CLAIMS

1. A flexible fabric comprising:

a flexible outer layer;

a first pair of electrodes and a second pair of electrodes integrated with the flexible outer layer; and

a flexible bladder holding a fluid, the flexible bladder comprising a continuous cavity having a first bulbous portion and a second bulbous portion, the first and second pairs of electrodes being interposed with the first bulbous portion and the second bulbous portion;

wherein:

the first pair of electrodes and the second pair of electrodes are operable to compress the flexible bladder and displace the fluid, and

the flexible outer layer is configured to stretch upon the displacement of the fluid.

2. The flexible fabric of claim 1, wherein the flexible bladder and the first pair of electrodes and the second pair of electrodes are components of a Peano-HASEL actuator.

3. The flexible fabric of claim 1, wherein the flexible bladder and the first pair of electrodes and the second pair of electrodes are at least partially encased in a gel.

4. The flexible fabric of claim 3, wherein the gel defines a finger-link appendage.

5. The flexible fabric of claim 4, wherein

the first pair of electrodes, the second pair of electrodes, and the flexible bladder are components of a first actuation assembly,

the finger-link appendage is one of a series of finger-link appendages, each having another actuation assembly.

6. The flexible fabric of claim 3, wherein the gel is enmeshed with a portion of the flexible fabric.

7. The flexible fabric of claim 1, wherein

in a first configuration, the flexible bladder has a first shape,

in a second configuration, the flexible bladder has a second shape, and

in response to an electrical charge, the first pair of electrodes and the second pair of electrodes move toward one another and cause the flexible bladder to transition between the first shape and the second shape.

8. The flexible fabric of claim 7, wherein the flexible fabric is stretched by the flexible bladder being in the second shape.

9. The flexible fabric of claim 1, wherein

the flexible fabric further comprises a sensor configured to detect a user input, and

the first pair of electrodes and the second pair of electrodes are configured to manipulate the fluid for changing a shape of the flexible bladder in response to the user input.

10. A method for manipulating a flexible fabric, comprising:

detecting an audible input from a user,

detecting a movement or a pressure distribution of the user on the flexible fabric through a first pair of electrodes and a second pair of electrodes,

transitioning a flexible bladder from a first shape to a second shape in response to the audible input and the detected movement or pressure distribution by compressing a portion of the flexible bladder between the first pair of electrodes and the second pair of electrodes in response to an electrical signal, the flexible bladder comprising a continuous cavity having a first bulbous portion and a second bulbous portion, the first and second pairs of electrodes being interposed with the first bulbous portion and the second bulbous portion, and

in response to the flexible bladder being in the second shape, causing a deformation of a flexible fabric.

11. The method of claim 10, further comprising applying an electric charge to the first pair of electrodes and the second pair of electrodes to move the respective pairs of electrodes closer to one another.

12. The method of claim 10, wherein

the flexible fabric defines a sleeping surface configured to engage a user arranged in a lying position, and

the method further includes, in response to the audible input, rolling the user using the deformation of the flexible fabric.

13. The method of claim 10, wherein

the flexible fabric defines a sleeping surface configured to engage a user arranged in a lying position,

the method further comprises detecting a force input from the user by detecting a pressure distribution of the user on the sleeping surface.

14. The method of claim 13, wherein the detecting of the pressure distribution comprises using a wavefront sensor to measure localized movements of the user.

15. The method of claim 10, further comprising, in response to the flexible bladder being in the second shape, pressing the flexible bladder against the flexible fabric.

16. The method of claim 10, further comprising stiffening the flexible fabric using the deformation caused by the flexible bladder being the second shape.

17. The method of claim 10, wherein

the first shape has a first dimension,

the second shape has a second dimension larger than the first dimension,

the transitioning further comprises transitioning the flexible bladder into an intermediate shape having an intermediate dimension, the intermediate dimension greater than the first dimension and less than the second dimension, and

the causing of the deformation further comprises causing an amount of deformation of the flexible fabric corresponding to a dimension of the flexible bladder being the first dimension, second dimension, or the intermediate dimension.

18. The method of claim 17, wherein the deformation is a localized deformation of the flexible fabric.

19. The flexible fabric of claim 1, wherein the first pair of electrodes and the second pair of electrodes are configured to detect movement or pressure distribution applied to the flexible fabric.