand to interpret the manipulation of the physical controls. The plastic yoke might be designed with the shape of the input device in mind and include, for example, depressions for the central body of the input device to fit in. In another embodiment, the degree of pressure applied when a user squeezes their fingers together is correlated to a tightness of a grip exerted on an object in a video game application being displayed on a monitor.

[0044] It will be apparent to one skilled in the art that through the addition of a camera and computer vision techniques, the exemplary embodiments described herein could be enhanced by adding graphical representations into live video of the user. Fingertip menus with selections above each finger, selected by touching the thumb and finger together, can also be accommodated through the input device. Here, the input device may also be used to perform click and drag operations similar to a mouse.

[0045] FIG. **6** is a top perspective view of an input device in accordance with one embodiment of the invention. Input device **100** consists of central body **116** and protrusions **112***a*-**112***e*. As mentioned with reference to FIG. **3**, central body **116** includes embedded electronics for transmitting signals to and receiving signals from a computing device such as a game console. Protrusions **112***a*-**112***e* include extension lines for determining the degree of bend of a user's fingers. Pressure sensors may also be provided to obtain fingertip pressure. Vibrational feedback is provided to a user through vibrators located in protrusions **112***a*-**112***e* and central body **116**. In one embodiment, the vibrators are configured to control the hardness and the pattern of the vibration to provide the user with tactile feedback. It should be appreciated that by varying the hardness and the pattern of the vibration the sensation per-

ceived by the user may differ. For example, a user can be provided a sense of gripping a steering wheel, typing, striking a piano key, etc.

[0046] FIG. **7** is a bottom perspective view of an alternative embodiment of the input device of FIG. **4**. Input device **100** includes central body **116** and protrusions **112***a*, **112***b* and **112***c*. Thus, in this embodiment, the thumb, forefinger and middle finger of the user are accommodated by protrusions **112***a*, **112***b* and **112***c*. Button **130** on the bottom surface of central body **116** releases protrusions **112***a*, **112***b* and **112***c* from a closed position. That is, depressing button **130** releases the latching mechanism holding protrusions **112***a*, **112***b* and **112***c* in a closed position. Of course, button **130** may be incorporated into the embodiments of the input device having protrusions for each finger. One skilled in the art will appreciate that the latching mechanism may be spring activated to release to an open position upon depression of button **130**. In another embodiment, input device **100** may be configured as having one protrusion. For example, one protrusion for an index finger extending from central body **116** may be provided. Here, the movement of the index finger is captured, although the single protrusion can accommodate any one finger or thumb. Vibrators may also be located in the single protrusion as well as the central core to provide tactile feedback to the user's hand through the finger and the user's palm.

[0047] FIG. **8** is a flowchart diagram of the method operations of method for communicating commands to a computer system from an external input device in accordance with one embodiment of the invention. The method initiates with operation **150** where a receiver is provided. The receiver is configured to communicate with an external input device configured to be held within a user's palm. In one embodiment, the receiver is integrated with a computing device, such as a game console. An exemplary input device is shown with reference to FIGS. **3-7**. The method then advances to operation **152** where the hand movements of a user are captured through deformation of the input device. Here, the user applies and releases pressure to the input device. Electronics embedded within the input device capture the change in position of the protrusions, which yields information on the degree of flex of the fingers as well as the pressure at the fingertips.

[0048] The method of FIG. **8** then proceeds to operation **154** where the captured hand movements are translated to a command to be communicated to a receiver. In one embodiment, the movements are translated and then transferred to a computing system to initiate a command, respond to a query, maneuver objects in an interactive video game, etc. The method then moves to operation **156** where the user's hand is stimulated with tactile feedback provided through the input device. Here, low latency vibrators as illustrated in FIG. **3** provide the tactile feedback. In one embodiment, the hardness and the pattern of the vibration is controlled to provide a certain feel to the user. That is, the type of vibrational feedback is dependent on the application being executed.

