CLAIMS

1. A pressure relief mattress comprising:

a plurality of inflatable bladders;

a pressure sensor pad arranged to detect pressure exerted on a subject, the pressure sensor pad comprising a dielectric substrate, plural rows of flexible conducting strips disposed on a first surface of the dielectric substrate, and plural columns of flexible conducting strips disposed on a second surface of the dielectric substrate, the plural rows and columns of flexible conducting strips overlapping at a plurality of intersections to form a matrix of pressure sensor cells,

a pressure-sensing electronic unit electrically connected with the plurality of pressure sensor cells, the pressure-sensing electronic unit being configured to selectively drive one or more of the pressure sensor cells for generating a pressure measurement result; and

a pressure-control electronic unit communicatively connected with the pressure-sensing electronic unit, the pressure-control electronic unit being configured to control operation of one or more of the inflatable bladders according to the pressure measurement result;

wherein the pressure-sensing electronic unit comprises a noise reduction mechanism for eliminating interfering signals from neighbouring said pressure sensor cells of the one or more selected said pressure sensor cells, the pressure-sensing electronic unit being configured to selectively drive an active said conducting strip on the first surface of the dielectric substrate at a pre-determined voltage level with reference to a corresponding sensing said conducting strip on the second surface of the dielectric substrate, and to measure a capacitive current from the sensing said conducting strip for generating the pressure measurement result, the noise reduction mechanism being adapted to control neighbouring said conducting strips of the active said conducting strip on the first surface and

the sensing said conducting strip on the second surface at a same voltage level.

2. The pressure relief mattress according to claim 1, wherein the pressure-sensing electronic unit is further configured to generate a pressure redistribution map based on the pressure measurement result, and the pressure-control electronic unit is configured to adjust a pressure level of one or more of the inflatable bladders to a desired pressure level based on the pressure redistribution map.

3. The pressure relief mattress according to claim 1 or 2, wherein the dielectric substrate is made of a compressible dielectric material.

4. The pressure relief mattress according to claim 3, wherein the compressible dielectric material is a polymeric foam.

5. The pressure relief mattress according to any one of the preceding claims, wherein the pressure sensor pad comprises 120 to 650 pressure sensor cells.

6. The pressure relief mattress according to any one of the preceding claims, wherein the pressure relief mattress further comprises at least one fluid supply being operatively coupled to the inflatable bladders and being operatively connected with the pressure-control electronic unit.

7. The pressure relief mattress according to any one of the preceding claims, wherein the pressure-sensing electronic unit is configured to control the pressure sensor cells using drive signals of a predetermined frequency range.

8. The pressure relief mattress according to claim 7, wherein the frequency of the drive signals used by the pressure-sensing electronic unit to control the pressure sensor cells is in the range of 20kHz to 200kHz.

9. The pressure relief mattress according to any one of the preceding claims wherein the pressure-sensing electronic unit is configured to process electrical signals of a predetermined frequency range from the pressure sensor cells.

10. The pressure relief mattress according to claim 9, wherein the frequency of the electrical signals from the pressure sensor cells is in the range of 20kHz to 200kHz.

11. The pressure relief mattress according to any one of the preceding claims, wherein the pressure-sensing electronic unit comprises a sense amplifier for amplifying the electrical signals from the pressure sensor cells.

12. The pressure relief mattress according to any one of claims 7 to 11, wherein the pressure-sensing electronic unit comprises a modulator for regulating a waveform of the drive signals and of the electrical signals.

13. The pressure relief mattress according to any one of the preceding claims, wherein the pressure sensor pad is configured to communicate with an external computing device.

14. The pressure relief mattress according to claim 13, wherein the pressure sensor pad is configured to communicate with the external computing device via a wireless transmission unit.

15. The pressure relief mattress according to claim 14, wherein the wireless transmission unit comprises at least one Bluetooth transceiver.

16. The pressure relief mattress according to claim 14, wherein the wireless transmission unit further comprises at least one ZIGBEE transceiver.

17. The pressure relief mattress according to any one of claims 13 to 16, wherein the external computing device comprises a display unit, the

display unit being configured to display the pressure measurement result in the form of a body pressure distribution map.

18. The pressure relief mattress according to any one of claims 13 to 17, wherein the external computing device comprises a control interface, the control interface being configured to switch between a plurality of operational modes.

