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(54) **COMMUNICATING STYLUS**

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G06F 3/0354 (2013.01)

(52) **U.S. Cl.**

CPC ***G06F 3/038*** (2013.01); ***G06F 3/03545*** (2013.01); *G06F 2203/0384* (2013.01)
USPC **345/179**

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CPC G06F 3/03545; G06F 3/038; G06F 2203/0383; G06F 2203/0384
USPC 345/156–184, 104; 178/18.01–20.04
See application file for complete search history.

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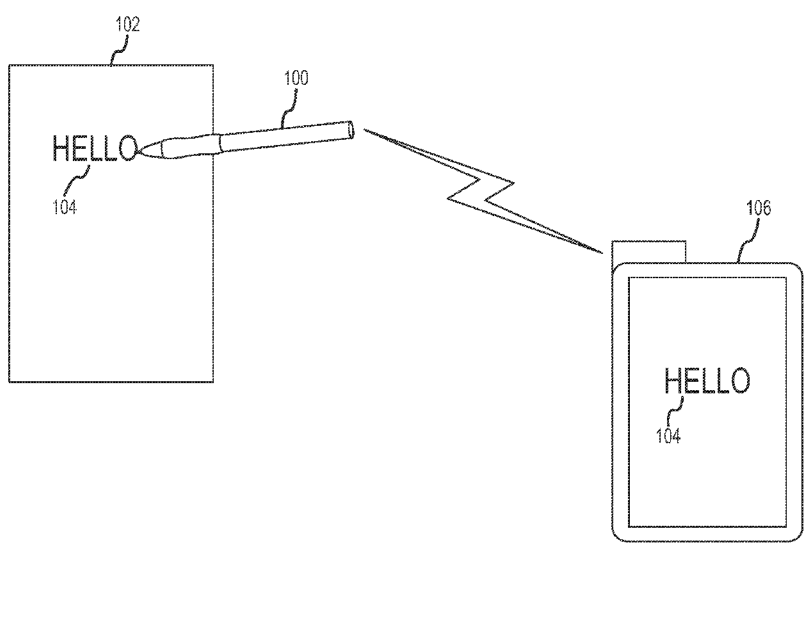
(57) **ABSTRACT**

A stylus for writing on any type of surface, such as a piece of paper or a whiteboard and subsequently displaying the written images or text on a display of a digital computing device. The stylus may likewise be moved in three-dimensional space and corresponding images displayed on a display of a computing device. The stylus tracks its different positions while a user is writing or drawing and then either stores the data to be uploaded later or transmits the data simultaneously to a computing device. The computing device then displays the images and text drawn on the surface. The computing device may be located anywhere, as long as it is able to communicate with the stylus, and be able to display the written text or images.

26 Claims, 5 Drawing Sheets



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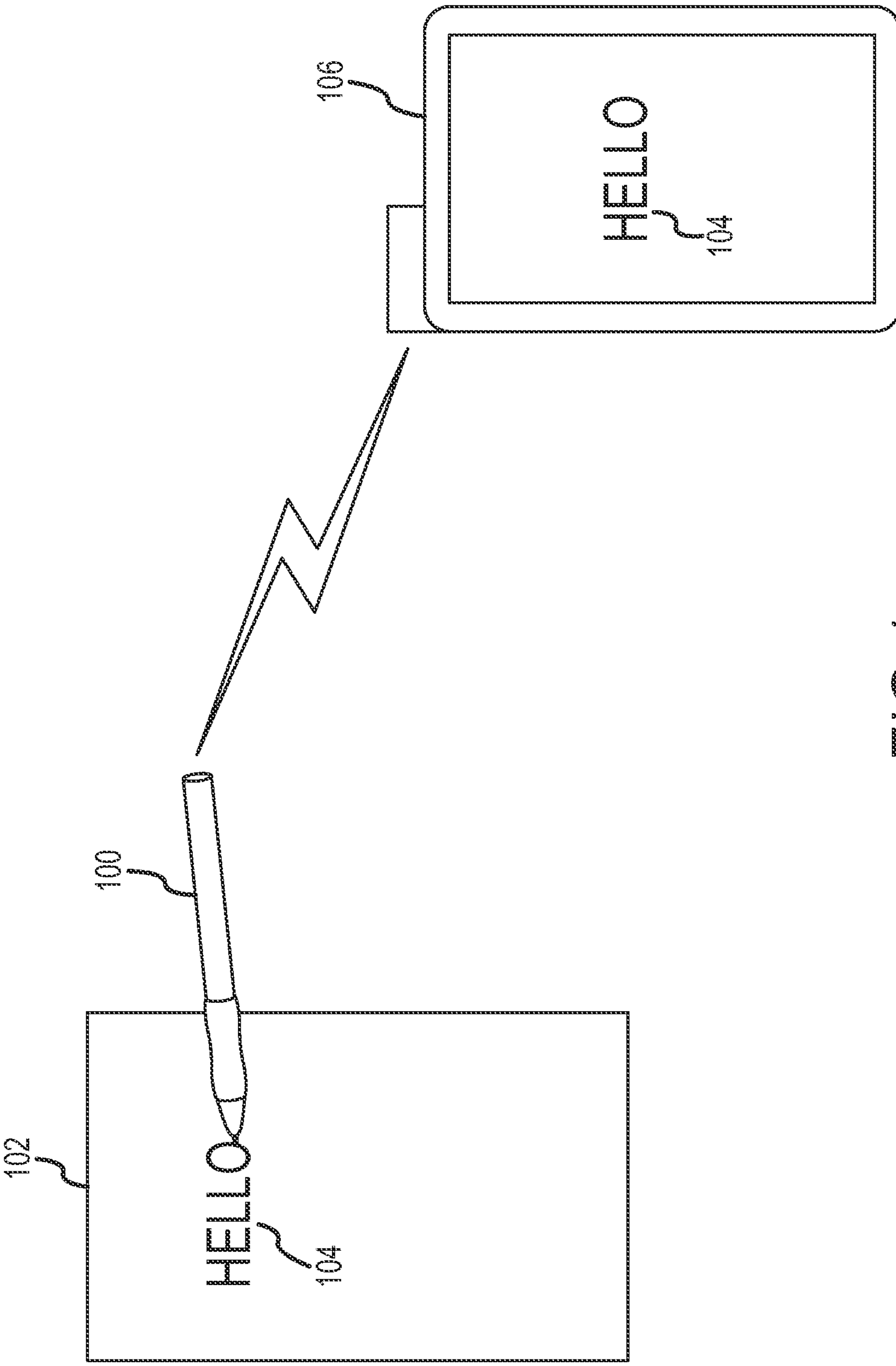

