

- a sensing unit which outputs a detecting signal by detecting a user's finger contacting a touch panel;
- a pattern generating unit which generates a pattern signal of haptic information from the visual information based on the detecting signal; and
- a control unit which moves the electro-active polymer based on the detecting signal from the sensing unit and deforms the electro-active polymer based on the pattern signal from the pattern generating unit.
2. The apparatus of claim 1, wherein the electro-active polymer is formed of a single electro-active polymer.
3. The apparatus of claim 2, wherein the control unit comprises:
- a polymer movement control unit which moves the single electro-active polymer to a point of contact of the user's finger on the touch panel by applying a first driving voltage or current to the single electro-active polymer based on location information of the point of contact in the detecting signal; and
- a polymer deformation control unit which expands and contracts the single electro-active polymer by applying a second driving voltage or current to the single electro-active polymer based on the pattern signal from the pattern generating unit.
4. The apparatus of claim 1, wherein the electro-active polymer is formed of a plurality of electro-active polymers.
5. The apparatus of claim 4, wherein the control unit comprises:
- a polymer movement control unit which horizontally moves the plurality of electro-active polymers to a point of contact of the user's finger on the touch panel, and activates the plurality of electro-active polymers by moving the plurality of electro-active polymers in a vertical direction by applying a first driving voltage or current to the plurality of electro-active polymers based on location information of the point of contact in the detecting signal; and
- a polymer deformation control unit which expands and contracts the plurality of electro-active polymers by applying a second driving voltage or current to the plurality of electro-active polymers based on the pattern signal from the pattern generating unit.
6. The apparatus of claim 1, further comprising a database storing the visual information including the haptic information.
7. A method of providing fingertip haptics of visual information using an electro-active polymer for an image display device, the method comprising:
- outputting a detecting signal of a user's finger contacting a touch panel;
- moving the electro-active polymer to a first point of contact of the user's finger on the touch panel by applying a first driving voltage or current based on the detecting signal;
- generating a pattern signal of haptic information from the visual information based on the detecting signal; and
- deforming the electro-active polymer by applying a second driving voltage or current based on the pattern signal.
8. The method of claim 7, wherein the moving the electro-active polymer comprises:
- determining if the visual information has the haptic information on the first point of contact; and
- generating a moving signal for moving the electro-active polymer to the first point of contact, if the visual information has the haptic information on the first point of contact.
9. The method of claim 7, wherein the moving the electro-active polymer comprises:
- detecting a second point of contact and a first touch state of the user's finger on the touch panel, after applying the first driving voltage or current to the electro-active polymer; and
- calculating a first distance from the first point of contact to the second point of contact; and
- moving the electro-active polymer to the second point of contact by applying the first driving voltage or current, if the first distance is within a predetermined range.
10. The method of claim 9, wherein the generating the pattern signal comprises generating a pattern of the haptic information corresponding to the second point of contact and the touch state from the visual information based on the detected signal.
11. The method of claim 10, wherein the generating the pattern signal further comprises processing the pattern of the haptic information based on a force calculated in a real time.
12. The method of claim 9, wherein the moving the electro-active polymer comprises:
- detecting a third point of contact and a second touch state of the user's finger on the touch panel, after applying the second driving voltage or current to the electro-active polymer;
- calculating a second distance from the second point of contact to the third point of contact; and
- moving the electro-active polymer to the third point of contact by applying the first driving voltage or current, if the second distance is not within the predetermined range, and generating the pattern signal if the second distance is within the predetermined range.
13. The method of claim 7, wherein the electro-active polymer is formed of a single electro-active polymer.
14. The method of claim 7, wherein the electro-active polymer is formed of a plurality of electro-active polymers.
15. The method of claim 14, wherein the moving the electro-active polymer comprises horizontally moving the plurality of electro-active polymers to the first point of contact and activating the plurality of electro-active polymers by moving the plurality of electro-active polymers in a vertical direction by applying the first driving voltage or current to the plurality of electro-active polymers based on location information of the first point of contact in the detecting signal.
16. A recording medium storing a program for performing a method of providing fingertip haptics of visual information using an electro-active polymer for an image display device, the method comprising:
- outputting a detecting signal of a user's finger contacting a touch panel;