mately up to 10 mm or more, with the nodule **302** made to be of an appropriate dimension to still allow a user to feel it when his finger scans touchpad **24**B. Nodule **302** may be positioned such that its top extends above the top level plane of well **606**. Alternatively, its top may be below the surface. Platform **610** may be shaped to receive well **606**. Again, air gap(s) **604** may be produced when contact is made. Similar signal analysis of signals generated by touchpad **24**B as mentioned before is conducted as finger **500** touches nodule **302** and touchpad **24**B.

[0087] Further detail is now provided on an exemplary circuit provided to detect feedback mechanism provided by an embodiment. Referring to FIG. **7**, circuit **700** generates one or more input signals for use by other components, devices and modules in device **10**. Circuit **700** may be provided for one or more pairs of terminals for one or more input devices in device **10**. As an example, circuit **700** may be tailored to generate input signals responsive to user actions imparted on one or more input regions on touchpad **24**B.

[0088] Touchpad **24**B is shown in circuit **700** as a transducer. A transducer may be in a resting state, where it is not activated and an activated state, where it vibrates at a particular frequency and amplitude. It may also be set to be in a stressed state, where it is being stressed from physical force applied to it, such as a user action.

[0089] The transducer may contain piezoelectric material (s) or crystals which are used to generate a voltage in response to the force. In a piezoelectric crystal, internal positive and negative electrical charges are separated, but symmetrically distributed throughout the crystal, so that the crystal has an overall electrically neutral charge. When a mechanical stress is applied to the crystal, the charge symmetry is disturbed, and the resulting asymmetry in the charge in the crystal generates a voltage across the crystal. The generated voltage may be very high. For example, a voltage exceeding 12,000 V (at a low current) may be created in a 1 cm cube of quartz when a 2 kN (k Newtons) force is applied to it.

[0090] As noted above, a piezoelectric element generates voltages when it is stressed. When a piezoelectric element is used as a sensor and when it is stressed, a voltage is generated which can be used as a signal indicating sensing of a user action on an input region defined by an embodiment. The voltage may be quite high. A circuit is provided to receive the voltage generated by the piezoelectric element and provide it to an appropriate circuit to charge or power other elements in device **10**. To harness the voltage, the generated voltage may be provided to a rectifier circuit to convert the voltage to a DC value, which may then be stored and used by other circuits.

[0091] Different electrical/deformation effects can be exhibited by a piezoelectric crystal, depending on how it is cut, including transverse, longitudinal, and shear effects. In a transverse effect, when a force is applied along a neutral axis of the crystal, the piezoelectric material generates an electrical voltage in a perpendicular direction to the force. In both longitudinal and shear effects, the amount of voltage produced is proportional only to the applied force as applied and the direction of the force does not affect the voltage.

[0092] Exemplary piezoelectric materials include crystals, ceramics and polymers. Man-made piezoelectric ceramics include: barium titanate ($BaTiO_3$), lead titanate ($PbTiO_3$), lead zirconate titanate (typically referred to by the acronym "PZT"), potassium niobate ($KNbO_3$), lithium niobate ($LiNbO_3$), lithium tantalate ($LiTaO_3$), sodium tungstate (Na_xWO_3), polyvinylidene fluoride (PVDF) and P(VDF-TrFE) which is a co-polymer of PVDF. An optically transparent piezoelectric polymer may also be used, which is sometimes referred to as an electro active polymer (EAP). Some optically transparent piezoelectric polymers include: lanthanum-modified lead zirconate titanate (PLZT) and lead magnesium niobate-lead titanate (PMN-PT).

[0093] Electrically, a piezoelectric transducer has very high direct current (DC) output impedance and may be represented schematically in a circuit diagram as a capacitor or as a proportional voltage source and filter network. A voltage at the source is directly proportional to the applied force, pressure or strain.

[0094] A piezoelectric transducer may be provided in many forms, depending on how it will be used. As a unimorph form, a single piezoelectric element is provided, typically comprising of a ceramic material. As a bimorph form, a center substrate has a first piezoelectric elements provided on one face of the substrate and a second piezoelectric element provided on the opposite face of the substrate. One piezoelectric element would be configured to operate as an actuator and the other would be configured to operate as a sensor. In another form, a piezoelectric transducer may be provide in a (ductile) fibre form, which may be made from spinning and drawing a fibre of piezoelectric crystal material from a larger shaped block through a viscous suspension spinning process (VSSP) known in the art. Such fibres typically have a diameter of between about 10 microns to 250 microns or more. The generated voltage may be a highly damped alternating AC voltage. For fibres, voltages in the range of 300 Vac (peak to peak) have been measured in response to an initial activation force. One or more sets of positive and negative electrode pairs may be provided on the transducer to pick up voltage signals when the transducer is operating as a sensor.

[0095] An output voltage signals generated by touchpad **24**B by a user action may be within a range of voltages and may have a range of time durations. An expected user action may have an expected voltage signal signature associated with it. There may be variations on one or more aspects of the signature (e.g. time, duration, location, amplitude, intensity) that would still be considered to match a template for the user action.

[0096] Ancillary voltages required to be applied to touchpad **24**B at node **704** in order for it to operate as a sensor are not shown.

[0097] Input signal generator module **74** may includes a digital signal processing module that analyzes the output from touchpad **24**B and then selectively generates the input signals at node **702** when a match to a user action has been detected. It may use DSP **58** provided in device **10**. Signal processing algorithms may be provided in tactile adjustment module **48**G or other modules. Analog circuits and/or components may also be provided in input signal generator **74** to provide other detection circuits. For example, a series resistor ladder may be provided with a series of taps for different voltage output levels for generator **74**. Each tap may represent a different signal for a user action. The signal may be selectively provided to the ladder by other circuits in generator **74**. It will be appreciated that other circuits and modules may be provided for input signal generator/

[0098] FIG. **8** provides an exemplary algorithm **800** executed by a combination of signal generator **74** and/or input signal processing application **48**G in processing signals generated by a user action, such as a finger scanning across touchpad **24**B. First at step **802**, the algorithm waits for a