FIG. 1

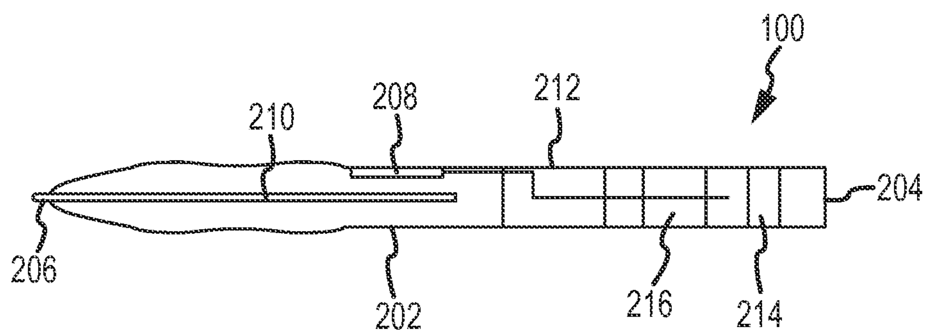
100
208
212
210
204
206
202
216
214

FIG.2

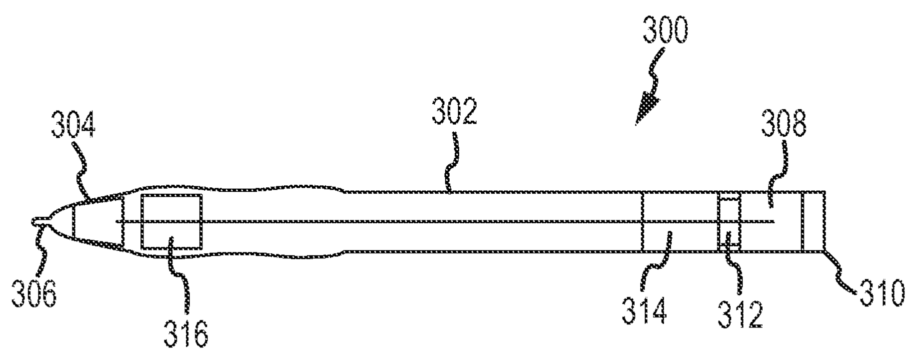
300
302
304
308
306
316
314
312
310

FIG.3

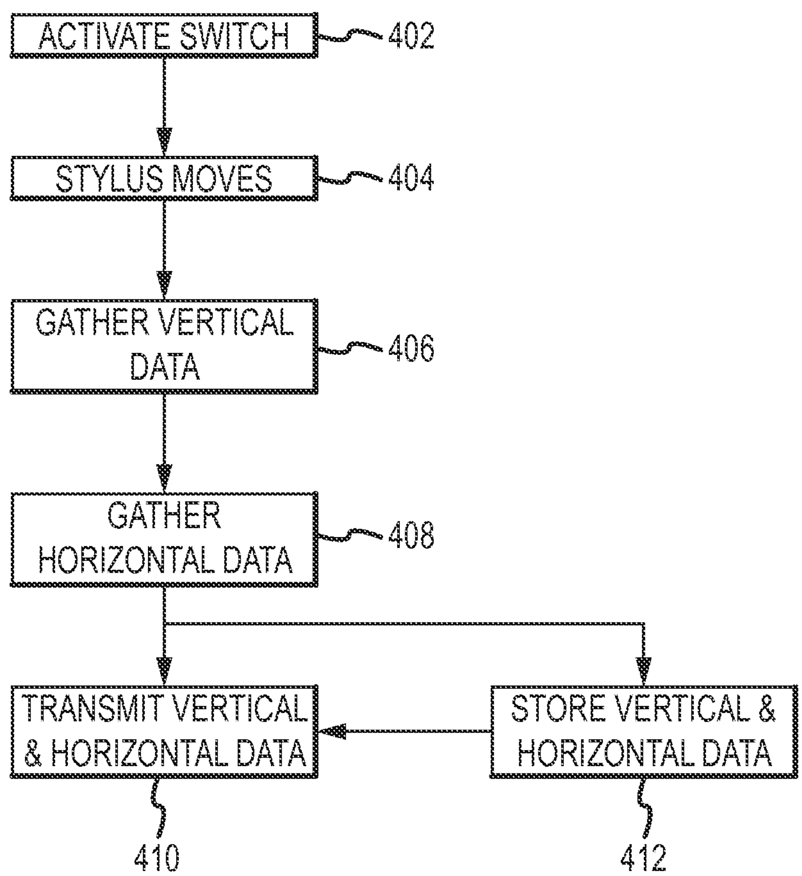
ACTIVATE SWITCH
402
STYLUS MOVES
404
GATHER VERTICAL DATA
406
GATHER HORIZONTAL DATA
408
TRANSMIT VERTICAL & HORIZONTAL DATA
410
STORE VERTICAL & HORIZONTAL DATA
412