[0049] In one embodiment, the invention may be a computing system capable of providing vibrational feedback to a user consisting of various components defined in terms of the functions of each of the components. For example, the computing system can include a means for capturing hand movements. The means for capturing hand movements of a user are provided through an external input device configured to be held by the user, such as the hand-held input device illustrated in FIGS. **3-7**. Means for transmitting the captured hand movements are included. The means for transmitting the captured hand movements to a computing device may be the embedded electronics discussed above with reference to FIG. **3**. Means for transmitting commands to the external input device in response to the transmitted hand movements of the user are provided. Here, a transmitter associated with a computing device transmits the commands to the external input device. Means for providing tactile feedback to the user in response to the transmitted commands to the external input device are provided by the vibrators illustrated in FIG. **3**. Means for displaying graphic images associated with the commands received from the external input device are provided by a display monitor in communication with a computing device.

[0050] In summary, a hand-held input device is provided. The hand-held input device is configured to be non-surface relational. That is, the input device does not require movement along a surface to function, as is required for a mouse. In one embodiment, a user's finger movements generate signals for controlling objects displayed on a monitor associated with a computing unit that receives the generated signals. For example, the objects may be associated with a video game application where the computing unit is a video game console. One skilled in the art will appreciate that above mentioned embodiments are applicable to a game console running the video games as well as on-line video gaming where a user accesses the video games from a server. Thus, the computing unit can be a game console or a server accessed through a distributed network, such as the Internet.

[0051] The invention may employ various computer-implemented operations involving data stored in computer systems. These operations are those requiring physical manipulation of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. Further, the manipulations performed are often referred to in terms, such as producing, identifying, determining, or comparing.

[0052] Any of the operations described herein that form part of the invention are useful machine operations. The invention also relates to a device or an apparatus for performing these operations. The apparatus may be specially constructed for the required purposes, or it may be a general purpose computer selectively activated or configured by a computer program stored in the computer. In particular, various general purpose machines may be used with computer programs written in accordance with the teachings herein, or it may be more convenient to construct a more specialized apparatus to perform the required operations.

[0053] The invention can also be embodied as computer readable code on a computer readable medium. The computer readable medium is any data storage device that can store data which can be thereafter be read by a computer system. Examples of the computer readable medium include hard drives, network attached storage (NAS), read-only memory, random-access memory, CD-ROMs, CD-Rs, CD-RWs, magnetic tapes, and other optical and non-optical data storage devices. The computer readable medium can also be distributed over a network coupled computer systems so that the computer readable code is stored and executed in a distributed fashion.

[0054] Although the foregoing invention has been described in some detail for purposes of clarity of understanding, it will be apparent that certain changes and modifications may be practiced. Accordingly, the present embodiments are

to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given herein, but may be modified within the scope and equivalents of the description.

What is claimed is:

1. An input device, comprising:

a central body;

a response and communications system incorporated with the central body, the response and communication system enabling communication between the input device and a computing device; and

a plurality of protrusions extending from the central body, wherein the central body and the plurality of protrusions are configured to capture a user's hand movements, and wherein the plurality of protrusions are configured to sense a degree of bending of a user's finger, wherein the input device is to be held by the user's hand as opposed to being worn on the user's hand like a glove;

wherein the response and communication system transmits signals to a device to be controlled, the signals defined by the user's hand movements.

2. The input device of claim **1**, wherein the entire input device is configured to be held in a user's hand.

3. The input device of claim **1**, wherein the central body and each of the plurality of protrusions include,

a vibrator configured to provide tactile feedback to a user.

4. The input device of claim **3**, wherein a hardness and a pattern of a vibration generated by the vibrator are controlled.

5. An input device for communication with a computing device, comprising:

a central body;

a circuit disposed in the central body, circuit configured for interaction between the input device and a computing device; and

a plurality of protrusions extending from the central body, wherein the central body and the plurality of protrusions are configured to capture finger movements of a user's hand, wherein the input device is to be held by the user's hand as opposed to being worn on the user's hand like a glove;

the circuit configured for transmitting signals to the computing device to cause interfacing with one or more features of a program executed on the computing device, based on the captured finger movements.

6. A computer game input device for interfacing with a computing device, comprising:

a central body;

a circuit configured for detecting interaction from the input device and for communicating with a computing device; and

a plurality of protrusions extending from the central body, wherein the plurality of protrusions are configured for movement relative to the central body, wherein the input device is to be held by a user's hand as opposed to being worn on the user's hand like a glove;

the circuit configured for transmitting signals to the computing device to cause interfacing with one or more features of a program executed on the computing device, based on the detected movements of the protrusions.

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