particular portion of the data plane (for example, data subset **524**) can be viewed. As will appreciated, in both the foregoing modes the speed of scrolling, the specific neutral tilt angle, and required pressures to initiate scrolling changes can be adjusted to fit a particular user.

[**0223**] PORTABLE COMPUTER WITH HANDEDNESS DETECTION

[**0224**] Pressure sensors have been added to augment a conventional keyboard **551** enabled user interface to a hand holdable Windows® CE class computer **550** (i.e. a Cassio® Cassiopia®) schematically illustrated in **FIGS. 38 and 39**. In this embodiment, user handedness was determined by using pressure sensors positioned on a right back-edge and a left back-edge of computer **550**. User studies have found that the difference in pressure between the right and left side gave a direct indication of handedness of a user. As respectively illustrated in **FIGS. 38 and 39**, handedness was used to justify formatted text **554** to the left (**FIG. 38**) or right (**FIG. 39**), thereby allowing more space **555** on display **553** for an electronic annotation pen to be used to mark-up the text.

[**0225**] For both the embodiment of the invention illustrated by FIGS. **35-37**, and the foregoing embodiment illustrated in **FIGS. 38 and 39**, material deformation of a spongy, elastic, or otherwise deformable material must be measured. Although various techniques can be used to measure material deformation, including those based on imaging or fluid volumetric changes, one particularly useful technique is based on the use of pressure transducers. Commercially available sensors measure pressure (indicative of material deformation) by converting a pressure change to a change in electrical characteristics. For example, inexpensive sensors that change resistance in response to pressure can be obtained in a variety of shapes and sizes, including paper thin sensors, and easily bendable sensor strips. Sensors of this kind can be customized to any particular shape or form that a gestural UI might require. The change in resistance is usually linearly related to pressure, with the sensor generally being placed in a potential divider network to model the pressure as a change in potential. For a practical circuit the resulting signal needs to be amplified, buffered and translated such that the change in value from minimum pressure to maximum pressure spans a useful range. The modified signal can now be fed into an analog to digital converter (ADC) to produce a digital representation of pressure. An 8-bit ADC can typically be used for most applications, however, if greater sensitivity to pressure changes is required, a higher resolution ADC (e.g 16-bit ADC) can be used. As will be appreciated, the ADC could be memory mapped into the processor's address space as a peripheral, or alternatively supplied as a retrofitted pressure interface to existing computers capable of benefiting from this system. Since an RS232 connection is an interface that is almost universally available on portable computers, one strategy is to have the parallel output of the ADC converted into a serial RS232 frame using a serializer such as a UART and then level-shift and buffer the signal as specified by the RS232 standard. At the computer end of the serial interface, another level-shifter and UART, the output of which is readable by the processor, performs the serial-to-parallel conversion.

[**0226**] As described with reference to **FIG. 40**, in realizing a working system a microcontroller **564** (a Signetics 87c752) with an ADC built in to combine many of the I/O tasks in a single chip can be used in combination with level shifter **566** (a MAX3223). This approach has the advantage that intelligent processing of the input signal is possible with software. Tilt measurement was provided by a tilt sensor **567** connected to a buffer/amp **562** to supply an analog signal to microcontroller **564**. The pressure measurement can also be encoded within a protocol across the serial link. This particular microcontroller **564** has five ADC inputs, but by making use of eight digital control lines, it is possible to use only one ADC input and one buffer amplifier **561**, to measure up to eight pressure points with pressure sensors **565**. This is achieved by using the control lines to select only one sensor at a time and take a reading for each using a single input to the ADC. After eight sensors have been selected, eight readings are acquired in memory. The design is practical because the microcontroller can take measurements and make analog to digital conversions at a rate far higher than is needed to communicate with a host computer **569**.

[**0227**] For scrolling or handedness based software applications, 16 levels were determined to be adequate for representing a pressure measurement. In order to have a high data throughput to the host computer **569**, each measurement was encoded in one byte of an RS232 frame such that the four lowest bits were the pressure representation and-the highest four bits were the sensor ID. Each frame of the RS232 data was therefore completely self contained. Of course any protocol that limits itself to a specific number of devices in its address space will eventually have the problem that someday applications might be designed that need to reference far more devices than are supported. The solution used in this protocol is to reserve the sensor ID number 15 as a special value that can extend the semantics of the encoding to include an arbitrary number of bytes representing a sensor or value. For the described software applications, the commonly used RS232 frame format (1 start, 8 data no parity, 1 stop bit at a baud rate of 9600) was chosen.

[**0228**] In operation, the host computer **569** determined handedness by utilizing information about the current pressure exerted on two subregions—one, on the back of the device, occupying roughly the left half, and the other, also on the back of the device, occupying the right half. The current pressure values were converted from analog to digital form, such that a digital value of 0 (zero) represents no pressure, and a digital value of, for example, 15 represents maximum pressure. The detection circuitry then proceeds:

```
if (left_sensor is high AND right_sensor is high) then
    conclude that the user is gripping the device with both hands
else if (left_sensor is high AND right_sensor is low) then
    conclude that the user is gripping the device with the left hand only
else if (left_sensor is low AND right_sensor is high) then
    conclude that the user is gripping the device with the right hand only
else if (left_sensor is low AND right_sensor is low) then
    conclude that the user is gripping the device with neither hand
```

[**0229**] Also, to optimize communication, pressure values are only sent when they change. In order to account for jitter and error in the pressure sensors, a sensor is only considered 'high' if its value is higher than some minimum threshold (e.g. '2' on the 0 to 15 range).