configuration and the substrate is contracted in a second viewable display area configuration.

[0019] In a more particular embodiment, the elastic component is the substrate per se. Exemplary elastic materials suitable for forming an elastic substrate include elastic polymers among other natural and synthetic material having elastic properties. The elastic substrate may also be embodied as an elastic fabric capable of being stretched and contracted to increase and decrease the size and/or shape of the substrate. In these implementations, the elastic substrate expands and contracts parallel to the surface dimension of viewable display area. In this implementation, the substrate may also be considered to lie within the surface of the viewable display area. In some implementations, the height or vertical dimension of the elastic substrate may have a tendency to decrease as the substrate is stretched. It is also expected that the substrate could be three dimensional which will stretch in three dimensions.

[0020] In another implementation, the substrate comprises a structure formed of overlapping elements interconnected by an elastic component. FIG. **3** illustrates a substrate comprising an expandable pleated material **300** having portions interconnected by one or more elastic strands **310**. While, the one or more elastic strands are illustrated extending through a medial portion of the pleated material **300**, the strands could also be disposed on the top and/or bottom thereof. The pleated material is biased toward a more folded or collapsed configuration and may be expanded to increase the viewable display area upon stretching the elastic strands, thereby unfolding the pleated material. In this embodiment, the elastic component includes one or more elastic strands that are stretched and contracted substantially parallel to the surface of the viewable display area. The strand may also be considered to be within the plane or surface of the viewable display area depending upon where the pixels are located on the substrate. In this embodiment, the viewable display area may be expanded and contracted in at least one dimension. A more complex substrate folding topology would be required to expand and contract the viewable display area in two dimensions using arrays of elastic strands oriented orthogonally.

[0021] In another embodiment, not illustrated, the substrate structure comprises interleaved or overlapping shingle-like elements interconnected by elastic strands. The shingle-like elements may be formed of an elastic or non-elastic material. The shingle-like elements may be discrete elements or they may be interconnected by a flexible web. In one implementation, the elongated shingle-like elements are interconnected by elastic strands that bias the elements in a partially overlapping collapsed configuration. The elements may be fanned-out to increase the viewable display area by stretching the elastic strands. A single array of overlapping shingle-like elements extending the full length or width of the display and interconnected by elastic strands or other elastic elements could be extended and collapsed in one dimension. An array of overlapping shingle-like elements interconnected by orthogonal elastic strand could be extended and collapsed in two dimensions. The substrate and pixels may also be implemented as e-paper having an elastic property, or by islands of e-paper disposed on an elastic substrate. In one embodiment, e-ink is deposited on a conductive elastomer.

[0022] In one embodiment, the picture elements are embodied as light emitting diodes (LEDs) disposed on the substrate. For example, the LEDs may be fastened to the substrate using a conductive adhesive, or by soldering or by other suitable means. Alternatively, the LEDs may be formed integrally with or on the substrate using printing and/or lithography techniques. Integral implementations of the substrate and the picture elements may be embodied as plastic semiconductors. The pixels could also be implemented with transistors as in a TFT, or with MEMs utilized as shutters or mirrors disposed on an elastic substrate. For example, the pixels **112** in FIG. **1** could be clusters or islands of LCD pixels arranged on an elastic substrate. In FIG. **3**, pixels **312** may be located on the troughs and/or ridges of the pleated material, or therebetween. In the shingle-like substrate example, one or more pixels may be located on each element. The pixels could be coupled to the elastic conductors using conductive glue or solder or they could be printed on at least some of the exemplary substrate materials.

[0023] The picture elements may be electrically interconnected, for example, to an electrical interface or other components by elastic conductors. The elastic conductor may comprise a conductive core and an insulating sheath. The core could be a silver impregnated rubber or some other elastic material with a conductive doping or conductive properties. The insulating sheath could be any compatible elastic material with suitable insulating properties. In one embodiment, the elastic conductor is integrated with the substrate, for example, by weaving it into an elastic fabric or integrating the elastic conductor with a discrete substrate component. In another embodiment, the substrate is woven or otherwise created from elastic strands, at least some of which are conductors, thus forming a stretchable sheet of substrate or an elastic fabric as discussed above. In embodiments where the substrate and the picture elements are integrally formed of an elastic semiconductor, the leads could also be printed using lithographic techniques.

[0024] FIG. **4** is a side or sectional view of a substrate **400** having a plurality of pixels **410** disposed thereon in a contracted configuration. In FIG. **5**, the substrate **500** is in an expanded configuration, wherein spacing among the picture elements **510** is relatively far apart compared to the spacing in FIG. **4**. In this implementation, the density of the picture elements on the substrate is dependent on the configuration of the substrate. In other embodiments, however, the pixel density on the substrate may not necessarily change. In some applications, the changing density of the picture elements as the substrate is configured may provide some opportunities to control and/or address the picture elements differently, as discussed further below.

[0025] In some embodiments, the plurality of picture elements have an elastic characteristic, wherein the size of each picture element changes in some proportion to the size of the underlying substrate. In FIG. **6**, the substrate is contracted and in FIG. **7**, the substrate is extended or expanded. In FIGS. **6** and **7**, the picture elements comprise an elastic characteristic, wherein the picture elements expand when the substrate is expanded and the picture elements contract when the substrate contracts. Thus the picture elements **610** in FIG. **6** have less width than the picture elements **710** in FIG. **7**, since the picture elements in FIG. **7** have been expanded or extended. The density of the picture elements on the substrate is also dependent on the configuration of the substrate. The pitch or spacing between picture elements does not vary as much when elastic picture elements are used as it does for non-elastic elements. Also, in some implementations, as the picture elements are extended in one or more dimensions, there may be a tendency for the height or vertical dimension of the picture elements to decrease.

[0026] FIG. **8** illustrates a visual interface or display assembly **800** that is suitable for integration in an electronic device. The display includes a configurable substrate **810** captured or otherwise retained in an expandable frame. Picture elements **830** embedded in the substrate are electrically coupled to an