FIG.4

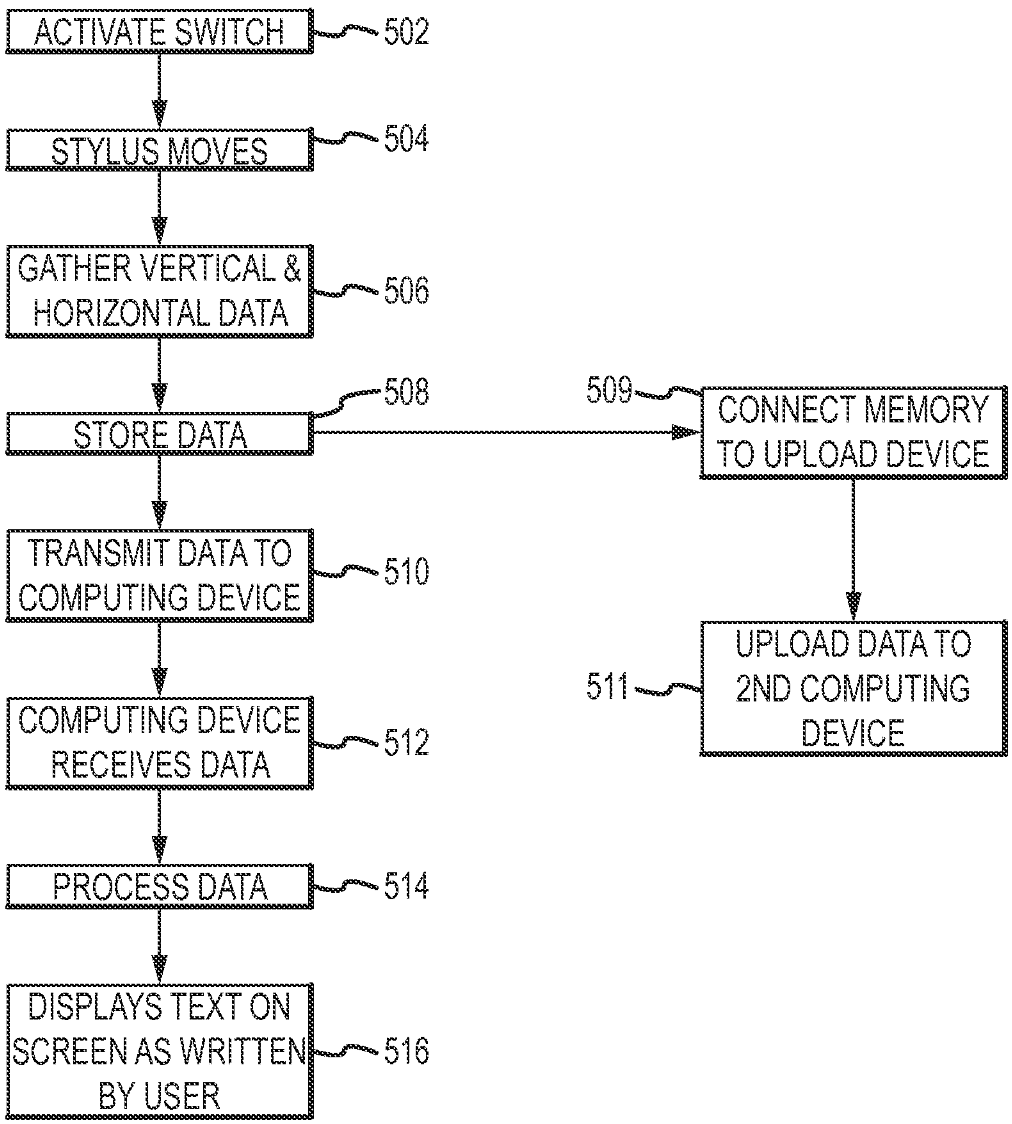
ACTIVATE SWITCH
502
STYLUS MOVES
504
GATHER VERTICAL & HORIZONTAL DATA
506
STORE DATA
508
509
CONNECT MEMORY TO UPLOAD DEVICE
TRANSMIT DATA TO COMPUTING DEVICE
510
UPLOAD DATA TO 2ND COMPUTING DEVICE
511
COMPUTING DEVICE RECEIVES DATA
512
PROCESS DATA
514
DISPLAYS TEXT ON SCREEN AS WRITTEN BY USER
516

FIG.5

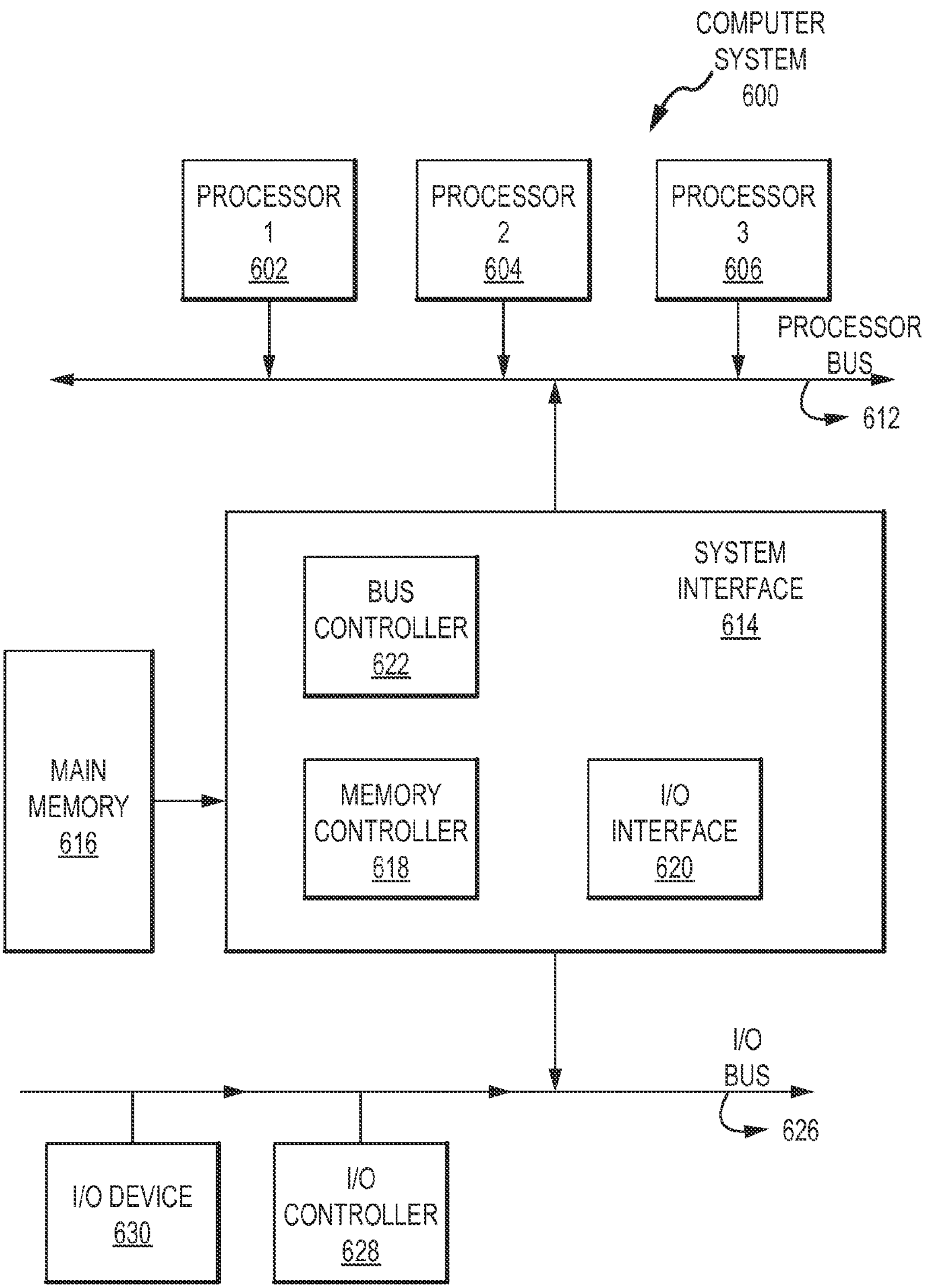
COMPUTER SYSTEM 600
PROCESSOR 1 602
PROCESSOR 2 604
PROCESSOR 3 606
PROCESSOR BUS
612
SYSTEM INTERFACE 614
BUS CONTROLLER 622
MAIN MEMORY 616
MEMORY CONTROLLER 618
I/O INTERFACE 620
I/O BUS
626
I/O DEVICE 630
I/O CONTROLLER 628

