a non-planar surface, for example, around the rounded grip of a steering wheel or around the edge rim of a cellular phone. The surface **115** of the user interface system **100** preferably remains flat until a tactile guidance is to be provided at or in substantial proximity to the location of the particular region **113**. The surface **115** of the user interface system **100** may also be deformed when a user input is required. At that time, the displacement device **130** expands the cavity **125** to expand a particular region **113** outward, forming a deformation that may be felt by a user, and providing tactile guidance for the user. The expanded particular region **113** preferably also provides tactile feedback to the user when they apply force onto the particular region **113** to provide input. However, any other arrangement of the user interface system **100** suitable to providing tactile guidance and/or detecting user input may be used.

[0028] The sheet in of the preferred embodiment functions to define a surface **115** on one side and at least partially defines a plurality of cavities **125** on an opposite side. The sheet **111** preferably includes a layer **110** that defines the surface **115** and a substrate **120** that supports the layer no and at least partially defines the plurality of cavities **125**. The sheet **111** is preferably similar to the sheet and layer taught in U.S. application Ser. No. 12/319,334, but may alternatively be any suitable device that a sheet **111** that defines a surface **115** on one side and at least partially defines a plurality of cavities **125** on an opposite side.

[0029] As shown in FIGS. **20***a* and **20***b*, the substrate **120** may include a lattice-like support member **160** under the particular region of the surface **115**. When the cavity **125** is expanded and the deformation is present in the surface **115**, the support member **160** functions to prevent a user from "pressing too far" into the deformation below the plane of the surface **115**. When the cavity **125** is not expanded and the deformation is not present in the surface **115**, the support member **160** functions to reduce (or potentially eliminate) the user from feeling "divots" in the surface **115** when swiping a finger across the surface **115**. As shown in FIG. **20***c* , the support member **160** preferably includes holes or channels that allow for the expansion of the cavity **125** and the deformation of the surface **115**. The support member **160** is preferably integrally formed with the substrate **120**, but may alternatively be formed with the layer **110** or may be separately formed and later attached to the substrate **120**. Finally, as shown in

[0030] FIG. **20***d*, the support member **160** may alternatively partially define the cavity **125**. The substrate **120** is preferably rigid, but may alternatively be flexible in one or more directions. The substrate **120**—if located above the display **150**—is preferably optically transparent, but may—if located below the display **150** or if bundled without a display **150**—be translucent or opaque. The substrate **120** is preferably made from a material including polymers or glass, for example, elastomers, silicon-based organic polymers such as poly-dimethylsiloxane (PDMS), thermoset plastics such as polymethyl methacrylate (PMMA), and photocurable solvent resistant elastomers such as perfluropolyethers. The substrate **120** may, however, be made of any suitable material that supports the layer **110** and at least partially defines the cavity **125**. In the preferred version, the substrate **120** is a single homogenous layer approximately 1 mm to 0.1 mm thick and can be manufactured using well-known techniques for micro-fluid arrays to create one or more cavities and/or micro channels. In alternative versions, the substrate **120** may be constructed using multiple layers from the same material or from different suitable materials.

[0031] As shown in FIGS. **3***a*, **3***b* and **3***c*, the cavities **125** of the preferred embodiment each function to hold a fluid and to have at least two volumetric settings: a retracted volume setting (shown in FIG. **3***a*) and an expanded volume setting (shown in FIG. **3***b*). When in the expanded volume setting, the user may inwardly deform the particular region **113** to provide a user input (shown in FIG. **3***c*). The fluid is preferably a liquid (such as water, glycerin, or ethylene glycol), but may alternatively be a gas (such as air, nitrogen, or argon) or any other substance (such as a gel or aerogel) that expands the cavity **125** and deforms the surface **115**. In the expanded volume setting, the cavity **125** expands above the plane of the surface **115**, thereby deforming a particular region of the surface **115**. The deformation of the particular region **113** functions to provide tactile guidance and/or tactile feedback on the surface **115** for the user. The deformation of the particular region **113** also preferably functions to inform the user of the type of input the deformation represents. For example, the deformation of the particular region **113** may be of a shape that indicates the type of input that the deformation represents. Alternatively, the sheet **111** may include tactile instructions, for example, a pattern of beads or substantially small protrusions that may be felt by the user on the particular region **113** that indicate the type of input the deformation represents. The tactile instructions on the particular region **113** may alternatively be any other type of feature that is able to be felt tactilely by the user.

[0032] As shown in FIGS. **4-5**, the plurality of cavities **125** and the displacement device **130** are preferably coupled to the fluid network **200**, which functions to allow fluid to communicate through the user interface system **100** to expand and retract the plurality of cavities **125**. The fluid network **200** preferably includes a channel **138** that preferably couples each of the plurality of cavities **125**, either directly or indirectly (shown in FIG. **6**), to the displacement device **13***o*. The channel **138** may be composed of a plurality of segments (or "branches") that couple to each of the plurality of cavities **125** and the displacement device **130**. The fluid network **200** may also include a reservoir **132** that functions to contain a volume of the fluid.

[0033] Each of the plurality of cavities **125** preferably function substantially similarly and are expanded and retracted by fluid displaced by the displacement device **130**. In some variations, the plurality of cavities **125** may be substantially similar to each other. In other variations, the plurality of cavities **125** may have differences in overall geometry, volume, expansion properties, and/or retraction properties. The plurality of cavities **125** preferably provide the user interface system **100** with the ability to adapt to a variety of user interface scenarios, for example, to user interface scenarios that require more than one possible input (e.g. "Yes" or "No").

[0034] As shown in FIGS. **4***a* and **4***b*, the displacement device **130** of the preferred embodiment functions to expand the cavity **125**, subsequently deforming the particular region **113** of the surface **115**. The displacement device **130** preferably functions to both expand and retract the cavity **125**. In other words, the displacement device **130** functions to increase the volume of fluid within the cavity **125** and decrease the volume of fluid (or "drain" fluid) in the cavity **125**. The user interface system **100** may, however, use another