19. The pressure relief mattress according to claim 18, wherein the plurality of operational modes comprises a static low-pressure body support mode, an alternate-pressure body support mode, and a dynamic-pressure body support mode.

20. The pressure relief mattress according to any one of claims 13 to 19, further comprising a notification means for providing an alert to a caregiver.

21. The pressure relief mattress according to claim 20, wherein the notification means is configured to provide a notification to adjust the pressure of at least one of the plurality of inflatable bladders.

22. The pressure relief mattress according to claim 21, further comprising a timer, wherein the pressure relief mattress adjusts the pressure of at least one of the plurality of inflatable bladders at pre-determined time intervals.

23. A system for managing a body pressure of one or more subjects comprising:
    - one or more pressure relief mattresses according to claim 1, and
    - one or more external computing devices in communication with one or more of the pressure relief mattresses,

    wherein the external computing device is configured to receive a pressure measurement result from one or more of the pressure relief mattresses for monitoring the pressure measurement result and for

putting one or more of the pressure relief mattresses in various operational modes.

24. The system according to claim 23, wherein the plurality of pressure relief mattresses are arranged in signal communication with each other via a wireless mesh network.

25. The system according to claim 24, wherein the wireless mesh network uses ZIGBEE wireless communication protocol.

26. A method of managing a body pressure of a subject lying on a support surface comprising:
    - measuring the body pressure at a plurality of locations on the support surface by using a pressure sensor pad having a matrix of pressure sensor cells, the pressure sensor pad comprising a dielectric substrate, plural rows of flexible conducting strips disposed on a first surface of the dielectric substrate, and plural columns of flexible conducting strips disposed on a second surface of the dielectric substrate, the plural rows and columns of flexible conducting strips overlapping at a plurality of intersections to form the matrix of pressure sensor cells,
    - selecting one or more of the pressure sensor cells by a pressure-sensing electronic unit for generating a pressure measurement result,
    - creating a pressure distribution map according to the body pressure measured at the plurality of locations,
    - generating a pressure redistribution map according to the pressure distribution map,
    - generating at least one digital command according to the pressure redistribution map,
    - transmitting the at least one digital command to a pressure-redistribution layer having a plurality of inflatable bladders, and

- adjusting a pressure level in one or more inflatable bladders to a desired pressure level according to the at least one digital command,

wherein the pressure-sensing electronic unit comprises a noise reduction mechanism for eliminating interfering signals from neighbouring said pressure sensor cells of the one or more selected said pressure sensor cells, the pressure-sensing electronic unit being configured to selectively drive an active said conducting strip on the first surface of the dielectric substrate at a pre-determined voltage level with reference to a corresponding sensing said conducting strip on the second surface of the dielectric substrate, and to measure a capacitive current from the sensing said conducting strip for generating the pressure measurement result, the noise reduction mechanism being adapted to control neighbouring said conducting strips of the active said conducting strip on the first surface and the sensing said conducting strip on the second surface at a same voltage level.

27. A control system for managing body pressure of at least one subject, which comprises one or more pressure relief mattresses according to claim 1, wherein the pressure-control electronic unit comprises a communication module being configured to receive a pressure measurement result from the pressure sensor pad, and a controller module being operatively connected to one or more of the inflatable bladders,

wherein the controller module is configured to identify one or more high-pressure regions according to the pressure measurement result, and generate a pressure redistribution map for lowering a pressure at the identified high-pressure regions, and adjust a pressure level in one or more of the inflatable bladders to a desired pressure level according to the pressure redistribution map.

28. The control system according to claim 27, wherein the pressure redistribution layers are configured to connect with each other via a wireless mesh network.

29. The control system according to claim 28, wherein the wireless mesh network uses ZIGBEE wireless communication protocol.

30. The control system according to any one of claims 27 to 29, wherein the control system is arranged in communication with an external computing device for switching between a plurality of operational modes of one or more of the pressure redistribution layers.

31. The control system according to any one of claims 27 to 30, further comprising a notification means for providing an alert to the caregiver.

32. The control system according to claim 31, wherein the notification means is configured to provide a notification to adjust the pressure of at least one of the plurality of inflatable bladders.

33. The control system according to claim 32, further comprising a timer, wherein the pressure redistribution layer adjusts the pressure of at least one of the plurality of inflatable bladders at pre-determined time intervals.