FIG.6

COMMUNICATING STYLUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application incorporates co-pending application titled "Stylus for Touch Sensing Devices," identified as Ser. No. 12/683,287 and filed on Jan. 6, 2010, as if set forth herein in its entirety.

TECHNICAL FIELD

Embodiments relate generally to input apparatuses for computing devices, and more particularly to a stylus used for entering data into a computing device.

BACKGROUND

There are a number of different options for entering data into a computing device, including keyboards, mice, styluses, touchscreens, and so on. Some touchscreen computing devices, such as cellular phones, tablet devices and personal digital assistants, allow a user to use his finger to enter data. Other types of computing devices also allow a user to enter data using a resistive-tip plastic stylus. However, styli currently used for entering data with a touch-screen computing device typically require that the tip of the stylus actually contact (or very nearly contact) the touchscreen or another type of specialized surface. The problem with these different types of styli is that they all require that the user write on a specialized surface, whether it be the actual screen of the computing device or specialized paper. There is a need for a stylus that can enter data into a computing device, regardless of the surface with which it is used.

SUMMARY

The following embodiments and aspects thereof are described and illustrated in conjunction with systems, tools and methods which are meant to be exemplary and illustrative, not limiting in scope. In various embodiments, one or more of the above-described problems have been reduced or eliminated, while other embodiments are directed to other improvements.

One embodiment is a stylus that includes a position sensing device such as an accelerometer, a tip for writing, a transmitter for sending position data, a receiver and a computing device. The stylus may be used for entering data into the computing device without actually touching the device nor requiring any specialized paper. Rather, the stylus is able to enter data into the computing device, corresponding to images or text drawn draw on any surface. Additionally, the stylus can enter the data from a distance, such as from across the room, to the computing device. This allows a user in one embodiment to keep the computing device stored, for example with a cellular phone, in his pocket and still be able to use the stylus to enter text or drawings into the device. This makes it easy, for example, in a classroom setting for a user to take handwritten notes and simultaneously create a digital version of those notes. Additionally, in another embodiment, the stylus allows for the user to write on a whiteboard mounted on a wall and simultaneously display what he has written on a computing device.

In addition to the exemplary aspects and embodiments described above, further aspects and embodiments will become apparent by reference to the drawings and by study of the following descriptions.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiments are illustrated in referenced figures of the drawings. It is intended that the embodiments and figures disclosed herein are to be considered illustrative rather than limiting.

FIG. **1** illustrates one embodiment of a stylus;

FIG. **2** illustrates a perspective cross-sectional view of the embodiment of FIG. **1**;

FIG. **3** illustrates a perspective cross-sectional view of a second embodiment of a stylus;

FIG. **4** is a flow chart illustrating a sample method for operating the embodiment of FIG. **1**;

FIG. **5** is a flow chart illustrating a sample method for operating the embodiment of FIG. **2**; and

FIG. **6** is a block diagram illustrating a computing system which may be implemented for operation with either the first or second embodiment.

DETAILED DESCRIPTION

Embodiments disclosed herein may take the forms of systems, apparatuses, and methods for a wirelessly communicating stylus. In one embodiment, a user may use such a stylus to write or draw on a surface. The stylus may activate by being pressed against a surface, grasped, withdrawn from a dock or manually turned on by the user. As the stylus is used and moved, it tracks its position and changes thereto, typically with respect to an initial or zero point. This allows the stylus to gather data that will enable a computing device to display a graphical representation of the stylus' movements.

As the stylus moves, one or more accelerometers may track the position and relative motion of a tip of the stylus. The stylus may store the output of the accelerometer(s) as position data for a period of time; position data may be transmitted in bursts to an associated computing device. It should be noted that the use of multiple accelerometers may permit the stylus to track three-dimensional motion as opposed to tracking only two-dimensional motion. It should also be noted that the stylus may continuously transmit position data rather than transmitting such data in bursts.

Generally, after either a certain time elapses or a certain amount of data is gathered, the stylus may transmit this position data to a receiver associated with a computing device. The computing device may be located anywhere, as long as the receiver is able to receive the position data from the stylus. For instance, the computing device may be located in the user's pocket or across the room from the user. The computing device, after receiving the position data, processes the position data and then displays corresponding images on an associated display such as a monitor, television, mobile phone or tablet surface, other computer screen and so on. For example, the device may show a line or trail on a screen that corresponds to the motion of the stylus. This allows the user to simultaneously take notes (or otherwise draw/write,) on a sheet of surface, or even in the air, and create a separate digital copy of his work.

In this manner, the stylus may be moved and the motions depicted on a display associated with the computing device. In short, the stylus may track its motion, relay position data created by this motion to a computing device, and the computing device may render on a display graphic(s) mirroring the stylus motion. Thus, as a user moves the stylus to write on a surface (or even in air), the writing may be shown on a display.

Referring now to FIG. **1**, in one embodiment the stylus **100** is used to write text **104** on a surface **102**. The stylus **100** tracks its movements and then transmits the position information corresponding to the text **104** written on the surface **102**, to the computing device **106**. The computing device **106** receives the position data, processes the position data and displays the text **104**.

