CLAIMS

1. A flexible fabric comprising:

a flexible outer layer;

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

a flexible bladder holding a fluid;

wherein:

in response to an electrical signal, the pair of electrodes are operable to move relative to one another to manipulate the fluid for changing the shape of the flexible bladder,

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

the pair of electrodes are configured to detect movement or pressure distribution applied to the flexible fabric.

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

3. The flexible fabric of claim 1, wherein the flexible bladder and the 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 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 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 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 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 moving the pair of electrodes relative to one another in response to an electrical signal to compress a portion of the flexible bladder between the pair of electrodes, 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 pair of electrodes to move the pair 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, second, or third dimension.

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