A tip of the stylus **100** may be placed against a surface **102**, such that the stylus may move across the surface to create corresponding writing, images, letters and so forth on a display of the computing device. The surface **102** may be any type of surface, such as a sheet of paper, whiteboard, chalkboard, electronic screen or the like. The surface **102** may or may not be able to display the text **104**, depending on properties of both the surface and stylus. For instance the stylus **100** may not include any ink or other medium that is left behind on the surface. In such an embodiment, text **104** and/or images is typically only displayed on the computing device after the corresponding position data has been transmitted and processed. In another embodiment, the stylus **100** may include ink, graphite, or another similar substance, such that motion of the stylus across the surface **102** will leave the substance behind. In this manner, the surface may display markings left by the motion of the stylus; these same motions may be shown on a display associated with the computing device **106** once position data is received and processed by the computing device.

In addition, it should be noted that the angle of the surface **102** is irrelevant, at least with respect to the creation and transmission of position data, as well as the display of any markings corresponding to motions of the stylus. For instance, the surface **102** may be located horizontally on a desk, positioned vertically on a wall, or the like.

As previously mentioned, the computing device **106** receives position data from the stylus **100**, processes the data and displays corresponding text or drawings drawn with the stylus **100**. The computing device **106** may be any device capable of receiving data, processing data and displaying an output. For instance, the computing device **106** may be a computer, a personal digital assistant, a cellular telephone, or tablet laptop computer. The computing device **106** may include an integrated receiver or may use an external receiver in electronic communication with the computing device **106**, in order to receive the position data from the stylus **100**. The receiver may be any device capable of receiving an electronic signal, such as a radio wave or infrared signal, or the like. See FIG. **6** for a more detailed explanation of what may be included in the computing device.

Referring now to FIG. **2**, the stylus **100** may include a body **202**, a position sensing device **204**, a tip **206**, a switch **208**, an ink tube **210**, a power source **212**, a transmitter **214** and memory **216**. One or more of these elements may be omitted in certain embodiments. For example, the memory may be omitted in some embodiments and the transmitter may operate continuously when the stylus is in use.

The body **202** is held by the user to write or draw on the surface **102** with the stylus **100**. The body **202** may be either hollow, solid or partially solid and may be made from any type of material, for instance, plastic, metal or wood. The elements shown as within the body **202** may reside within the body **202** if the body **202** is hollow, as illustrated by FIG. **2**. Alternatively, the elements may reside on the outside of the body **202**, for instance as a clip-on or other attachment to the body **202**. As one example, the position sensing device **204**, power source **212**, transmitter **214** and/or memory may be enclosed is a separate housing and attached to the body **202**. Similarly, certain elements may be within the body and others outside the body, with interior and exterior elements connected as necessary. As another example, the transmitter and memory may be within the body while a power source is external thereto, and connected by a USB or other connector to the internal elements.

The position sensing device **204** tracks the position of the stylus **100**, and particularly the tip, as it is used to write or draw on the surface **102**. The position sensing device **204** may be located anywhere on the body **202** of the stylus **100** but is often located at or proximate the tip in order to more easily track tip motion. The position sensing device **204** may be any type of device able to determine and/or track the position of an object, such as an accelerometer.

In certain embodiments, one or more infrared, radio wave, ultrasonic and or other frequency transmitters may be used. In an embodiment employing a frequency transmitter as a position sensing device, the associated computing device **104** may be provided with multiple receivers (not shown). The transmitted position data may be time stamped or otherwise encoded. In this manner, the position data may be received at each receiver. The encoding may be used to establish a difference between time of receipt at each receiver. By comparing the difference in time of receipt and knowing the relative positions of the receivers, the position of the stylus may be determined. This process may be done on a continual basis, for each portion of a packet of position data, to establish motion of the stylus.

The position sensing device **204** may consist of multiple devices. For instance, another embodiment may use two position sensing devices, as described below with respect to FIG. **3**. The position sensing device **204** may be located anywhere on the body **202**, or as discussed with respect to the body **202**, may be provided as a separate attachment. The position sensing device **204** is used to track the different positions of the stylus **100** as a user writes or draws on any surface. In certain embodiments, the position sensing device is located at or near the tip **206** of the stylus. When a second position sensing device is used (as discussed below with respect to FIG. **3**), in certain embodiments it may be placed at the end of the stylus opposite the tip.

The tip **206** is the end of the stylus that makes contact with the surface **102** as the user writes. The tip **206** is connected to the body **202** of the stylus **100** at the front end. The tip **206** may be any material, such as graphite, lead, metal, plastic, felt or the like. Additionally, the tip **206** may consist of any shape, such as a ball, a point or the like. The tip **206** material is determined based on the surface **102** on which the stylus **100** will be used. For example, if the stylus **100** is intended to be used with a sheet of paper, the tip **206** may be a graphite point, a lead point, or a rolling ball connected to an ink well. This enables the user to draw/write with the stylus as he would with a pencil or ink pen. If, on the other hand, the stylus is designed to interact with an electronic screen such as a tablet personal computer, the tip **206** may be a sphere or partial sphere made of metal, plastic, an elastomer impregnated with metallic flecks to provide capacitance, and so on. The tip **206** may enable the user's writing to be displayed on the tablet laptop computer screen as well as the screen of the computing device **106**, either through capacitive coupling with the screen or resistive operation. Furthermore, multiple tips **206** may be available for a single stylus. For instance, a switch could be placed on the body **202** of the stylus **100** that permits a user to rotate between multiple tips **206**.

The switch **208** is used to activate the power source **212** of the stylus **100**, and may be omitted in certain embodiments. The switch **208** may be located anywhere on the stylus **100**. The switch **208** may be any device capable of having at least two states, for instance "on" and "off." However, the switch **208** may be more than just a toggle switch. In one embodiment the switch **208** may be a pressure sensing device. In this embodiment the switch **208** may be toggled to a second position when the user depresses the tip **206** of the stylus **100**. This may allow the stylus **100** to conserve power by only operating certain elements in certain circumstances, such as operating the transmitter **214** and power source **212** only when the user is using the stylus **100**. In another embodiment, the switch **208** may be activated manually by the user. In this embodiment the user could determine when the stylus **100** should be capturing his writing and would allow the stylus to function as a plain writing instrument as well as a communicative stylus.

In some embodiments omitting the switch **208**, the stylus **100** may be activated when it is withdrawn from a dock or separated from the computing device. For example, the computing device and/or stylus may detect when the stylus is separated (or when the stylus is removed from an associated dock). When this is detected, the stylus may be activated and the computing device may enter a data reception mode.

Generally, actuating the switch may not only activate the stylus **100**, but also set an initial coordinate or zero point for the position data. That is, position coordinates may be set to zero (or some other default value) every time the stylus is initiated. In this manner, the position sensing device may track motion of the stylus relative to the zero point and transmit this information to the computing device. The use of a zero point or initial coordinate permits the position data to be measured relative to the zero point, rather than measured relative to the position of the computing device or any other fixed, absolute position.

The ink tube **210** provides the ink or other pigment-type elements to the tip **206**, so that the stylus **100** is able to display what is being written by the user on the surface **102**. The ink tube **210** may be located anywhere on the stylus **100**, and may likewise be omitted completely. The ink tube **210** may be any type of material capable of displaying on a surface, for instance, ink, graphite, lead, or paint. The ink tube **210** material depends on the type of tip **206**. For example, if the tip **206** is a ball point, then the ink tube **210** will be a plastic tube filled with ink to provide ink to the ball. On the hand, if the tip **206** is graphite or lead, such as in a pencil, the ink tube **210** may be either a solid piece of either graphite or lead or a tube containing multiple pieces of graphite or lead. Additionally, if the tip **206** is a capacitive element, the ink tube **210** may be omitted from the stylus **100** or may flow around the capactive tip. Also, just as the tip **206** may have a switch to let the user choose the tip **206** material from different options, the ink tube **210** may include multiple tubes for different tip **206** materials. For instance, the ink tube **210** may include red ink, blue ink, and pencil lead/graphite.

The power source **212** provides power to the elements in the stylus **100** which require power, for example the position sensing device **204**, the transmitter **214** and the memory **216**. The power source **212** may be located anywhere on the stylus **100**. The power source **212** may be any device capable of storing and providing electrical current. For instance, the power source **212** may be a battery, such as nickel-cadmium, nickel-metal hydride, lithium ion, polymer, alkaline or lead-acid. In certain embodiments the power source **212** may be a power cord, USB cord or other type of hardwired connection to a power outlet. The power source **212** provides power to the transmitter **214**, the memory **216**, the position sensing device **204** and any other additional elements which may be added to the stylus that may require a source of power. The power source **212** may be in a constant "on" state or, if the stylus uses a switch **208**, may be turned on/off by the switch **208**.

The transmitter **214** sends the position data from the stylus **100** to the computing device **106**. The transmitter **214** may be located anywhere on the stylus **100**. The transmitter **214** may be any device capable of sending data from one location to another. For example, the transmitter may send a modulated signal including the position data created by the position sensing device **204**, along with a time stamp or other marker embedded in each datum of the position data. The transmitter **214** may output position data as radio waves, infrared waves, or any other type of signal. In one embodiment the transmitter **214** receives the position data of the stylus **100** from the position sensing device **204**, modulates the signal onto a radio frequency wave and transmits the radio wave to the computing device **106**.

The memory **216** accumulates and stores the position data from the position sensing device **204** before the data is transmitted to the computing device **106** or until the user uploads the data to a computing device. The memory **216** may be located anywhere on the stylus **100**. The memory **216** may be any type of recording medium that can save digital or analog data. For example, magnetic storage, optical storage, volatile or non-volatile, or the like. For instance, the memory **216** may be random access memory (RAM), disk storage, flash memory, solid state memory, or the like. The memory **216** may be configured to receive the position data from the position sensing device **214** and store the data until the transceiver is ready to transmit the data to the computing device **106**. Additionally, the memory **216** may be configured to receive the position data from the position sensing device **204** and store the data, even after the transceiver **214** has transmitted it the computing device **106**. This may allow the user to store a copy of his written text **104** on the stylus and upload it later to a separate computing device.

Referring now to FIG. **3**, in another embodiment, the stylus **300** includes a body **302**, a switch **304**, a tip **306**, a power source **308**, a transmitter **310**, memory **312**, a first positioning sensing device **314** and at least a second position sensing device **316**. In this embodiment the first and second position sensing devices **314**, **316** may be used such that the position of the stylus **300** may be determined in three dimensions. That is, the position data collected by both sensing devices may allow the computing device **106** to determine on which surface **102**, out of a number of different surfaces, that the stylus is writing. Continuing example, the user could write on one surface, a sheet of paper and at a separate time write on a second surface, a chalkboard. If the chalkboard is positioned at a different location from the sheet of paper, the computing device could display the two writings in different windows or otherwise illustrate on which surface the writing originated.

Typically, when two position sensing devices **314**, **316** are used in a single stylus **300**, one is placed at or proximate the tip while the other is placed at or proximate the back end **310**.

The first and second position sensing devices **314**, **316** are used to track the position changes of the stylus **100** in different dimensions. The first and second position sensing devices **314**, **316** may be any type of position sensing device as described above, but in certain embodiments take the form of three-axis accelerometers capable of tracking motion in three dimensions. By locating one position sensing device **314** near a back end **310** of the stylus **100** and the second position sensing device **316** near the stylus tip **306**, differences in motion between the tip and back may be detected by comparing the position data collected by each position sensing device.

The stylus **100**, and its attendant position sensing devices **314**, **316**, may be calibrated to establish multiple aforementioned zero points in three dimensions as well as in two dimensions. As one example, the stylus may be used to define a plane in three-dimensional space by tapping the four corners of a whiteboard or other surface. Instead of tapping, the switch on the stylus may be activated at each corner or the stylus may be set into a "zero point" mode, in which every activation of the switch (or a separate input) may correspond to a zero point. Once the four corners of the surface are established, the stylus **100** and/or computing device may map these to the four corners of the corresponding display. Further, the stylus may occasionally be recalibrated to either a single or multiple zero points in order to eliminate accumulated positioning error.

In operation and when accelerometers are used as the position sensing devices **314**, **316**, each position sensing device initially is located at its zero point, which may be defined as a series of Cartesian coordinates (e.g., X**0**,Y**0**,Z**0**). As the stylus moves, the accelerometers generally track changes in speed from this zero point, and, combined with additional appropriate circuitry, may yield differences in position from the zero point (e.g. a delta for each of the X, Y, and Z axes). These changes in speed and/or position are relayed to the computing device as the position data. A receiver on the computing device receives the position data and may be defined as a second point in space (e.g., X**1**,Y**1**,Z**1**). Given the receiver's position and the position data from the first positions sensing device **314**, as well as the initial zero point, the location of the stylus may be established and a line calculated between the receiver and the stylus. In this manner, the positioning data may be used to triangulate the location of the stylus relative to the computing device.

Alternatively, because the positioning data includes changes in location from the zero point, triangulation may be omitted and the position data, along with the zero point, may be used to establish the stylus' location relative to the zero point. That is, by using the delta along the X, Y and Z axes included in the position data, the computing device may determine the distance of the stylus from the initially established zero point. In this manner the motion of the stylus may be tracked without triangulation and corresponding markings may be depicted on a display associated with the computing device or stylus.

By using the second position sensing device **316** and its position data, the computing device may establish a plane in which the stylus is located and use the location of the second position sensing device for three-dimensional calculations. Alternatively, a second receiver may be placed in the computing device to provide an additional location point in space and the second position sensing device might be omitted. It should be appreciated, however, that multiple receivers and multiple positioning devices may be employed.

Embodiments have generally been discussed in which the computing device receives position data and performs the calculations necessary to determine the position of the stylus, as well as the operations necessary to depict markings on a display that correspond to motion of the stylus. It should be appreciated that the stylus may include a microprocessor capable of calculating its relative position from the zero point based on the position data accrued by the position sensing device(s). In such an embodiment, the stylus may perform digital signal processing to determine its location and transmit a calculated position as a set of coordinates, such as Cartesian, polar, spherical, cylindrical coordinates and so forth, to the computing device.

FIG. **4** is a flow chart illustrating operation of one embodiment. When the user first begins to use the stylus **100**, he activates the switch **208**, as illustrated in operation **402**. Operation **402** may be accomplished through either the user manually activating the switch **208** or simply beginning to use the stylus **100** and the switch **208** activating automatically. For example, when the switch **208** includes a pressure sensor it may activate when the tip **206** presses down on a surface **102**. After the switch **208** has been activated, in operation **404** the position sensing device(s) detect when the stylus moves. For example, a user may move the stylus to write on any type of surface **102**, draw any type of picture, write any text, draw a combination of text and pictures and so forth. In operation **406** the position sensing device **204** gathers the vertical movement data of the stylus **100** as the stylus moves. Simultaneously with operation **406**, operation **408** may be accomplished. In operation **408** the position sensing device **204** gathers the horizontal data from the horizontal movements of the stylus **100** while the user is writing. It should be noted that the accelerometer or other position sensing device may gather horizontal and vertical data simultaneously, as well as depth data, thus permitting data gathering in three dimensions at once. It should also be noted that this data may be expressed as a motion vector, a set of changes as compared to a prior position, and/or a set of coordinates. Similarly, if the stylus includes multiple position sensing devices, each such device may execute operations **406** and **408** independently of one another.

In operation **410** the stylus **100** transmits the vertical and horizontal data, and optionally depth data, via the transmitter **214**. In operation **412** the stylus stores the vertical and horizontal data in the memory **216**. However, operation **410** and operation **412** are interchangeable and/or may be omitted. For example, operation **410** may come after operation **412**. This would mean that the stylus **100** would gather the horizontal and vertical data (as illustrated in the third and fourth operations **406**, **408**) and store the horizontal and vertical data as illustrated in the sixth operation **412** and then transmit the data as illustrated in the fifth operation **410**. Such transmission may occur at set time intervals. Furthermore, either operation **410** or operation **412** may be omitted. For example, after the stylus **100** completes operation **410** and transmits the vertical and horizontal data the process may be complete. Conversely, the stylus **100** could gather the horizontal and vertical data as required by operation **408** and then proceed to operation **412** without ever executing operation **410**. This would allow the stylus **100** to store the horizontal and vertical data in the memory **216** without transmitting said data.

FIG. **5** is a flow chart which illustrates another operating method for an embodiment. In operation **502**, the switch **208** is activated. As discussed above with respect to FIG. **4**, this may be accomplished either manually by the user, or automatically by the switch **208**. In operation **504** the stylus is moved and the motion detected by the position sensing device (s). Once again, the user can write on any type of surface and draw any desired combination of shapes, pictures or text. In operation **506** the stylus gathers the position data. This may involve only horizontal and vertical data, or may involve more dimensions, as discussed with respect to FIG. **3**. Operation **506** is repeated until the stylus stops moving, optionally at least for a threshold time. In operation **508**, the stylus **100** stores the position data. This is accomplished through by the memory **216**. Operation **508**, however, may be omitted, and the method may proceed directly to Operation **510**. Additionally, operation **508** may lead directly to the operation **509**.

In operation **510** the stylus **100** transmits the position data to the computing device **106**. This is accomplished by the transmitter **214** and may be done after the stylus stops moving or may be done simultaneously as the stylus moves. In operation **512** the computing device **106** receives the position data. This may be accomplished through a receiver integral or external to the computing device **106**. In operation **514** the position data is processed by the computing device **106**. This may be done by any means, such as a microprocessor or the like. In operation **516** the computing device **106** displays the motions of the stylus as graphical data on an associated screen or other display device. In operation **509** the stylus, and thus the memory **216**, is connected to an upload interface. Then, in operation **511** the position data is uploaded to a computing device associated with the upload interface. This would allow the user to upload the data of his drawing/writing onto any desired computing device.

FIG. **6** is a block diagram illustrating an example of a computer system device **600** which may be used in implementing embodiments described herein. In general, the computing device **106** and stylus **100** may include or omit any of the described components. In FIG. **6** the computer system (system) includes one or more processors **602-606**. Processors **602-606** may include one or more internal levels of cache (not shown) and a bus controller or bus interface unit to direct interaction with the processor bus **612**. Processor bus **612**, also known as the host bus or the front side bus, may be used to couple the processors **602-606** with the system interface **614**. System interface **614** may be connected to the processor bus **612** to interface other components of the system **600** with the processor bus **612**. For example, system interface **614** may include a memory controller **618** for interfacing a main memory **616** with the processor bus **612**. The main memory **616** typically includes one or more memory cards and a control circuit (not shown). System interface **614** may also include an input/output (I/O) interface **620** to interface one or more I/O bridges or I/O devices with the processor bus **612**. One or more I/O controllers and/or I/O devices may be connected with the I/O bus **626**, such as I/O controller **628** and I/O device **630**, as illustrated.

I/O device **630** may also include an input device (not shown), such as the stylus **100**, an alphanumeric input device, including alphanumeric and other keys for communicating information and/or command selections to the processors **602-606**. Another type of user input device includes cursor control, such as a mouse, a trackball, or cursor direction keys for communicating direction information and command selections to the processors **602-606** and for controlling cursor movement on the display device. Additionally, the I/O device **630** may include a display screen, such as a liquid-crystal, plasma, light emitting diodes, vacuum florescent, surface-conduction electron-emitter display

System **600** may include a dynamic storage device, referred to as main memory **616**, or a random access memory (RAM) or other devices coupled to the processor bus **612** for storing information and instructions to be executed by the processors **602-606**. Main memory **616** also may be used for storing temporary data.

Certain embodiments may include a magnetometer in the stylus **100**. The magnetometer may provide orientation data for the stylus. For example, the magnetometer may be located proximate the tip and determine the orientation of the tip with respect to magnetic north. This orientation data may be packaged as part of the position data or may be separately transmitted and/or processed. The orientation data may be used to refine a position of the stylus by providing a magnetic north reference for the stylus tip.

While a number of exemplary aspects and embodiments have been discussed above, those of skill in the art will recognize certain modifications, permutations, additions and sub combinations thereof. It is therefore intended that the following appended claims and claims hereafter introduced are interpreted to include all such modifications, permutations, additions and sub-combinations as are within their true spirit and scope.

It should be noted that the flowcharts of FIGS. **4-5** are illustrative only. Alternative embodiments may add operations, omit operations, or change the order of operations without affecting the spirit and scope of the present invention.

The invention claimed is:

1. A stylus comprising:

a body with a first end and a second end;

a tip located at a first end of the body;

one or more position sensors disposed on the body, wherein the position sensor is in communication with the tip; and

a transmitter operative to transmit position data generated by the one or more position sensors to a remote computing device, the position data including zero points established at four corners of a plane defined by the stylus in three-dimensional space for an initial location of the stylus; wherein

the one or more position sensors are one or more accelerometers; and

the position data and a location of the remote computing device are used to:

triangulate a three-dimensional position of the stylus utilizing the zero points; and

map the four corners of the plane to four corners of a display.

2. The stylus of claim **1** wherein the transmitter operates intermittently.

3. The stylus of claim **1** further comprising a memory, wherein the memory is in communication with the position sensor.

4. The stylus of claim **1** further comprising a tube located within the body and connected to the tip, the tube holding an ink.

5. The stylus of claim **1** further comprising a power source, wherein the power source is in communication with the position sensors and the transmitter.

6. The stylus of claim **5** further comprising a switch, wherein the switch is in communication with the power source.

7. The stylus of claim **6** wherein the switch is a pressure sensor.

8. The stylus of claim **1**, wherein the three-dimensional position of the stylus is used to determine a location of the stylus relative to the remote computing device.

9. The stylus of claim **1**, wherein the plane is unknown to the remote computing device until it receives the zero points used to establish the four corners of the plane.

10. A method for capturing text written by a user, comprising:

actuating a stylus;

establishing zero points at four corners of a plane defined by the stylus in three-dimensional space for an initial location of the stylus;

detecting that the stylus is moving;

measuring the motion of the stylus in at least two dimensions;

creating first position data based at least on a motion of the stylus in at least two dimensions;

transmitting the position data to a remote computing device;

triangulating a three dimensional location of the stylus using the first position data, the zero points, and a location of the remote computing device; and mapping the four corners of the plane to a display in communication with the remote computing device, wherein movement of the stylus in the plane is correlated to an output on the display.

11. The method of claim **10**, wherein the first position data is a motion vector generated by an accelerometer.

12. The method of claim **11**, wherein the accelerometer is located in a tip of the stylus.

13. The method of claim **12**, further comprising:

creating second position data based at least on a motion of a back end of the stylus in at least two dimensions;

transmitting the second position data to the remote computing device.

14. The method of claim **13**, wherein the first and second position data are based on the motion of the stylus in three dimensions.

15. The method of claim **10**,

wherein the zero points are established prior to detecting that the stylus is being moved.

16. The method of claim **10**, wherein the three-dimensional location of the stylus is determined at substantially any angle of the stylus relative to the remote computing device.

17. The method of claim **10**, wherein establishing the zero points includes

activating an input to the stylus.

18. The method of claim **17**, wherein activating an input comprises tapping the stylus at the four corners of the plane.

19. The method of claim **17**, wherein activating the input comprises selecting a switch on the stylus at the four corners of the display.

20. A system for entering data, comprising:

a stylus comprising:

a body;

a tip;

at least one or more position sensors, wherein a first position sensor tracks the position of the tip and produces position data including zero points established at four corners of a plane defined by the stylus in three-dimensional space for an initial location of the stylus;

a transmitter, in communication with the position sensor, operative to transmit the position data; and

a power source in communication with the position sensor and the transmitter; and

a computing device comprising:

a receiver operative to receive the position data from the transmitter;

a processor in communication with the receiver, the processor operative to:

receive the position data and process it along with a location of the computing device to triangulate a three-dimensional position of the tip;

determine the four corners of the plane in three-dimensional space established by the stylus;

map the four corners of the plane in three-dimensional space to a display; and

the display in communication with the processor, and depicting graphics corresponding to a motion of the tip, wherein the depicted graphics are depicted in a location mapped to a location of the motion of the tip in the plane in three-dimensional space.

21. The system of claim **12** wherein the position sensor is an accelerometer.

22. The system of claim **21**, further comprising a magnetometer, wherein the magnetometer operates in conjunction with the accelerometer to provide position data.

23. The system of claim **22**, wherein the position data includes orientation data.

24. The system of claim **22**, wherein the processor employs the position data to determine a motion of the stylus.

25. The system of claim **20** wherein the stylus further comprises a memory in communication with the position sensor, the power source and the transmitter.

26. The system of claim **20** further comprising a pressure sensor in communication with the power source and operative to activate the position sensor.

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